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# FUTURE DISASTER TRENDS: IMPLICATIONS FOR PROGRAMS AND POLICIES

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## ABSTRACT

## FUTURE DISASTER TRENDS
## IMPLICATIONS FOR PROGRAMS AND POLICIES

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

Making for an increase are: (1) the accelerating expansion of accidents and mishaps in the chemical and nuclear areas; (2) technological advances that reduce some hazards but make some old threats more dangerous; (3) new versions of old and past dangers such as urban droughts; (4) the emergence of innovative kinds of technologies such as computers and biogenetics that present distinctively new dangers; and, (5) an increase in multiple (e.g., natural disasters creating technological ones) or synergistic type disasters resulting in more severe environmental consequences.

Increasing the vulnerabilities are that: (1) both natural and technological disaster agents will have more built-up areas to impact; (2) more vulnerable kinds of populations will be affected than in the past; (3) 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; (4) increasing localities will have disastrous conditions from sources that may be quite distant and even from the past; and (5) certain future disasters have catastrophic potential although they may produce neither casualties nor do much property damage.

There are some countervailing trends. Among the two most important are first, the increasing role of the mass media in calling attention to disasters; the second is the increasing activism of citizens in matters of public policy, including environmentally related issue. Nevertheless, they cannot match the effects of industrialization and urbanization that will almost make certain we will have both quantitatively more and qualitatively worse disasters in coming decades.

However, policies can be established and steps can be taken that will reduce and weaken some of the negative effects of the probable catastrophic disasters of the future. Among major ones are: (1) noting and accepting the fact that all disasters are essentially social occasions that initially and primarily have to be dealt with by social means; (2) dropping the distinction in planning between natural and technological disasters and moving to an all hazard or generic approach; (3) making disaster mitigation at least as much a priority in planning and application as emergency preparedness, response and recovery; (4) more closely integrating disaster planning to the developmental planning or social change processes of the social system involved; and (5) ascertaining in what ways disaster problems are similar to and different from other environmental problems, and concurrently addressing both where there are similarities.

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.

## Introduction

The conditions associated with future disastrous occasions  are the focus of this paper.  Our emphasis is on future rather than current or past conditions.  While social scientists usually explain past situations, they also have a responsibility to look into the future and to project what will happen in both the short and long run.  A true social science approach must not only provide an adequate accounting of what has happened, but it should also forecast generally what is likely to occur.  Historical explanations of the past that provide understanding are useful, but analyses that provide knowledge of the future can be undertaken and are more worthwhile.  While the past cannot be undone, the future can be affected if what is known is applied in acts and policies.

There is an additional reason for taking this point of view.  This is because on the global scene we are inevitably faced with more and worse disasters in the future.  Irrespective of whether the agents involved are natural or technological, there will be both quantitative and qualitative increases in the negative direction 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.

## Current Social Trends

Studies that make projections into the future usually assume that the rate of change can be very uneven.  We are now in terms of world history, in a period of very rapid change. The social landscape and features of the next century will be notably different from that in which we have lived in the 20th Century.

Massive social changes are happening in the political, economic, familial, cultural, educational and scientific areas.  These are not only occurring in the developed societies, but also in the developing nations of the world and in Eastern Europe too in the wake of the disappearance of the Soviet Union.  The most important structures and activities of human life are drastically changing (Smelser, 1991).  This can be seen in many ways.  As examples, we can note:

> *the basic alterations occurring in the role and status of women;*
> *the move almost everywhere to a market type economy to produce goods and distribute services;*
> *the spread of at least nominal democratic patterns of government;*
> *the growing dominance of nontraditional artistic and musical forms as well as a globalization of popular culture*
> *the new family and household patterns that are emerging;*
> *the escalating uses of computers and related means for training and educating people: and,*
> *the growing diffusion and expanding sue of applied social science to many areas of life.*

Given such existing trends, almost all societies of the 21st Century will mostly have cultural values and beliefs that will primarily emphasize productivity of goods, economic growth, national wealth and international competitiveness. This orientation is based on improving technology, especially in its machine aspects, and its application in all spheres: agricultural, industrial and informational. The continuing drive toward technological growth and application means an acceleration of long standing trends toward structural differentiation and complexity that are mostly to be handled by bureaucratic organizations, increasingly centered in urban localities. This will also be accompanied by increasing pressure toward democratization that includes a drive for the rights of citizens, inclusion and participation in the polity, equality, justice, and adequate welfare provisions. Many of these tendencies are further fostered by their presentation in ever more global mass communication systems that are constantly expanding their abilities to expose their contents to world wide audiences through a variety of advanced electronic and high tech means (for more discussion of future trends, see Smelser, 1991; see also Kennedy, 1993).

Collectively, these world wide changes will affect the appearance, characteristics and dynamics of disasters, and the planning and managing of them everywhere. However, we want to single out two of the master social trends because they particularly will influence the numbers and kinds of disastrous occasions that will happen.

The two, while not new, are nevertheless massive in their social effects and accelerating in their recent manifestations. They are the ever increasing *industrialization* as well as the quickening of the *urbanization* process in all societies, but especially developing ones.

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% of the world's industrial production, a century later the output of the top five was only 57% 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. Thus by the year 2010, there will be 511 cities exceeding a million inhabitants each and for the first time in history the world population will be predominantly urban, 51.8%; 15 years later, there will be 639 metropolises of over a million persons (Jones, 1992).

These two interrelated trends or processes, industrialization and urbanization, will have consequences for disastrous occasions. They insure we will have both more and worst disasters. Built into the very dynamics of social life as they are, industrialization and urbanization will of necessity quantitatively increase and qualitatively worsen the disastrous occasions of the 21st Century.

In the next two sections of this paper we illustrate and explain why this will happen. The evidence and data base we use does not come from any specific study. Instead they are derived from the corpus of the social science literature on disasters (for summaries see Lagadec, 1982, 1990; Covello and Mumpower, 1985; Drabek, 1986; Dynes, De Marchi and Pelanda, 1987; Quarantelli, 1988; auf der Heide, 1989; Mitchell, 1990; Drabek and Hoetmer, 1991; Kreps, 1991; Britton and Oliver, 1993; Burton, Kates and White, 1993; Shrivastava, 1993; Cutter, 1994, Dynes and Tierney, 1994 and Sylves and Waugh, 1995), and also general sociological analyses of social change and trends (Bell, 1973; Harrison, 1988; Lenski, Lenski and Nolan, 1991; Perrow, 1991; Smelser, 1991, 1994; Crook, Pakulski and Waters, 1992; Sztompka, 1993; Chase-Dunn and Hall, 1994; Kumar, 1994; Therborn, 1995).

Since we are interested in the disaster-related aspects associated with continuing and increasing industrialization and urbanization, we will discuss mostly the negative and problematical outcomes of these two processes of social development. This of necessity ignores the more positive features that are also the consequences of an industrial technology and an urban way of life. It could be easily argued that if on balance there were not more favorable or positive effects than unfavorable or negative ones, the processes would eventually come to a halt, if not reverse.

In the main, our remarks will be mostly about *disasters*. That is, we will be primarily discussing 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.). Thus, our observations may 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. For other even more different kinds of crises especially the ones involving social conflicts such as in wars, revolutions, riots, terrorist attacks, acts of sabotage, product tampering, etc., our comments may be less applicable.

## Increases in Disaster Agents and Occasions

1. **There are escalating kinds of technological accidents and mishaps that were relatively nonexistent before World War II and that will increasingly result in disastrous occasions**.

To the threat of so-called natural hazards we have been adding at an accelerating rate a relatively newer risk, those stemming from technological accidents and mishaps (for an annotated bibliography see Hughes, 1992; see also Herring, 1989). We are faced with ever more disasters in the technological area resulting from human errors and collective mistakes of groups (Perrow, 1984). To the "*Acts of God*," have been added at an escalating rate the "*Acts of Men and Women*" or "*Society*." These technological hazards are a relatively newer class of danger that the contemporary world is only beginning to fully recognize. Disastrous occasions brought about by the unintended consequences of technology has largely been a product of the large-scale development of industry initiated by the 19th century European industrial revolution. Of course, what has been in being in developed societies for a few decades now, is rapidly occurring at present also in developing social systems.

Obviously, mishaps associated with technology have occurred since the first tool was produced by a human being and some even several decades ago were substantial (e.g., a liquified natural gas explosion in Cleveland, Ohio on October 20, 1944 killed 130 persons, injured more than 225 and destroyed 79 houses, two factories and 217 cars, see Lovins and Lovins, 1981: 65).

Nevertheless, in terms of social disruption and the damaging of the environment, the scale of consequences began to reach significant proportions only with the appearance of large industrial complexes to mass produce myriad goods (Britton, 1991: 1-2). And especially dramatic catastrophes such as a Bhopal or Chernobyl have come to be symbolic of a far larger threat beyond the immediate event (see Wilkins, 1986).

The growth and activities associated with industrialization--the invention of new energy sources with large-scale production and storage requirements; the creation of complex transportation modes, haulage routes and depots; the need for disposal of unwanted wastes; increasing amounts of and dangers from atmospheric pollutants; the development of mass transit modes, networks and stations--have produced environmental conditions that more and more jeopardize public safety and enlarge community vulnerability. Thus, any increase in industrialization creates greater risks and eventual disastrous occasions.

The major newer current technological threats are in the chemical and the nuclear area. The manufacture, processing, transportation or distribution, storage, and the application or use of many products of these two areas are inherently hazardous. They almost insure quantitatively more and qualitative worse future disastrous occasions.

**a.** The chemical area.

Chemicals have transformed the world and modern societies are impossible without them; their use reflects a widespread desire to have higher standards of living and particular lifestyles that otherwise could not be achieved. The technology of chemistry has been consciously cultivated and applied because of the perceived and actual benefits involved. This is true not only in developed but also developing societies, as indicated by the fact that in a country like India the chemical industry has become a 20 billion dollar a year industry that accounts for 10% of the gross national product and 40% of the nation's gross industrial output (Ramasubramanian, Mitra and Bandopadhyay, 1987: 180).

Yet as Bhopal showed, there are multiple risks associated with the production, transportation, storage and use of dangerous chemicals for there are multiple ways in which human and other organisms, plant life and fauna, and physical material objects can be destroyed, damaged or negatively affected. A chemical emergency or disaster can involve many perilous consequences for the environment. The referents of the term "chemical hazard" are many.

Analyses of accidents in petrochemical plants, gas processing plants, terminals and related facilities in the United States are not reassuring. For example, the number of plant emergencies has:

> *[been] increasing at a high linear rate over the last thirty years. In fact, the number of these accidents has almost quadrupled during this time period . . . the cost of these same plant emergencies [adjusted for inflation] has been escalating apparently at an exponential rate over this thirty year time frame . . . this means that every day, the problem is getting worse at a faster and faster rate. This is a very frightening trend which appears to indicate that our technology is getting out of control (Sullivan, 1993: 1)*

As others have indicated (e.g., Dwyer, 1991), workplace accidents and errors are symptoms of some of the dysfunctional aspects of complex, modern organizations. Moreover, there is every reason to believe that such mishaps are also becoming a problem in those countries that are industrializing (see Haines, 1991). As an example, in August 1993, a series of explosions shook the city of Shenzhen in China killing at least 70 and injuring hundreds. The first explosion was set off by a leak of nitric acid from a warehouse for hazardous materials. The fire from that blast then ignited a nearby natural gas plant and in the next several hours eight more warehouses in the area exploded (Kristof, 1993: A3).

Important is the fact that even localities that in the past had none or few risks from natural disaster agents, now are vulnerable if they have roads, railways or navigable waterways in the vicinity of toxic chemical spills, explosions, or fires. In a sense, the creation of major transportation infrastructures reduces the geographic selectivity of possible disastrous impacts. All inhabited areas have now become vulnerable to threats from hazardous chemicals although there may be no manufacturing, storage or use facilities in the vicinity. Not all communities are subject to major natural hazard threats; but now almost all are at risk as they are increasingly subject to dangerous chemicals being more and more moved around. In Cali, Colombia, seven trucks loaded with dynamite exploded in a slum and squatter area in the city center, demolishing around 2,000 buildings and killing about 1,200 people, making it the second largest total after Bhopal of deaths in developing countries from a nonammunition explosion (Cutter, 1991: 276). Even when there are no casualties, a great number of people may be at risk; for example, a toxic sulfur trioxide release in New Delhi, India forced around 100,000 to evacuate (Cutter, 1991: 280).

Furthermore, the threat of greater disasters of this kind is spiraling because of the greater amounts of dangerous material involved. For instance, from 1960 to 1980, not only has the number of seagoing tankers carrying petrochemicals doubled, but their shipping tonnage has expanded sevenfold! Economic considerations are leading to the use of ever larger tankers. So increasingly, there is something bigger to spill, explode or burn on waterways as illustrated by the Amoco-Cadiz oil spill off the French coast, the famous Exxon Valdez oil spill off Alaska, and more recently the Aegean Sea tanker oil spill and fire in December 1992 at the harbor of La Courna, Spain, a city of about 250,000 people. A large tanker carrying liquified natural gas has the equivalent of the energy content of 55 Hiroshima type atomic bombs (Louvins and Louvins, 1981: 64).

Also, not only are there more trucks on the roads than ever before (413,000 tank trucks regularly transport hazardous materials in bulk in the United States), but they are increasingly larger (e.g., including the advent of double and triple length trucks, see Mead, 1994). Of the over four billion tons of hazardous materials transported annually in America in more than 180 million separate shipments, over 60 percent go by truck (Transportation, 1986). One estimate we have seen is that at any given time from five to fifteen percent of all trucks on the road are carrying hazardous substances.

In addition, to the in-plant and transportation kinds of acute chemical hazards types of disastrous occasions, there are the more slowly developing and diffuse types associated with hazardous waste sites (see Peck, 1989). Seveso in Italy (Homberger, Ressiani, Sambeth and Wipf, 1979) and Love Canal and Times Beach (Whiteside, 1979) in the United States are examples of what we may expect (Reich, 1991). In fact, the *Seveso Directive* issued by the Council of European Communities accepts the probability of such future disasters by setting forth as legal policy the idea that citizens must be adequately informed of the nature of and extent of existing hazards, the planning measures being undertaken, and what might be expected of a disastrous occasion. In the former Soviet Union one estimate is that over a million residents live in contaminated areas, especially the 300 towns and cities where chemical weapons were once produced, stored, tested or destroyed (Shargorodsky, 1993).

Finally, there are the threats associated with more diffuse and slower moving kinds of certain hazards. In particular some mass human poisonings from toxic chemicals especially in developing countries have not been widely noticed elsewhere. For example, 10,000 Moroccans suffered when they ingested cooking oil contaminated with degraded lubricating oil; 50,000 people were affected in Iraq from exposure to methylmercury; and 7,500 persons were made ill in Pakistan from a misuse of the insecticide malathion (see Weiss and Clarkson, 1986: 217). There is no reason to think that there will not be such happenings in the future.

**b**. The nuclear area.

The nuclear power area is another increasing source of danger. It has less than a half century existence. Yet it was developed because it initially seemed to offer a dependable and inexpensive source of energy for industrial expansion, compared with other energy sources such as oil that was seen as eventually depletable and increasingly costly to obtain. A move in the direction followed made much economic sense. In fact, a number of developing countries are still continuing to build nuclear plants.

However, the risks associated with the development of nuclear power have been exemplified first by Three Mile Island, then Chernobyl (and less well know incident at Windscale in England in 1957, see Arnold, 1992). We may expect more along those lines given that there are over 436 commercial nuclear plants in existence at present, and about 100 more under construction in 26 different countries (Meshkati, 1991: 134). In fact, in 1992 in a nuclear plant at Mihama, 70 miles from Tokyo, Japan, a reactor core meltdown was only aborted by the last emergency shutdown mechanism in place. It should be noted that such a happening would pale the negative effects of Chernobyl, which contrary to much popular and even official thinking was far from a worst case scenario.

Apart from in-plant nuclear plant problems there are the risks associated with the transport of nuclear wastes (see Kirby, 1988). In the United States alone, by the year 2000, there will be about 47,900 metric tons of spent fuel, compared to 12,900 tons in 1985, to be shipped to some deposit somewhere. Between 1964-1989 approximately 2,600 commercial shipments (not including military shipments) were made totaling about 1,900 metric tons of spent fuel (ORNL, 1991: 7). In addition, the dozens of societies that presently have nuclear plants will eventually be faced with the problems stemming from their necessary shutting down. The large volumes of radioactive wastes resulting from the dismantling of such nuclear facilities will pose problems of disposal. Keeping the reactor fuel in storage tanks near the plants as is currently done involves possible leaks or spills (Wald, 1993: 1) which newspaper headlines in the United States such as the following suggest have already begun to be a problem:

> *Reactor Fuel Storage Tanks Deteriorating. Report Says Radioactive Waste Has Begun To Leak (Wilmington News Journal, December 8, 1993: 4).*

That this is not a purely academic issue is indicated by the recent disclosure of a not widely known disaster in the former Soviet Union in 1957. That year, a tank of radioactive waste exploded at a weapons plant near Chelyabinsk, spewing 70-89 tons of waste. At least 270,000 people are estimated to have been exposed to the cloud. While even now few of the negative consequences are known, it has been reported that because of the ensuing contamination, 23 villages were razed, over 10,000 residents were permanently resettled, and 17,000 acres of farm land were turned into a nature preserve (Monroe, 1992: 535-6; see also, Medvedev, 1979)

Eventually too, the presently stored material is going to have to be transported from many places to some chosen sites, and naturally that raises the probability of some accident in all societies involved in such transportation (this is complicated by the fact that some European nations ship their nuclear waste overseas to developing countries). In addition, there is the military related problem in a few countries of dealing with the highly radioactive materials that have to be handled and that also accumulates from the increasing decommissioning of nuclear submarines, the dismantling of nuclear weapons, and the closing of nuclear weapon plants (See Nuclear Weapons, 1993). Russia, for example, has 52 decommissioned nuclear power vessels docked in ports near Scandinavia with another 70 facing decommissioning in the next 15 years (Khodakovsky, 1994).

2. **There are technological advances that reduce some hazards but add complexity to old threats**.

Without doubt modern technology can be used to try to eliminate or reduce some risks. The medical health area is marked by any number of such successful efforts. In fact, some agents in the past such as yellow fever that produced disasters (e.g., Bloom, 1993), have for all practical purposes been eliminated as major threats. Similarly smallpox epidemics no longer occur (Hopkins, 1983) which in certain past time periods were responsible for one death out of every five (Duncan, Scott and Duncan, 1993: 406). A general rise in living conditions, extensions of public health measures, and even changes in attitudes towards illnesses also played major roles, but new medical technologies did contribute to creating a healthier population.

Unfortunately, sometime positive consequences from technological applications are accompanied by negative effects. There are two aspects to this: (1) preventive or protective measures that indirectly can lead to other kinds of risks, and, (2) the scale of chain reactions possible which because of network linkages can turn a minor emergency into a major disastrous occasion.

Fires in high rise buildings are an example of the first. In combination with the highly combustible and toxic construction and furnishing materials presently used, they have brought an additional threat dimension to that kind of situation. Buildings are prevented from being burned by raising the probability of their inhabitants being asphyxiated (in addition, the very heights of buildings can create protective and response problems as seen, for example, in some spectacular fires in skyscrapers in Brazil and South Korea a few years ago which killed hundreds, and in Nigeria in early 1993 and in Philadelphia in the United States).

Technology sometimes is directly used to improve safety and reduce the possibilities of accidents and mishaps. This is a laudable effort but not necessarily always achieved. This can partly be seen in the following quotation from Lee Thomas, a one time head of the US Environmental Protection Agency. He said:

> *It is entirely possible that somewhere in the country toxic metals toxic metals are being removed from the air, transferred to a waste water stream, removed again by water pollution controls, converted to a sludge, shipped to an incinerator and returned to the air (New York Times, May 11, 1986).*

He is pointing to the fact that some technologies that reduce or prevent the growth of certain kinds of risk or environmental threats do so by solutions that can generate their own dangers.

As another example, in the United States it has been found that to meet the Clean Water Act of 1972, the waste water treatment of sewage can lead to the production of sludge that will contain viruses, toxic substances and heavy metal. The sludge can be treated, but this frequently produces methane gas and carbon dioxide. The latter additionally may contribute to the greenhouse effect that is warming the earth, which can lead to changing climatic and agricultural patterns, and may contribute to the melting of the polar ice caps and the subsequent rise of ocean levels (Rosenberg, 1988). This last is a very controversial point, but if valid, it suggests the probable flooding of many seaport cities around the world such as Manila, Shanghai, Bombay and Rio de Janeiro (Cohen, 1991: 93). So, an initial good measure may set off a chain reaction of bad effects (see Williams, 1991: 73).

Yet the linkages between happenings that may have ultimate negative effects, can be even more direct. This is because as technologies are elaborated and enlarged to meet the economics of scale, a small mishap at one point can bring down the total network or system. Many have noted that while small scale failure can be produced very rapidly, large scale ones can be generated only if large amounts of time and resources are involved. For example, there have always been electric power system failures; actually, outages occur on a small to moderate scale almost every day even in developed societies (e.g., the four day electric power outage in downtown Seattle, Washington in 1988). They are recognized as such, and coped with as normal emergencies by the public utilities. Yet not only can something in a far distant place have local effects, but the elaborate linkages almost insure that even in societies where the power supply is normally dependable eventually there will be large scale effects as in the widespread blackout in 1965 that occurred in southern Canada and the northwest United Sates, and in France in 1978 and the province of Brittany in 1987 (Lagadec, 1990: 107). More recently, in October 1992, eight of the eleven states in Malaysia and a third of Singapore concurrently lost electricity in an interrelated massive power failure in two of the most advanced Asian countries.

Massive glitches that impair telephone systems are also becoming increasingly common in many societies. In 1984, such a system outage in Tokyo, Japan affected 89,000 subscribers and cost around 300 million dollars. Eleven major phone system outages affecting metropolitan areas occurred just in the United States alone in 1991 (see also, Telecommunications, 1993). In the report accompanying those figures, it is noted:

> *modern fiber optics carry 10,000 time more calls than the old than the old copper cables they replace. An accidental cut of a single fiber optics can cut off entire metropolitan areas . . . Failures that once would have been minor in nature now induce widespread disruption of services. The computerization of telephone switching centers means that where five years ago an AT & T switching center handled about 180,000 calls per hour, new computerized switches handle 700,000 calls an hour. The loss of a single switch (AT & T has 114 around the country) now means a much wider disruption of service (Lee, 1992: 8).*

A statement by an expert on telecommunications networks summarizes many of the potential problems (McDonald, 1989). He notes that the switching networks are becoming more vulnerable to disruption because of the introduction of new technologies. Because of economic incentives to cut the costs of normal operations, networks are being designed and established without sufficient attention being paid to emergency preparedness. Accidents threaten the integrated networks of tomorrow with more extensive damage than they did yesterday's simpler network. Thus, as the societies of the 21st Century including developing ones increasingly rely on highly integrated communication networks, the consequences of network failure will be more severe (see also Physical, 1990).

3. **New versions have developed of old or past dangers**.

Certain particular forms of danger have been around for centuries. Yet in the modern world, the versions of the risks involved have taken new forms especially as large cities have come into being. Inevitably these kinds of communities require elaborate lifeline systems or complex physical or mechanical infrastructures. For a small village, a well or two can provide the necessary water; for metropolitan areas, distant reservoirs, dams, pumping stations, pipelines and gauges, monitoring points, etc. linked together in complicated ways are needed to generate and distribute the water. This can create new versions of old or past dangers.

For instance, increasing chronic water shortages are affecting many societies, including developing ones. This is partly related to the great need for water to support the industrialization process. A recent report of the Worldwatch Institute noted that besides parts of the western United States:

> *Many areas could enter a period of chronic shortage during the 90s, including northern China, virtually all of northern Africa, pockets of India, Mexico, much of the Middle East . . . Where scarcities loom, cities and farms are beginning to compete for available water (Postel, 1989: 1)*

Droughts used to be mostly a rural problem. This is no longer the case (see Glantz and Mason, 1994). It was reported in November, 1993 that the water supply of Athens, Greece had fallen so low that severe rationing would have to be quickly imposed if rainfall did not soon increase (Quinn, 1993). Increasingly in different parts of the world, urbanized localities are finding themselves faced with shortages or reduced water supplies. In part this is because their populations and manufacturing activities require substantially larger per capita quantities of water than in rural areas. In particular:

> *freshwater resources are being sued up at such rapid rates that groundwater supplies are dwindling and surface waters are fouled with pollutants from industries, municipalities and agriculture. In much of sub-Saharan Africa, the Middle East and parts of Asia, water consumption will reach 30-100 per cent of available reserves in 10-15 years--a result of population growth and inefficiencies in use (Jones, 1991: 19).*

This situation appears to be coming to the fore in China:

> *Water supplies are drying up under the relentless demands of new industries, population and agriculture. Of China's 500 cities, 300 are short of water and 100 are seriously short. More than 80 million people have to walk more than a mile for drinking water (Tyler, 1994: E4).*

Moreover, additionally there will be an acute disastrous occasion in the future if an urban area runs out of water or has enough only for the most vital of water needs. This is most likely to occur in combination with the collapse of a major tunnel, pumping station or other critical facilities of a water supply system.

This last probability is escalating because of a deteriorating public works infrastructure of lifeline systems in many older cities in the Western world. The prevalence of decaying bridge and tunnel structures, crumbling highways, obsolete and overloaded waste water and sewerage treatment plants, worn out sewer and water mains, aging pipelines initially put in place for an expanding industrial sector, suggest many potential disastrous possibilities beyond the isolated and occasional accidents of the past. A flood in the downtown area of Chicago in 1992 because of the collapse of a 100 year old underground freight tunnel is a specific case in point. It resulted in a major electric power cutoff shutting down the Board of Trade with a resulting loss of billions of dollars in trading, and leading to the evacuation of department stores and hotels, and disrupted businesses for weeks( Arnold, 1992).

Put another way, these problems are starting to appear because the physical infrastructure involved is reaching the end of its normal lifetime. One can project that this will also become a problem for urban areas in developing countries compounded by the fact that there is reason to believe there are even less maintenance and accident prevention measures for the urban lifelines in them than exist in developed societies. This is illustrated by the major failure in 1989 of a pipeline in Russia that killed at least 575 persons, as well as the explosion of a natural gas pipeline in 1984 in Gahri Ohoda, Pakistan which killed 60 people, and the explosion at the liquid petroleum gas plant at San Juan Ixhuatepec near Mexico City in the same year that forced several hundred thousand of nearby residents to evacuate and killed several thousand people.

None of the disasters likely to occur from these factors are totally new in the geophysical or physical sense, but they represent new versions of old threats, either because of where they could occur or the large scale nature that they can assume.

4. **There is the emergence of new kinds of technological accidents and mishaps that can and will lead to disastrous occasions.**

**a**. Inventions and advancements in computer technology.

A major new threat that is surfacing is associated with all the disastrous consequences that will come from the computer revolution that human society is presently undergoing. Use of computers undoubtedly has improved disaster planning and managing, as well making life easier for most of us in many ways. Yet our increasing dependence on computer technology will magnify future disastrous occasions and turn some minor emergencies into major crises. This is particularly true in that many governmental and business sectors are increasingly computer based for the data and information they need to function, sometimes literally from minute to minute. Thus:

> *It is . . . estimated that more than 85% of the largest firms in the US are totally or heavily dependent on computer technology and that, on average, a business would lose 25% of its daily revenue after the sixth day of its system breakdown, while this figure is close to 40% for the financial, banking and public utility industries (Pauchant, Mitroff, Weldon and Ventolo, 1990: 254)*

These figures are for the United States but comparable figures could be found for countries in Western Europe. To the extent that developing countries move to computerize their businesses and industries, and there are many advantages to doings so, they will also increasingly become vulnerable to computer failures.

However, what is important is not simply the use of computers. Rather more crucial are their linkages to other technologies and the massive networks they create. The so-called Informational Society is really a huge web dependent on many complicated technological links.

Now we can predict with certainty that computer systems and their networks will, cease to function, or function incorrectly (and we leave aside deliberate sabotage by the use of computer viruses). We will then have a really **new** kind of disaster--a computer disaster, with all kinds of negative chain reactions of an economic and social nature. Even partial failures of computer networks can have massive consequences..

As an example we might cite figures from a recent incident in Hinsdale, Illinois where a fire disabled a major Bell Telephone switching center in the Chicago area over which three and a half million calls a day passed. The telephone outage as a result of its links to computers affected both voice and data communications for more than a half million residents and business customers in six metropolitan suburbs for periods ranging between two days to three weeks. In addition, local and long distance communications for both telephone and computer networks were also severely affected since the Hinsdale center affected was an aggregation point for major telecommunications links.  The outage:

> *affected the normal operations of dozens of banks, hundreds of restaurants dependent on reservations, three large catalogue sales companies  . . . about 150 travel agencies, most of the paging systems and cellular telephones in the affected area, and hundreds of businesses located in the area or others not located in the affected area but conducting business with those that were . . . At present, a conservative estimate for the business losses and the repair costs of the accident are set at $200-300 million (Pauchant, Mitroff, Weldon and Ventolo, 1990: 244).*

**b**. Biotechnological advances.

There are also going to be disastrous occasions that will be produced by developments in biotechnology, especially genetic engineering.  Basically, this technology involves altering the blueprint of living organisms--plant, animal or human--and creating new characteristics, some of which are very useful (e.g., various kinds of oil and chemical waste eating bacteria have been created that can be used to help clean up spills!).  However, there clearly are all kinds of potential disastrous possibilities with this kind of technology.  There can and will be the creation of or the escape from control of some altered organism that cannot be checked by presently known means.  Our ability to custom design living organisms almost insures that one day there will be some almost Frankenstein-like bacteria, plant or animal let loose on the world.  We are not talking of an unreal movie, Jussaric Park, but of real possibilities.

Of course there are constant assertions about the safety of the process.  Thus, a National Science Foundation reported stated:

> *There is a broad consensus among biologists that R-DNA techniques are safe . . . basic and applied scientists generally agree that many contemplated introductions are either virtually risk free or have risk-to-benefit ratios well within acceptable bounds . . . no hazard particular to genetic engineering has yet surfaced (quoted in Schmeck, 1987: 7).*

The term R-DNA is the scientific shorthand label for recombinant DNA, the technical name for the process of rearranging genetic material-DNA-or combining genes from diverse sources.

Yet as was written in a letter that same year:

> *The advocates of recombinant DNA technology claim that it is safe because they cannot see how a disaster would occur and because no disaster has ever happened yet.  That amounts to saying that the technology is as safe as the Titanic, the Chernobyl nuclear reactor or the space shuttle (Robert J. Yaes letter in 1987 The New York Times).*

Such assertions of absolute safety of course are quite similar to  some of the statement issued by the Atomic Industrial Forum just a few months before the Three Mile Island nuclear plant accident, namely:

*Nuclear power plants area designed and built to withstand every conceivable Acts of God--and some inconceivable ones as well (quoted in* Chronicle of Higher Education*, 4/1/79, p. 20).*

We are confident in making the assertion that biotechnology will similarly bring us a major catastrophe sooner or later. In fact, just as the 1970s was the time when the world became aware of nuclear power threats, the 1980s of the chemical hazards risks, the decade of the 1990s could very well be when we will have a Chernobyl or Bhopal-scale like biotechnological disaster.

Actually a small forerunner of what could occur in the biotechnological area is suggested by a related although slightly different kind of disaster in 1979. In that instance, there was an accidental release of biological toxins at a Soviet research center. Probably 1,000 workers were killed and a 20-square mile area around the city of Svardlovsk was contaminated by the release of highly toxic anthrax spores. To the extent that any country anywhere in the world sets up facilities for biotechnological purposes, it will create risks in the production, storage, transportation, distribution and use of the products involved (see the discussion of future biological hazards of all kinds by Bradford and her colleagues, 1993).

5. **There will be an increase in multiple or synergistic type disastrous occasions resulting in more severe impact consequences**.

There has been little recognition of the fact that natural disasters will increasingly generate or magnify concurrent technological ones. Increasingly so, because of the accelerated production, transportation and storage of hazardous substances of all kinds, natural disaster agents that in the past would have simply been natural disasters can now create technological ones.

There already have been instances of this. For example, the inundation of chemical plants occurred in the 1993 Midwest American floods (see Goolsy, Battaglin and Thurman, 1993). An earthquake in Ecuador triggered massive landslides that destroyed six miles of the Trans-Ecuadorian pipeline, shutting off the flow of 250,000 barrels per day resulting in lost revenue and reconstruction costs of perhaps one and half billion dollars (Eguchi and Seligson, 1993: 80). The convergence of a tornado and a radiologically active cloud could pose a very threatening situation. Yet something of this kind already occurred in 1961 when windstorms spreading radioactive material (plutonium and strontium) in the Lake Karachay region increased by 30 to 50% the land area previously contaminated by an earlier nuclear disaster in Russia. The initial technological disaster was magnified by a later natural disaster agent (Porfiriev, 1992). Also, the dumping of radioactive wastes into Lake Karachay and several artificial reservoirs created to contain them had negative effects when droughts impacted the area. Thus:

*droughts occurred in 1967 and 1972, exposing dried former shoreline of the lake, allowing the wind to scatter radioactive particles. In 1967 particles . . . were strewn over an area of 2,700 km2, raining down upon 63 settlements and 41,500 people. The combination of the Techa dumping, the Kyshtym cloud, and the droughts are believed to have exposed over 400,000 people to radiation and to be the cause of at least 935 diagnosed cases of chronic radiation illness in the Chelyabinsk region (Monroe, 1992: 538)*

The earlier technological disaster was magnified by two later natural disaster agents.

Lindell and Perry in looking at the Northridge earthquake note that:

> *the overall hazmat picture after Northridge was characterized by a few large events, with a greater number of smaller events . . . Of course, here we are dealing with reported events . . . A total of 1,689 hazmat assessments were conducted . . . The inspections yielded 82 sites with hazmat concerns (1995:8).*

These researchers additionally noted that a train derailment spilled sulfuric acid and diesel fuel, and that there were nine pipelines ruptures and 35 breaks in natural gas transmission lines and 717 breaks in distribution lines, as well as 15,201 natural gas leaks at customer facilities (1995: 11). The latter leaks resulted in three street fires, 51 structural fires and the fire destruction of 172 mobile homes.

In an even more systematic general study, Showalter and Myers (1994) examined how frequently there was interaction between natural and technological disasters in the 1980-1989 in the United States. They conclude that the number of incidents where there is interaction between natural and technological disasters is rising, while preparations that recognize the complications inherent in such combined happenings, remain cursory.

Not often noticed is that this process can also go in the other direction. Let us cite several examples. It has long been known, for instance, that the injection of fluids into the soil to recover oil and dispose of waste can trigger surface land faulting (see Healy, Rubey, Griggs and Raleigh, 1968; see also Cypser, 1996 for a bibliography). In 1963, this led to the collapse of a dam, the emptying of the Baldwin Hills Reservoir and some deaths and property loss in metropolitan Los Angeles (Hamilton and Meechan, 1971: 333). Or the building of dams for the purpose of creating reservoirs to impound water for residential or industrial uses may also set off earth tremors. In one of the least seismic areas of the world, a reservoir behind Koyna Dam appears to have triggered a series of shocks that devastated Koyna Naga, India in December, 1967 killing 177 residents, injuring around 2,300 and damaging or destroying most of the buildings in the community (Earthquake, 1972).

There is another possibility on a larger scale, that of climate change that is the result of human activities. For example, it has been said that continuing pollution of the air could result in stronger hurricanes (Barron, 1995: 24). Another study suggests that if the atmosphere's carbon dioxide content doubles, the maximum possible intensity for hurricanes could rise to 40 to 50 percent generally, and 60 percent in the Gulf of Mexico. This last example suggests that not only are disaster agents and occasions increasing, but that because of human and group behavior, there will be an enlargement of social risks and vulnerabilities in the future, a matter that we will now discuss.

## Enlargement of Social Risks and Vulnerabilities

Paralleling the increase or negative changes in disastrous agents, are certain transformations in the populations that can be impacted. The end result of these social trends mostly stemming from the urbanization process, is an enlargement of social risks and vulnerabilities, especially in developing countries. Thus, even if there were no change in agents or occasions, we could still expect more and worse disastrous occasions just from the changes that are occurring in the individuals and groups, which are candidates for impact in the future.

**1. Both natural and technological disaster agents will simply have more to hit and along some lines will have greater impact.**

Disastrous occasions are always social happenings involving some vulnerable entity; they are not merely the presence of some risk or hazard in some physical sense. Thus, natural hazards only remain hazards and cannot become disasters unless there is some effect on social life. An earthquake hitting a totally uninhabited area is simply an earthquake. The same is true of technological agents. For example, the several sunken Soviet and American nuclear powered submarines that presently rest on ocean floors, at worst may create some possible long run ecological problems (Solomon, 1988).

Nevertheless, technological disaster agents as we discussed earlier are definitely on the increase although not neatly manifesting themselves in some kind of linear progression insofar as casualties are concerned (Glickman, Golding and Silverman, 1992). However, the occurrence of physical hazard agents is probably not increasing, at least on any observable short range human time scale, although it is known that some such as hurricanes can fluctuate considerably over time, and there may be time cycles in the appearance of other kinds of natural hazards agents.

Yet it should be noted that more and more there is the advancing of the hypothesis that atmospheric and climate conditions are being altered and worsen by human activities that therefore are increasing the possibility of disastrous occasions (Liverman, 1990; Stern, Young and Druckman, 1991; Bruce, 1993). For example, it has been suggested that "acid rain" generated by human actions help produce avalanches and landslides as well as helping "cause flooding both in the mountains and on the plains" of Germany and Austria (Lieven, 1988: 11). At present, clearly far more is unknown than is known about the possible effects of climate changes brought about by social practices (see Joint, 1992 for a discussion of the range of the uncertainties). However, irrespective of possible future negative outcomes of current social behavior on global and regional climate, we do know even now that what any physical agent can socially impact has and is changing.

Many different regions of many countries are being subjected to unprecedented population growth, building of structures, and economic development. For a variety of social reasons mentioned at the start of the paper, many areas are being built up. This means that more than ever before there are greater number of people and greater amounts of property vulnerable to the risks of different disaster agents. For example, there are more people and settlements than ever before in riverain flood plains. Because of social factors, where in the past there were marsh or swampy areas, there are now housing complexes and industrial parks. The same picture could be drawn for earthquakes. For example, 15 of the 20 most seismic countries have high population growth, and 64 of the world's 90 largest cities are located in seismic zones (Coburn and Spence, 1992), the majority being in developing countries. The same tendency holds for tornadoes and volcanic eruptions (and of course the same is true for technological agents). There is simply more of a built environment they can impact.

Where empty or very sparsely populated space might have been hit in the past, in the future many people and their build environments will be hit. The property destruction wrought by Hurricane Andrew in Florida would have been considerably less just a decade ago because there was much less of a built environment to impact. Likewise, for the brush fires around Sydney, Australia's largest city, which burned and threatened thousands of suburban homes in January, 1994, and similarly for the fires which forced many to evacuate from the northern suburbs of Athens, Greece in July 1995. As to the future, by the year 2000, about 75 percent of the US population will live within ten miles of either coast, subject to hurricanes in the East and earthquakes in the West.

There is practically nothing of the reverse process, that is, abandonment or withdrawal of human activity from dangerous areas. A way to document the probable greater future impact is to ask the following: if the last major disaster to hit an area were to hit exactly in the same way now or in the future, would there be more or less at risk? We think almost all would have to answer more. (Galveston, Texas where over 6,000 died in a 1900 hurricane, the largest fatality figure in a single disaster in the United States, had a population of around 44,000 at that time; now it has over 217,000). While it is possible to cite some cities in developed countries that now have less population and sometime even fewer manufacturing facilities than in the past (e.g., a few cities in the northeastern United States and in England), it is very difficult to give examples from anywhere else. If anything, cities in developing countries tend to increasingly have extremely high population density rates. For example, there are 55,000 persons per square mile in Madras, India (Dogan and Kasarda, 1988: 13).

Not only is there more to impact but the very process of urbanization in itself increases the physical vulnerabilities of all built up localities, and adds additional risks. They do so, for example in the instance of flooding, in that natural drainage areas are reduced or eliminated, in that dams and levees are built that lead to vast pools of water accumulating far beyond that which would normally occur. Geipel (1993) in discussing the background of the 1988 flooding of the River Danube notes that:

> *The severity of flooding on the Danube has been strongly influenced by many changes occurring to its floodplain since the beginning of the 19th century. Moors and bogs have been drained, cultivated and settled . . . Since steamship navigation began in 1836, the meandering stream has been straightened. Artificial cut-offs through . . . bends reduce the length of the Danube and caused it to incise its bed, thus increasing its fall and decreasing its width. The construction of levees began in 1884, with the aim of confining floodwaters to a narrower path . . . the construction of a ship canal . . . These modifications led to a loss of floodwater retention space, as stagnant waters have been cut off and drained and the land filled. Riverain forests have been eliminated, wetlands drained and the infiltration capacity of both soils diminished by field clearance (1993: 112).*

Similarly in the 1993 floods in northwest Europe in Germany, the Netherlands and France--which was the worse in more than half a century--partly resulted from flood protection mitigation measures that had been put in place, and partly from the elimination of natural drainage areas and wetlands. Thus, in Germany the flooding was attributed to too many dikes, concrete embankments and artificial channels built along the Rhine River and its tributaries, and it was argued that low lying lands should be allowed to return to their natural state (Whitney, 1993: 4). The same has been stated about the upper Mississippi River flooding.

> *The deep channels that improve navigation also speed the flow of flood water . . . the levees that prevent local damage raise the river crest downstream . . . "When we turned the Mississippi into a canal, we redistributed the burden of flooding" . . .*
>
> *at least a third of the five million acres converted to from wetlands in the lower Mississippi Valley since the 1930's was induced by Federal control projects. One result was that the valley lost much of its capacity as a natural sponge, absorbing less water in periods of heavy rain . . . perhaps more important, flood control effectively transformed more than million acres from a biological filter to an emitter of chemical pollutants . . . while it may have been a mistake to encourage intensive development on the Mississippi's flood plain, encouraged it was (Passell, 1993: D2; see also Midwest Flood, 1995).*

For the reasons just indicated, to the extent that developing countries industrialize and concentrate much of that process in urban localities, the more also a target they will present for all kinds of hazards. The result could be a natural or technological disaster, the latter being illustrated by the hydrocarbons explosions that occurred in Tacso, Venezuela in 1982 that killed 145 persons (Cutter, 1991: 277).

Additionally, we cannot only be certain of the happenings of technological disasters, but some could have qualitatively worse effects than certain other kinds of impacts. For example, chemical poisonings and radiation contaminations often require complex, sophisticated and labor intensive kinds of medical treatment. They can and do put much more of a strain on emergency medical services than the "ordinary" disaster. In Bhopal, for instance, the local emergency health system was overwhelmed both by the numbers and by the kinds of medical problems faced. The city's biggest hospital, the 760 bed Hamidia, admitted 1,900 seriously ill patients the first day and eventually treated more than 70,000 victims (Bowonder, Kasperson and Kasperson, 1985: 32).

Often in these kinds of disastrous occasions too, material things, equipment, land, can be polluted and contaminated in complex ways. The cleanup is often far more costly and requires more specialized knowledge than is usually the case, say after tornadoes and earthquakes. However, the ensuring problems with people and machinery from the ashes of the Mt. St. Helens volcanic eruption showed that this problem is not confined to the technological area alone. Also, sometimes, there are second order effects; for example, health consequences can surface years later, a major concern in Russia, Byelorussia and the Ukraine following Chernobyl.

2. **More vulnerable kinds of population will be impacted than in the past**. Because of social changes--some of lifestyle, others of a demographic nature--populations in future disastrous occasions will be more vulnerable to negative effects. There are several

interrelated factors.  For example, older, poorer people living by themselves--a growing tendency in some societies--are more likely to be casualties in disasters.  However, for expositional purposes, we treat the different dimensions being discussed here as if they were independent of one another.

Lifestyle changes.  For example, notions of leisure times and vacation have become very widespread in developed societies.  This in turn leads to the creation of certain kinds of resort areas that are particularly vulnerable.  For instance, there have always been flash floods in the physical sense in the United States, but they are increasingly resulting in disasters such as the Big Thompson flood that killed over 100 persons.  Changes in lifestyle are leading more people to be tourists in localities at risk from such happenings.  For example, the weekend, seasonal and holiday populations in the tourist resort areas on the east coast of the United States are usually 10 to 100 times more than the permanent coastal residents.  A similar general change in population patterns is true in Europe along with exposure to avalanches in ski resort villages.

Also, increasingly families are building second or vacation homes in wildlands that are quite vulnerable to brush fires (Cortner and Gale, 1990).  This is in addition to the encroachment of homeowners whether in the French Riviera or California, on land that used to be much more sparsely populated in the past.  In the latter locality, the Oakland Hills fire of 1991 resulted in 25 dead, nearly 3,000 homes damaged and more than a billion and half dollars of property losses.

There are fundamental changes occurring in family patterns.  For example, more and more, the recent traditional type of the family in the Western World known as the nuclear one, a husband and wife with children, is less and less the dominant form.  Households are increasingly made up of members that consist of single persons, childless couples, both male and female single parents, unmarried same or different couples such as heterosexual partners and gay couples, as well as unrelated roommates (this is increasingly also the patterns starting to appear in cities in developing countries).  Much disaster planning implicitly assumes that most households will consist of families.  Yet this is a diminishing social pattern.  Furthermore, the other growing types of households all present different kinds of issues and problems for disaster planning and managing.  For instance, the increase in homeless  in the United States presented unexpected major relief problems after the Loma Prieta earthquake and Hurricane Hugo (Phillips, 1996).  However  in developing countries, residents living in informal shelters or having no homes can run up to 70 percent for some cities such as Casa Blanca, Ibadan, and Addis Ababa (Kasarda and Crenshaw, 1991: 17).

Demographic changes. Then there are changes occurring in the demographic characteristics of populations.  These can result in qualitative changes in vulnerability (see Bolin and Klenow, 1982).  As an example we are increasingly getting an older population in at least most developed countries around the world such as France and Japan (where 12 percent of Japanese are now 65 years and older).  For various reasons older persons often live in places that are more subject to risks such as hurricane at risk areas of Florida in the United States, or in flood prone areas.  Yet irrespective of where they live, it is known that older people among other things are proportionately more likely to be injured and killed in disasters (e.g., tornado victims in the United States who are over 60 years old or more, are seven times more likely to be injured than persons aged 20 or less, see **MMWR**, 1991). Of the over 5,000 who died in the earthquake in Kobe, more than half were over the age of 60 (Kristof, 1995: A4). In addition, older victims find it more difficult to make up for property losses; in fact, the elder usually have proportionately more to lose. Interestingly, they are not more vulnerable to psychological problems as a result of the stress of disasters, but this does not carry over into the economic arena.

The problem is just the reverse in developing countries since they usually have very young populations. In the Bangladesh Cyclone of 1991, which killed an estimated 130,000 people, 63% of the deaths were in the under 10 age category although this category represented only 35% of the precyclone population (Mushtaque, Chowdhury, Bhuyia, Choudhury and Sen, 1993: 301). However, along with the elderly it is also the very young who are more likely to be casualties in disastrous occasions. Infants, as was true in Bhopal, are disproportionately likely to die (Bowonder, Kasperson and Kasperson, 1985: 10).

In the future there will also be expanding risk for those already at social disadvantage in a community. The poor are the most vulnerable in several ways. They generally live in more dangerous locations such as flood plains or around chemical plants (however, see Hazardous and Nonhazardous Waste, 1995). It was not the well off who lived in the Reforma district in Guadalajara near the PEMEX gasoline distribution center, when a series of sewer-drainage explosions along an 18 kilometer course ripped through 13 square kilometers of the area killing several hundred, injuring around 1,500, damaging at least 1,100 houses, and doing an estimated 300 million dollars of property damage. To the extent that developing countries continue to industrialize and urbanize, they will put poorer city dwellers more and more at risk.

In fact, cities in developing societies already typically have huge slums. Natural disasters such as floods and typhoons that have hit Rio De Janeiro and Hong Kong respectively have typically devastated squatter settlements in those communities. Sometimes, when technological disasters occur, the impact is much greater than would otherwise be the case. For example, the gasoline leak from a pipeline that exploded in Cubatao, near San Paulo in Brazil in 1984 set off fires in a nearby shantytown that resulted in 508 deaths (Cutter, 1991: 276). The same is true for natural disasters. For example, the 1992 earthquake in Cairo, Egypt killed 541 people, injured over 6,000 and left about 20,000 homeless. Most of these negative effects occurred in the poorer neighborhoods of the city where there was lack of quality in building construction resulting from the use of brittle construction materials, inadequate design and detailing standards, deficient craftsmanship and lack of maintenance (Khater, 1992).

That those at risk are more likely to be the socially disadvantaged is of course not peculiar to developing societies. Britton well describes this for Australia:

> *risk is not evenly distributed throughout Australian society . . . Hazardous industries are not randomly distributed . . . Industrial zones in general, and hazardous industry sites in particular, tend to be located in less-affluent areas characterized by low socio-economic residents less able to capably deal with, or respond to, crises . . . For instance, when the LPG storage tanks exploded . . . in Sydney's inner western suburb . . . the residential group most endangered was markedly over-represented in terms of the classification of*

*youth and adult unemployment; overseas born non-English speaking background; unskilled; low income; and the least formal qualifications (Britton, 1991).*

In the Kobe earthquake, it was the poor and elderly who disproportionately lost their homes, jobs and lives (Kristof, 1995:A4).

Also, after impact the poor are less able to cope with the losses suffered in disasters. In that sense, age can become a factor in the impact of a disastrous occasion. The problem is compounded by the fact that certain populations in urban areas are particularly heterogeneous, which we will now discuss.

3. **Increasingly metropolitan areas will be impacted: along certain social lines they are not well suited for coping with disastrous occasions**.

For a variety of reasons, some of which have already been suggested, metropolitan areas will be increasingly subjected to disastrous occasions (Havlick, 1986; Cohen, 1991). But as we have noted and as Mitchell has written:

*Urbanization is one of the most important factors propelling worldwide growth in natural disaster potential. People and material investments are pouring into cities that are already exposed to significant physical risks, or are expanding into areas at risk, or are pushing against the limits of biogrophysical systems and sociotechnical systems (1993: 29).*

In fact, the future "vulnerability of megacities" to disastrous occasions has been identified by an international group of experts as a task that should have high priority for scientific study during the United Nation's declared International Decade for Natural Disaster Reduction (Implementing the Decade, 1989).

While towns and cities have been impacted and destroyed by catastrophes since they evolved in the course of human history, it is only now that extremely large metropolitan areas or megacities are
becoming increasingly at risk. This is because megacities are only recent developments. While London in England reached a million population around 1800, in the next 100 years there were only 13 cities of such size. However, since then about 300 cities have reached that size with most of the increasing occurring the past half century (Mitchell, 1993: 30). Thus, before World War II, only the Tokyo-Yokohama metropolitan area had been impacted by a catastrophe; in that particular instance, the great Kanto earthquake, killed over 100,000 residents and destroyed over 700,000 homes. Since then there have been devastating disasters in such places as Tangshan, China and Bucharest, Romania, not to mention the more well known one in Kobe, Japan, as well as the two in Californian metropolitan areas in the United States..

Of course before and since then there have been less catastrophic disasters in the largest cities, ranging recently from a very severe windstorm in London, England to a typhoon in Nagoya, Japan. There is every reason to expect a rise of disastrous occasions in the full range of urban localities in the future.

In general, the social characteristics of urban localities will increase the difficulties in many kinds of crises because of the highly bureaucratic nature of urban organizations, the social rhythms of urban life, and the heterogeneous sociocultural patterns of urban groupings. Since all three makes planning for and managing social crises more difficult, the more there are disastrous occasions in urban areas, the more there will be problems.

a. Urban bureaucracies.

Stereotypical negative notions of bureaucracies should be avoided when discussing such types of social organizations. They can be very efficient ways of organizing very complex tasks and are absolutely necessary for the functioning of metropolitan areas. Nevertheless, it is true that bureaucracies are not very adaptive social organizations for coping with fluid and ambiguous crises, among the very hallmark of the emergency periods of disastrous occasions. Disasters involve nonroutine occasions. In those kinds of situations, as disaster studies have consistently found, new or emergent rather than traditional or standard behavior patterns are more adaptive for the demands or problems that surface. For example, hospitals and the hospital system can better provide emergency medical services if the bureaucratic authority structure, the traditional decision making process, and even the traditional division of labor, is not completely followed (Quarantelli, 1983). As such, even predisaster planning may not suffice especially in a catastrophic disaster. For example, in the recent earthquake in Japan there had been prearranged mutual aid agreements between Kobe and nearby cities, but as it turned out, the resources needed were also required elsewhere, and while the city had predesignated places for emergency shelter and accommodation, a large number of them were affected by the earthquake (see The Great Hanshin, 1995)

When faced with serious loss threatening occasions, organizations are often advised to adopt radical or frame-breaking changes. However, research shows that they are inclined to do the reverse: to be rigid and detached, relying heavily on existing strategies, routines and resources to pull them through such occasions. Put another way, since bureaucracies are not the best social organizations to prepare for and respond to disastrous occasions, their presence in the midst of such crises, can only magnify the problems that will appear.

All cities everywhere have many everyday problems not well handled by their bureaucracies. However, the problem is particularly acute in developing societies. It has been written of them that:

> *almost any account of Third World urbanization of cities reads like a litany of seemingly intractable problems. What is more, by interchanging a few names and adjusting some figures slightly the litany is depressingly similar throughout much of Asia, Africa, and Latin America (Dogan and Kasarda, 1988: 24 quoting an unreferenced McNulty writing)*

Whether the reference is to particular cities or urban communities generally, almost all observers draw a rather bleak picture. For example, although the specific reference is to Lagos, Nigeria, the following could be said of many other large cities elsewhere:

*[it] teems with inadequate services, uncollected garbage, unmoving traffic, inefficient institution, and unbridled corruption in the public and private sector (Dogan and Kasarda, 1988: 24 quoting an unreferenced McNulty writing).*

Of course, an actual situation may be more complicated than might appear on the surface, but not necessarily in the negative direction. In Mexico the formal governmental structure is on paper a highly centralized and rigid bureaucracy. However, after the 1985 earthquake, a detailed study found that in reality the system was somewhat functionally decentralized at the informal level. The result was that at the local level the response by organizations coped relatively well with a series of problems such as the restoration of the public utilities (Dynes, Quarantelli and Wenger, 1990). However, in the main, we should anticipate that urban bureaucracies will not cope well with disastrous occasions and as such will make populations more vulnerable to disaster impacts.

**b**. Social rhythms.

Everyday life and routines in cities tend to magnify and at times increase the potential impacts of any disastrous occasion. For instance, the work week, the daily rush hours and other temporal features associated with commercial life can considerably change who and what is at risk at any give time. For example, the Los Angeles earthquake of January 1994 could have occurred at 4:31 in the afternoon of a regular work day instead of the early morning of a holiday. If it had, the casualty totals would have substantially more because there would have been very heavy rush hour traffic on the half dozen overhead passes on the freeways that collapsed during the earthquake.

Earlier we had noted the importance of tourists in the life of many communities. As an example, the county in which Ocean City, Maryland is located has about 35,000 population which however swells to about 350,000 on major holiday weekends during the summer. The problem is compounded in that many localities do not have much planning for visitors.

The more general point is that the social rhythms of modern metropolitan areas tend to concentrate large number of people at very vulnerable points at times of disasters, such as in large structures or on dangerous roads.

c. Heterogeneous subcultures.

There is a widespread belief that many segments of urban populations live in very disorganized social settings. This is not correct. This perception mostly reflects the view of majority groups when they look at the non-mainstream social groupings that increasingly live in urban areas. However, far from disorganization, what is present are well-integrated social worlds and subcultures whose members simply have different values and beliefs, most stemming from different ethnic and/or religious backgrounds, than the dominant social pattern and culture. Many metropolitan areas in developed countries are the end point of migration from developing countries. And in developing societies the cities too are the magnets for rural migrants, as seen in Calcutta. A major consequence is that heterogeneity characterizes their urban way of life.

These kinds of population mix can affect response in disastrous occasions in a variety of ways, make planning even more complicated than usual, and generally raise the risks and vulnerabilities for the persons and groups in the mix. For instance, some ethnic and minority groups see hazards differently from other groups, with some assuming dangers can be overcome and others assuming human beings have to accept and adjust to threats. Depending on the belief, this can affect efforts at mitigation or prevention of disastrous occasions. People from different cultures can also vary in their support for protective actions, with some taking a fatalistic and resigned position because of certain kinds of religious values. Adoption of emergency preparedness measures can be affected by this. Also, some groups have very extended kinship systems that can provide considerable support at times of crises; conversely, other disaster victims because they trust no one other than their own, may have few or none to turn to for social support. As another example we may note that studies show minorities in most societies often have the most problems recovering from disastrous occasions because they frequently are not that socially visible to those providing help.

Our point is that any kind of sociocultural mix along any of the lines indicated will complicate and generally make less efficient and effective any aspect of crisis planning or managing. A relatively homogeneous population is much easier to plan for and will have less risks and vulnerabilities in disastrous occasions. But to take just one example, in the present day city of Los Angeles, the population speaks some 82 non-English languages and come from more than 100 different ethnic and cultural backgrounds. As another example, in Germany, workers from southern Europe and northern Africa make up one quarter of the population in Frankfurt, nearly 20 percent in Stuttgart and Munich, and about 15 percent in Dusseldorf, Mannheim, Cologne, Berlin and Hamburg.

However, we should note that not all scholars agree with the greater vulnerability of urban areas. Thus, one author wrote that:

> *Since World War II the study of tornadoes, fires, floods, hurricanes, earthquakes, typhoons, pollution disasters, epidemics, plane crashes, blackouts, and other emergencies has led to a far better understanding of how cities recover from disaster. If there has been a central lesson, it is that the processes at work in cities during and after disasters are the same as those that account for concentrated social and economic developed in less stressful times. Just last year, San Francisco suffered less and recovered faster from a major earthquake than anyone at first expected. The ability of cities to recover from disasters, once thought to be very limited, now appears to be broadly based on a variety of mutually reinforcing conditions and factors. For all their technological infrastructure and complexity, cities remain, above all, great concentration of human energy and resourcefulness. Indeed, Eric Jones, an economic historian, has argued that the rise in the West since the Middle Ages can be explained in part by the ease with which Western societies have recovered from disaster, as compared with African and Asian societies. Yet the myth of terrible urban vulnerability endures (Knovitz, 1990: 59).*

However, in our view, the very fact that reference is made to Western European cities as the exception, implies that urbanization is not the crucial factor in allowing recovery.

4. **Increasingly, localities will have disastrous conditions from sources that may be quite distant**.

An increasing pattern for some future disastrous occasions is that their source and their point of impact will be quite distant from one another. These situations have already occurred. Sometime impact is within a limited geographic area but with threatened localities away from the original risk source. For example, a chlorine gas cloud in Florida drifted about 28 miles from where a train accident occurred; if the same derailment had occurred in a metropolitan area rail yard in the United States, millions of people would have been put at risk. As another example, in Italy a 1980 pollution episode of the Po River stretched over 60 miles.

Far more important are when hazardous effects go over important jurisdictional boundaries, sometime of nation-states. For example, the 540 mile Meuse River arrives in Maastricht, The Netherlands loaded with very polluting human sewage and chemical waste picked up earlier upstream in France and Belgium. The radiation fallout from Chernobyl fell in various parts of the world, especially in European countries. The radiation falling on moss in Lapland in northern Scandinavia affected reindeer who used it for food that in turn affected natives who because they used the reindeer for several purposes, suffered economic losses. The toxic contamination of the Rhine River which starting in a fire in a chemical plant in Basel, Switzerland, eventually affected six different nations and polluted upriver for almost 800 miles (van Eijndhoven, 1994), or the Ohio River pollution that had severe consequences for several states (Comfort, Abrams, Camillus and Ricci, 1989) are again harbingers of what we might expect more in the future. Sometime there will be a linkage between natural and technological dimensions. Thus, in the Northridge, California earthquake which brought about electric power failures in the Los Angeles area, set off a chain reaction in interlocking grid systems that led to power disruptions in Oregon, Washington and across the border to western Canada.

There has been an increase in concern about similar potential disastrous occasions simultaneously or concurrently affecting distant communities. Recently, West Europeans have expressed considerable concern for future risks to themselves, not from their own nuclear plants, but from deteriorating facilities in Eastern Europe, especially the six nuclear plants in Bulgaria that produce about 40 percent of that country's electricity. A later U.S. intelligence report lists ten Soviet-built nuclear reactors in Slovakia, Lithuania, Russia, Bulgaria and the Ukraine as having an abnormally high risk of failure (Broad, 1995).

Consequences at a distance are not confined to technological type disasters. A Japanese bank recently analyzed the effects on the world economy if a major earthquake impacted Tokyo. It projected that because of the central role of Japan in the internationalized financial markets, the economic after shock would be felt around the world. It noted that in 1987, some 18.7% of the about two billion in foreign money that flowed from abroad into American securities came from Japan. The report also estimated that if the earthquake had occurred in 1988, world economic growth would have been curtailed by 0.3 percentage points in 1989; by 0.9 percentage points in 1990; by 1.5 points in 1991; by 2.1 points in 1992; by 2.4 points in 1993 and by 2.6 points in 1994 (Japanese, 1989: 1). It is only appropriate to note, that the specific example of a Tokyo earthquake creating worldwide negative economic and financial effects, has been seriously challenged by some American disaster researchers (see Hazards Assessment Update, 1996:7). However, it is probable that most who have considered the question, would agree that a disaster in one locality will swell consequences elsewhere, given the increasing interconnectedness of social life everywhere.

Additionally, certain kinds of technological type disasters can reach far away in both time and space. This occurred in a **PBB** pesticide poisoning in Michigan in the 1970s (see Chen, 1979; Reich, 1991) that worked its way into the second generation, the children of the original victims later living thousands of miles away from the original pollution source (Egginton, 1980). We may anticipate the more slowly moving and diffuse kinds of disaster threats to cut across such space and time dimensions, and we can expect them to increase in the future.

This will be compounded by the fact that increasingly the traditional community is becoming less important in terms of human organization. This general trend has been often observed outside of the disaster arena. For example, many have noted that transnational corporations are very difficult to control at the national level. And it is a commonplace observation now that the flow of money and financial transactions has become so internationalized that banking systems are increasingly less able to influence their activities although they have billions of dollars, yens, marks, etc. at their disposal. This is consistent with the observation that:

> *The phenomenon of globalization has led to a reduction of the room for maneuver of national governments in a growing number of fields (Cable, 1995: 51)*

By almost any criteria, the number of influential nonstate social actors is growing. Citizen groups, social movements, and nongovernmental associations, are still other examples of ever increasing important nonstate social players. This is to some observers and using the title of a recent book, the beginning of the end of the nation state (Guehenno, 1995; see also Horsman and Marshall, 1993). To others:

> *the pace of technological change . . . has led many to question the future of the nation-state as the main building block of governance (Cable, 1995: 23).*

A somewhat parallel development in the disaster area is the beginning of the eroding of the local community as the major base for disaster planning and managing. Since the human race has evolved, human beings have collectively organized themselves in terms of local communities that involve spatially proximate populations and functions. However, we are now entering a historical period where humans are starting to organize themselves collectively independent of <u>local</u> communities (just think of the new social circles created by computer networks). The public utilities, at least in the United States, have been among the first to recognize this in the disaster area. Increasingly, the utilities are organized in ways that cut across community lines. For example, we once studied an electric company that serviced many local communities in a Northwestern state. However, the major control center of that utility was hundreds of miles away, two states further east. Yet if a disaster occurred the company was going to try to manage it from that distant central point. The utility also pointed out to us the difficulty it had in that since it was operating on a regional and non-local basis, it could not coordinate very well with the diverse planning of many local communities it serviced on an everyday basis. This diminishing importance of the traditional local community is going to become ever more prominent in the 21st Century, and will pose major problems for disaster planning.

5. **Some future disastrous occasions have catastrophic potential even if they would produce no casualties nor have physical impact**.

There is a very misleading tendency to equate disastrous occasions only with casualties and property damage. In the first place, even occasions that are catastrophes in the sense of such losses are rare. As written of a particular disaster agent, earthquakes:

> *Despite their often overwhelming and destructive effects, death-and-injury producing earthquakes are still relatively rare events. Over 70% of the approximately 1.3 million earthquake related deaths since 1900 have occurred in 12 single events . . . In the United States, only an estimated 1,600 deaths have been attributed to earthquakes since colonial times (Jones, Noji, Smith and Wagner, 1993: 19, 20).*

However, to equate the magnitude of impact to the number of people killed or injured and/or to the amount of property damage misses often what is far more important. Focusing just on casualties and even property losses, ignores the psychological stress, social disruption, economic cost, and political strain that are almost inevitable in disastrous occasions even when the killed and injured and direct property damage may be very low. For instance, there were no casualties and little property damage in Mississauga, a suburb of Toronto, Canada when over 217,000 residents had to be evacuated because of a train derailment that threatened the release of very toxic chemicals such chlorine toluene and propane (Scanlon and Padgham, 1980). Yet the threat and evacuation were very disruptive for a period of days for the everyday life and routines of more than a quarter of a million people. The disruption was major in psychological, social, and economic terms.

In the future some disastrous occasions in terms of their direct effects will be primarily economically costly. The accident at Three Mile Island (**TMI**) provided a demonstration that factors besides injury, death, and property damage impose serious costs. Although there was not one death at **TMI** and few if any latent cancer fatalities are expected, as Slovic has written:

> *no other accident . . . has produced such costly societal impacts. The accident . . . certainly devastated the utility that owned and operated the plant. It also imposed enormous costs (estimated at 500 billion dollars . . . ) on the nuclear industry and on society (1987: 282).*

It did this through stricter regulations and the reduced operation of reactors worldwide, greater public opposition to nuclear power and greater reliance on more expensive energy sources, and increased costs of reactor construction and operation. Slovic additionally notes:

> *It may even have led to a more hostile view of other large scale, modern technologies, such as chemical manufacturing and genetic engineering. The point is that traditional economic and risk analyses tend to neglect these higher-order impacts, hence they greatly underestimate the costs associated with certain kinds of mishaps.*

*Although the reaction to . . . TMI . . . was extreme, it is by no means an isolated example. Other recent events that have had enormous indirect impact include. ..the discovery of pollution from chemical wastes at Love Canal . . . and Times Beach . . . the disastrous launch of the space shuttle Challenger . . . Following these extreme events are a myriad of lesser incidents varying in the breadth and magnitude of their impacts (1987).*

As a variant of this, we may note that some future disasters will be very socially disruptive, less because of their direct physical impacts, but as a result from the way that the hazard will be perceived. A good example of this occurred in Brazil in 1987. A cancer treatment machine abandoned in a junkyard, released some dangerous cesium 137 that through radiation contamination killed about four people and seriously affected about 44 others.

But far more consequential was the perceived risk from anyone that initially resided in the affected locality, namely Goiania. The occasion is a classic case of the potential negative impacts of perceived risk. Over 100,000 residents out of a total population of about one million underwent Geiger counter examinations to detect possible contamination; about 8,000 formal certificates were issued to counter the effects of being stigmatized as a hazardous carrier of radiation. This was a reasonable coping effort since anxiety over potential contamination led hotels elsewhere in Brazil to cancel reservations of persons from Goiania, buses and airplanes to refuse to take Goianians as passengers, and doctors and dentists not taking new patients who did not have the certificates. There were also cancellations of scheduled conventions with one estimate being that regional tourism fell over 40%; property values fell too, with sales for the entire city and state being affected. Possible as much as 50% of the state's export sales were lost during one month with the area's agricultural products being boycotted (or purchased at 50% of value). Even textiles and clothing manufactured in Goiania were affected--some losing nearly 40% of their value (see Petterson, 1988).

Clearly these kinds of future disastrous occasions resulting mostly in nonphysical but massive social, economic and/or psychological disruptions will have to be planned for in the future. There will be a need to get away from equating disastrous occasions only with fatalities, a rather narrow and almost completely discarded notion in most of the recent social science research literature.

## The Future of Planning for Disastrous Occasions

How might planning for future disastrous occasions be changing? Our exposition here is not normative, indicating what should be, but rather is projective, what is likely to occur. In that perspective there are certain general social trends are likely to lead to improvements in preparing for and managing disasters.

So far we have projected a picture of the future that by most criteria are negative. Yet that is neither our intent nor is it a fully accurate projection if left at that. Some of the social changes occurring will also <u>positively</u> affect planning in future decades. We want to note, in particular, some of the implications of the increasing importance of the mass media in social life and in the trend toward democratization of political activities.

The mass communication systems around the world, particularly as the result of accelerating developments in electronic and computer technologies, have greatly increased their capabilities to quickly produce and distribute information of all kinds. In part because of technological developments we are moving everywhere into what many have called the "information" type of society (Dordick and Wang, 1993). There are numerous and fundamental consequences from this for practically every aspect of human life. However, for our purposes, we want to note solely some of the implications for the disaster and catastrophe area.

For example, the mass media outlets increasingly put disastrous occasions on the agenda of everyone they reach. The information put forth about such occasions is simultaneously exposed to mass audiences in far distant places. Thus, a hurricane in Florida, the United States, will be noted as happening and significant not only by Americans, but also by some in Dacca in Bangladesh, an area also subject to major cyclonic disasters. An earthquake in Armenia will not only be visually exposed to those in that region in the former Soviet Union, but will equally be brought to the attention of audiences in Mexico City, another earthquake prone area.

However it need not even be a disaster experienced in a given area. For example, we happened to be on the ground in Abu Dhabi in the Arabian Peninsula when the Challenger space shuttle explosion occurred--it totally dominated that day all of the news stories in the mass media of that country. In a somewhat similar fashion, a Chernobyl becomes, as a result of media outlet exposure, instantly memorialized all around the world as an important historical happening as well as a symbolic representation of catastrophes that threaten the human race as do in slightly different ways the current famine in Somalia or an earlier one in Ethiopia.

This kind of exposure to the content of mass communication systems, often given its depiction in very dramatic visual ways, contributes to the notion there should be planning for disastrous occasions. In part this is done not only by putting disasters on the attention agenda of both citizens and officials, but also by the way the phenomena is "framed" (a technical notion out of the sociology of mass communication which we can not develop here, but see, e.g., Gitlin, 1980). Massive or image creating disastrous occasions in particular would seem to have the potential for generating efforts at planning for such crises. Even though distant, officials and communities elsewhere are given striking examples, depending on the framing used, that they can use to argue for more local preparedness.

There is every reason to think that mass communication systems will increasingly report on distant major crises. Modern technologies have enhanced the abilities of local electronic mass media stations to send their own personnel to report directly on disastrous occasions. For example, television stations from many areas in the United States, as well as some from Japan and Western Europe, sent their own reporting teams to transmit live reports back to their local communities after the 1985 Mexico City earthquake.
However, we should note two aspects about the depiction of disasters in mass communication systems. One, unlike other topics that the systems put on the attention agenda of citizens and officials, only a short time span is given over to disasters. Thus, the opening of a window of opportunity for action is very narrow. Usually the systems go back to highlighting only about five to seven more traditional issues (McCombs and Zhu, 1995: 495). Second, simply noting

that a disaster has occurred is not enough. It depends considerably on how the news of the disaster is framed. For:

> *There also is evidence that the way an object on the agent is framed can have measurable behavioral consequences (McCombs, 1993: 63).*

Unfortunately, our general impression is that the mass communication content usually emphasizes the the short run, the atypical and the individual aspects of the disaster occasion instead of the long run, the typical and the social aspects of the situation especially prior to the actual impact. This makes it difficult for disaster to become part of the policy agenda of the society as do other issues (Page and Shapiro, 1992).

Nevertheless, if operative in the best way, this kind of mass media information dispersal supports already existing tendencies to improve planning for disastrous occasions. We should note that we are not talking of a static social setting insofar as such planning is concerned. In fact, looking at the historical evolution from the past to the present, one might be encouraged in terms of dealing with future disastrous occasions. The present situation is certainly better than what existed in the past, and as such augurs well for the future.

The Disaster Research Center (**DRC)**, has done considerable research for nearly 30 years on preparations for and responses to natural and technological disastrous occasions. Along some lines our recent field studies report rather good news. For example, local emergency management agencies in the United States, have much better planning and managing and have better personnel than they once had. Across the country, their preparedness as a whole has markedly improved over the last 15 years or so (see Wenger, Quarantelli, and Dynes, 1986).

A similar picture can be found if one looks at most countries, developed or developing, around the world. In the last few decades planning for and responding to disastrous occasions has improved. There has been a particular acceleration of the process in European countries such as Italy, Great Britain, Greece and Spain. Where nothing once existed, much has been created; where there was something in place it has been made better. Almost anywhere that one looks the present as compared with the past is an improvement. Even in developing countries, except perhaps in sub-Sahara Africa, there have been notable increases in crisis type planning in such societies as India, Mexico, China, Venezuela and Bangladesh.

There is every reason to think that the indicated improvements will continue to occur. Disastrous occasions will increasingly be on the agenda for attention as the mass communication systems everywhere will find it progressively easier to report on such news stories. While we would not want to suggest that such information dispersal is completely socially functional (a topic that cannot be discussed here), without doubt the news stories will contribute positively to existing efforts to improve planning for crises.

In turn, the mass media content about disastrous occasions will continue to converge with another major social trend. As a whole, a social change going on has been a move toward democratization of political activities. This involves changes in values, beliefs, activities and practices. For the purposes of this paper, the two most important have to do with what citizens increasingly expect of their governments and the rise of citizen activism (see Jenkins and Klandermans, 1995). Both of these will continue to move in the direction that citizens will more and more expect their own governments to protect them against disastrous occasions and/or join with their fellow citizens in efforts toward better planning for environmental threats (see Hadden, 1994).

For centuries in many places, populations had little expectation that their governments could or would do much to protect them again the impact of disasters. Partly because of religious beliefs as well as a general fatalistic attitude about the vicissitudes of life, "*Acts of God*" were accepted as inevitable (although even in the 1600s those interested in public health questioned the term and legal scholars in the 1800s saw the phrase as useless for technical purposes, see Loimer, Driur and Guarnieri, 1996). In more recent times, in some societies, especially of an authoritarian or dictatorial nature, the general population has little expectation that the government will do anything for them at times of crises.

Yet in many societies this is changing. Partly because of the secularization that has progressively become the dominant mode of thinking and also because of certain changes in political beliefs about the role of governments, "fatalism about disasters" has become less and less an acceptable popular view. Especially in the developed countries, but spreading rapidly elsewhere:

> *most citizens accept disaster planning as an appropriate and acceptable function of government . . . [and] is viewed as a public responsibility (Drabek, 1986: 23).*

In fact, this author notes that there has been:

> *some fundamental changes in hazard perceptions. God is losing ground, when it comes to flooding, for example. And if not God, than man.*
>
> *While events <u>per se</u> may still be viewed as "Acts of God," it is my belief that greater segments of the public view certain types of damages as avoidable, <u>if</u> government will act (1986: 342, 352).*

As other writers have noted:

> *As humans have come to understand and control natural processes, disasters which were previously disasters which were previously viewed as "natural" in that they were beyond human control, are now seen by many as environmental events which can and should be managed.*
>
> *currently, many "natural" disasters are not perceived as clearly natural or technological in origin . . . We suspect that humans will increasingly come to view natural disasters as "unnatural" in origin: people will increasingly assume that humans, and human created systems, are at fault (Blocker, Rochford and Sherkat, 1991: 378, 379-380).*

Of course the advent of technological disasters is accelerating the acceptance of this view because to many, such dangers are seen as inherently more capable of being controlled by human beings.

That the latter is the case is additionally supported by the emergence in many places of citizen groups interested in environmental threats mostly of a technological nature such as hazardous wastes, radioactive materials, chemical substances, etc. (Dalton, 1993; Szasz, 1994). From a reactive stance toward the happening of natural disasters, many in this movement have moved to a proactive stance with respect to technological disasters. Thus, both in Europe and the United States, numerous small groups of citizens, have often informally formed to better prepare for and respond to chemical and nuclear related hazards that might turn into disastrous occasions (see Quarantelli, 1985; also, Reich, 1991). There is every reason to think that such large scale citizen activism will if anything increase in the sense of both the number of such groups and the range of risks about which they think something should be done. It has been observed by many that there was much social activism generated by the Mexico City earthquake of 1985 (Dynes, Quarantelli and Wenger, 1990).

Overall then, social trends such as greater expectation by citizens that they should be protected against environmental threats as well as particular happenings such as the UN Decade for Natural Disaster Reduction, assure that we can anticipate continuing if not increased attention to planning for disasters and catastrophes. Yet while these social trends will also contribute positively to planning for disastrous occasions, unless a greater effort is made, it is certain that future disasters and catastrophes will be more of a problem than they have been in the past.

Although this already lengthy paper cannot discuss the severe consequences of future disasters in any great detail, we will at least note some probable effects. A particularly good summary statement, although it mostly discusses the situation in Bangladesh, phrased the problem as follows:

> *Most of the Asian countries, where the majority of world population live, are disaster-prone and have high density of population. They are facing tremendous problems of overpopulation, deforestation, desertification, overgrazing, soil erosion and environmental pollution. These problems are complicated by both natural and man-made recurrent disasters like floods, droughts, windstorms, storm surges, earthquakes, tsunamis, volcanic eruptions and environmental degradation.*

Although the specific reference is to societies in Asia clearly the rest of the statement, in our view, is applicable to many developing countries.

> *The impacts of disasters on environment and development are manifold. Disasters create substantial environmental degradation and ecological imbalance, hinder socioeconomic development and retard the process of improving the quality of life of the people. The interactions of disasters, environment and development have both short-term and long-term effects. These interactions and interdependencies work in a complicated way, affecting people, ecosystem and bio-diversity. As such, an optimum balance is needed among these factors so all human interventions should ultimately aim at providing*

*maximum benefits to the people less environmental degradation and sustainable conservation of ecosystem and bio-diversity.*

This of course is easily said but not easy to implement either in policy or practice. As the author goes on further to say:

> *It is very difficult to attain environmentally sound and sustainable development (ESSD) without making a compromise--optimization of the requirements of ESSD, development of adequate disaster preparedness and mitigation techniques, tackling of environmental issues, application of country-specific development strategy and other related parameters (Pramanik, 1993: 1).*

It is rather clear to us that whether focus is on the characteristics of disasters or their consequences, the situation is not a good one. We are going to be faced with more and worse disastrous occasions in the future unless disaster and emergency preparedness and personnel is improved.

## Policies and Actions for the Future

This is possible. Policies can be established and steps can be taken that will reduce and weaken some negative effects of the probable catastrophic disasters of the future. Let us present five 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. As we have detailed, 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 factors rather than in meteorological or geophysical factors 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 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, Hong Kong, 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 almost all 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 <u>natural</u> 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 <u>only</u> 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 intra and interorganizational 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.

Using the above example, at one level--a relatively immediate one--the problem could be partly addressed by instituting such measures as stronger building codes, more appropriate land use management, educational programs on safeguards against risks, as well as other hazard and disaster mitigation actions especially of a non-structural nature. At a more contextual level, there is a need, for instance, 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 which 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. 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: 63).*

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 any kind of technology for disaster planning purposes. However, any technology can not 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, discussed earlier, reinforces our belief that a distinction which was never valid in the first place should now bediscarded.

Those disaster theorists who argue that <u>all</u> disastrous occasions are attributable to human and group actions, usually see no meaningful conceptual distinction between "natural" and "technological" disasters (see, Wijkman and Timberlake, 1984; Quarantelli, 1987, 1991; Stallings, 1988; Rochford and Blocker, 1991; Clarke and Short, 1993). As such, the argument is that for planning and managing purposes it is <u>not</u> 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 hazards or 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 <u>per se</u> 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 (Quarantelli, 1992).

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 may different types of natural and technological agents.

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, disposition 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 an hazard 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 at the organizational level (as an example, see Belardo and Harrald, 1992  who show the basic similarities in planing for earthquakes and catastrophic oil spills).)

This is true even of 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 hazard chemical disaster prevention measures.  Put another way, most human, group, organizational, community and societal aspects of mitigation planning, tend to be generic rather than disaster agent specific.

In addition, apart from theoretical, logical or empirical research reasons for taking a generic or all hazard 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.

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

Earlier we tried to indicate 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 amelioriative 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 should include 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 redevelopmental 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, mass media personnel as well as citizens). Last but not least, mitigation should involve those measures taken during the short run preparedness, relief and recovery phases of disasters that indirectly contribute to mitigation.

To argue for more priority to mitigation is not to downplay the necessity of actually improving disaster preparedness, response and recovery planning. Mitigation should <u>never</u> 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.

Of course even at best 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 certain psychological stresses and social disruptions that result from disasters. While some reduction of economic losses might be anticipated from ordinary or typical disasters, it is possible there will be less effect on such losses from catastrophic ones.

(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. Yet 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 enough, 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 point this out is particularly true in developing societies). There should be no sharp boundary between routine village, regional and national developmental planning and disaster planning. Every decision about residential land use, plant sitting, and indeed every industrial and economic policy or program, carries with it some consequence for risk and hazard. 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, than 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 hazard 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 it 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 will not be 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 skillful managers--often particularly in short supply 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, this question can be asked. What are the present and future costs (social and political as well as economic) of the contemporary tendency to compartmentalize disaster and developmental planning? Are those "costs" less than would be incurred in efforts to integrate the two planning processes. Moreover, there would be "gains" in the long run in a stronger linking of the planning for development and for disastrous occasions.

(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. Let us note a few examples. 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 as we have just indicted, 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, that is, other environmental problems. The personnel, organizations and resources committed to disasters are frequently in different social circles and worlds than those focused on other environmental problems. More important, they are seldom studied or discussed in any common framework.

Now our view is that it would be incorrect and not very useful to fully equate disasters with all other environmental problems (apart from the fact that technically in sociology, disasters are not "social problems" in important respects). As we have written elsewhere (Quarantelli, 1993c), a number of ecological problems that are 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. 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 in to 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 elsewhere in this paper, 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 <u>environmental</u> 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 (Smelser, 1991).*

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 problems are similar to and different from environmental problems. To 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.

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. As someone has said, if the production of mushrooms were invented today, there would be those that would urge their total prohibition. The notion that hazards and subsequent disastrous occasions can be completely eliminated is not borne out by history. In fact, at times 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 {Rasumussen et al., NRC 1975}. (quotation from Lovins and Lovins, 1981:17).

Nevertheless, that not everything can be done, does not mean that something cannot be done. We can without doubt decrease the increase of 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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