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# THE FUTURE IS NOT THE PAST REPEATED: PROJECTING DISASTERS OF THE 21ST CENTURY FROM PRESENT TRENDS

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## THE FUTURE IS NOT THE PAST REPEATED: PROJECTING DISASTERS IN THE 21st CENTURY FROM PRESENT TRENDS

My basic theme is a very simple one. The future is not the past repeated. This is as true in the disaster area as anywhere else. If we are interested in what we will face by way of disasters to come, we cannot extrapolate only from the past.

This is important from a practical as well as a theoretical viewpoint. Research has consistently found that organizations and communities impacted by disasters, plan for future ones based on their last experience with such an occasion. Now it would seem reasonable to plan for the future based on past experiences. However, as just said, the future is not simply a repetition of the past.

What else can one use if not experiences? This is where research can be very useful. Research studies cannot only analyze what has happened, but also what is likely to happen. Such work can take existing present trends and project them into the future. To a considerable extent this is what I will be doing in the rest of my remarks.

Research that makes projections into the future usually assumes that change is a constant and that the rate of change can be very uneven. Even the most stable of social systems undergo change. The Greek philosopher, Heraclitus, said that you can never step in the same river twice because the river is always changing. The same is true for social systems, whether they are communities or societies. Yet the rate of change in any particular social setting, is not always the same. Thus, we are now in terms of world history, in a period of very rapid change. Although the 21st Century is only a few years off, it is safe to say that its social landscape and features will be markedly different from that in which we have lived in the 20th Century. What is in place now and was in being in recent past decades will be notably different in coming years.

Massive social changes of all kinds are happening in the political, economic, familial, cultural, educational and scientific areas. The most important structures and activities of human life are drastically changing (Smelser, 1991). We can see this in many ways. As examples, let us mention:

> *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 non-traditional artistic and musical forms as well as a globalization of popular culture,*
> *the new family and household patterns that are emerging,*
> *the escalating use of computers and related means for training and educating people, and*
> *the growing diffusion and expanding use of applied social science to many areas of life.*

If existing trends continue, the cultural values and beliefs of societies of the 21st Century will emphasize 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 require extensive bureaucratic organizations, increasingly centered in urban localities.

There will also be ever more pressure toward democratization that includes a focus on the rights of citizenship, inclusion and participation in the polity, equality and justice. These tendencies are spearheaded by their presentation in ever more global mass communication systems constantly exposing their contents to world wide audiences through a variety of advanced electronic means. These changes around the world will affect the appearance, characteristics and dynamics of disasters, and the planning and managing of such occasions everywhere. Given my time constraints, I will not discuss each of them in detail. Instead, I will only highlight some of the more significant changes. The changes discussed will potentially have mostly negative consequences. They could lead both to more and worse disasters in the future, and make response to them more difficult. However, some changes have the potential for more positive consequences. That is, they will set the stage for the better planning for and managing of disasters, if they do not reduce or prevent them in the first place.

There are different ways that various scholars have tried to group the various social changes that are occurring. For our purposes, we can subsume most of them as consequences of either

*industrialization* and *urbanization.*

Industry with its accompanying distinctive kind of ever developing 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). Paralleling this trend has been 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).

To be sure the industrialization and urbanization process have a long history in the Western World, but they are not finished. We should stress that industrialization means more than simply that there will be greater industry in a society. The reference is more to continual innovation, not only in the technology but the accompanying social organization. Similarly, urbanization means more than simply people living in cities. It has reference more to a way of life, certain lifestyles.

## The Possible Negative Effects

The consequences we will note for disasters are as significant, if not more so, for developing countries as for developed ones. Therefore, while I use more examples from Western type societies and particularly the United States, our observations are applicable everywhere. Furthermore, as will be obvious in some later examples, a distinction between developed and developing societies that assumes they are totally independent of one another with respect to disasters is a fallacious one.

I. Industrialization: (this process is providing new direct and indirect sources for disasters).

Let us discuss two major examples:

(1) Developments in computer technology.

A major new threat that is developing is associated with all the disastrous consequences that will come from the computer revolution that human society is presently undergoing. It is making life easier for most of us in many ways. Yet our increasing dependence on computer technology will magnify future disasters and turn some minor emergencies into major crises. This is particularly true because many sectors of government and business are increasingly computer based for the data and information they need to function, sometimes literally from minute to minute. Thus:

> *It is presently 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).

However, what is important is not simply the use of computers. Far 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 that form networks and systems.

For instance, the telephone networks are more important than ever before. Yet they are also more vulnerable than ever before. Massive glitches impairing telephone systems are becoming increasingly common. In 1991, eleven major phone system outages affecting major metropolitan areas occurred just in the United States alone. In the report accompanying those figures, the observation is made that:

> *modern fiber optics carry 10,000 time more calls 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 disruptions 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 switch handled 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)

In a parallel fashion, the transatlantic cables that in 1966 could only carry 138 simultaneous conversations, with the introduction of fiber-optic cables by 1988 the number rose to 40,000 and now in the early 1990s, there can be a million and a half simultaneous conversations. As the given illustrations show, since the societies of the 21st Century will increasingly rely on smoothly functioning communication networks, the consequences of network failure will be more severe.

As an actual example of a system 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. This 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 catlogue sales companies headquartered in the Chicago area, 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).

Similar scenarios have occurred in Japan (see Takanashi, Tanaka, Yoshii and Wada, 1988).

Computer disasters are in our future. Some might wonder if this area should be the province of disaster planning and emergency management. Yet if not there, whose responsibility is it to be concerned about disasters that involve interorganizational networks using computers and technologies that cut across many local community lines?

b. Biotechnological advances.

There are also developments in biotechnology, especially genetic engineering that are also going to produce disastrous occasions. Simply put, this technology involves altering the blueprint of living organisms--plant, animal or human--and creating new characteristics. Some of them are very useful (e.g., bacteria have been created that "eat" various kinds of chemical wastes such as occur in 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, Jurassic Park, but of real possibilities (see Holtzman, 1989).

Of course, there are constant assertions about the safety of the process. A National Science Foundation report 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 founds . . . 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 written in a letter the 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* (Letter of Robert J. Yaes in 1987, The New York Times).

Assertions of absolute safety of course remind some of us 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 are 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).

Against that background, we feel confident in asserting that biotechnology will bring us a major disaster sooner or later. In fact, just as the 1970s was the time when the world became aware of nuclear power plant threats, the 1980s of chemical hazards risk, 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. It involved the accidental release of biological toxins at a Soviet research center. The release of highly toxic anthrax spores probable killed 1,000 workers and contaminated a 20-square mile area around the city of Svardlovsk.

As in the computer area, there is almost no preparation by disaster planners for this kind of disaster. Yet to the extent that any country anywhere in the world sets up facilities for biotechnological purposes, it will create risk in the production, storage, transportation, distribution and use of the products involved. This is not an argument against biotechnology advances for there are wonderful results possible from them. It is however a prediction that we will have trouble in this area.

II. There are several very interesting aspects of these new disasters of the future (not just the computer and biotechnological ones mentioned, but many others that we can expect).

(a) the impacts of such disasters are often at a distance from the original source of the trouble.

Put another way, increasing localities will have disastrous conditions from disaster sources that are quite distant. Especially important are when disastrous effects cross important jurisdictional boundaries, sometimes of nation-states. The radiation fallout from Chernobyl fell in various parts of the world, but especially in European countries; the West Germany government alone paid more than $100 million in compensation to farmers for radiological contamination of their crops. An even more recent example of pollution in the Rhine River which starting in Switzerland affected six different nations and polluted upriver for almost 800 miles, or the Ohio River pollution that had

severe consequences for several states, are again harbingers of what we might expect more in the future. Recently, West European recently expressed considerable concern for future hazards 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% of the country's electricity. A later U.S. intelligence report listed 10 Soviet-built nuclear reactors in Slovakia, Lithuania, Russia, Bulgaria and 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 aftershock would be felt around the world. It noted that in 1987, some 18.7% of the about two billion in foreign money which flowed from abroad into US 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% points in 1989; by 0.9% 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).

The problems posed by distance sources for disaster planning are rather major. Part of good disaster preparedness is a risk analysis of likely dangers to a given community. However, it is very difficult to make a risk analysis and to plan for a very distant source of danger one is possibly not even aware exists such as a flawed nuclear plant.

(b) there can be catastrophic potentials even if there are no casualties or notable physical damages.

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

> *Despite their often overwhelming and destructive effects, dearth-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).

Moreover, disastrous occasions in terms of their direct effects may produce no casualties or property damage. Yet they can be devastating along other lines, such as being very socially disruptive, psychologically disturbing, economically costly, and politically damaging. The accident at Three Mile Island (TMI) provided a demonstration that factors besides injury, death and property damage impose serious social costs. There was not one death at TMI and few if any latent cancer fatalities are expected, and property damage was minimal. Some might even argue the occasion was not a disaster. Yet, as Slovic has written:

> *no other accident . . . has produced such costly societal impact. 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. Economics apart, the incident was very socially disruptive in upsetting the routines of millions of people, psychologically disturbing for some nearby residents to this very day, and politically damaging in a variety of ways.

As a variant of this, we may note that in the future we will have more of these disasters that stem less from direct physical impacts, but more from the way the hazard is 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 four people and seriously affected about 44 other (Petterson, 1988).

However, far more consequential was the perceived risk to and from anyone that initially resided in the affected locality, namely Goiania, Brazil. 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 the country 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 was also cancellation of scheduled conventions with one estimate being that regional tourism fell over 40%; property values fell too, with sales of 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 Goianaia were affected--some losing nearly 40% of their value.

We may expect more of these kinds of disasters in the future. We need to get away from equating disastrous occasions only with fatalities. This is a narrow and almost completely discarded notion in most of the recent social science disaster literature, in part because any assessment of negative effects involves cultural values, a point to which we will return near the end of this paper.

(c) There can be multiple effects or those of a synergistic nature.

There has been only the beginning of a recognition of the fact that natural disaster agents will increasingly generate or magnify concurrent technological disasters (and even possibly in the other direction). Increasingly so, because of the accelerated production, transportation and storage of hazardous substances of all kinds, disaster agents in the past that would have simply created natural disasters, can now create technological ones. For instance, a flood could inundate a chemical plant complex. The convergence of a tornado and a radiologically active cloud could pose a very threatening situation. An indication that this is not an idle threat is the fact that increasingly disaster

planning is taking into account possible hazardous chemical releases and spills after earthquake shocks (Seligson, Eguchi and Tierney, 1992; see also Tierney, 1989 and Tierney and Anderson, 1990). In the Whittiers Narrows earthquake, the City of Los Angeles fire department had to respond to 112 natural gas leaks (with the projected limits of what it could handle, being 200 incidents at one time). Lindell and Perry in looking at the Northridge earthquake of 1994 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 assessment were conducted . . . The inspections yielded 82 sites with hazmat concerns* (1995: 8)

The authors additionally note a train derailment that spilled sulfuric acid and diesel fuel, nine pipeline 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 structure fires and fire destruction of 172 mobile homes. In addition, the earthquake produced extensive hazardous material spills and fires in all three science laboratory buildings at the California State University in Northridge, although the level of hazmat incidents was not major in Rockwell's aerospace industrial facility.

In an even more systematic general study, Showalter and Myers (1994) examined how frequently there was interaction between natural and technological disasters in the United States in 1980-1989. They obtained data through a literature search, contacting organizations and individuals active in hazards research and mitigation, and also through a questionnaire sent to the emergency management agencies of all 50 states. The authors concluded that the number of incidents where natural and technological disasters interact is rising while preparations, which recognize the complications inherent in such combined happenings, remain cursory.

We should additionally note that the link between two hazards may not be an immediate temporal one. As a concrete example, we might cite one from the former Soviet Union. In 1961, windstorms spreading radioactive material (plutonium and strontium) in the Lake Karachay region in the Southern Urals in the former Soviet Union increased by 30 to 50% the land area previously contaminated by an earlier nuclear disaster (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).

Two later natural disaster agents magnified the earlier technological disaster.

Let us now turn to the other major source of problems. Parallel to the increase and/or negative changes in disaster agents, are social transformations in the populations and communities that can be impacted. The end result of these trends, mostly stemming from the urbanization process, is an enlargement of social risks and vulnerabilities. Thus, even if there would be absolutely no change at all in agents or occasions, we could still expect the probability of more and worse disasters just from the changes that have and are occurring in the individuals and groups, which are potential candidates for impact in the future.

> Urbanization: (the process is increasing or magnifying new sources for social risks and vulnerabilities)

Both natural and technological disaster agents will simply have more to hit which along some lines stems from the very process of urbanization itself.

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, there has been the building up of areas that are particularly vulnerable to hazards. Thus, by the year 2000, 75% of the US population will live within 10 miles of either coast, subject to hurricanes in the East and Gulf Coast and earthquakes in the West. This means that increasingly there are greater number of people and great amounts of property at risk from different disaster agents. For example, there are more people and settlements than ever before in riverine flood plains. Because of social factors, where in the past there were marsh or swampy areas, there are now housing complexes and office/industrial parks. The same picture could be drawn for earthquakes. As an illustration, we can note that 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 holds true for tornadoes, volcanic eruptions and hurricanes (and of course the same is true for technological agents). An example of the last, is that the property destruction wrought by Hurricane Andrew would have been considerably less just a decade ago because there was much less of a built environment to impact. Similarly, for the brush fires around Sydney, Australia's largest city, which burned and threatened thousands of suburban homes in January 1994.

It is not only that there is more to impact. It is also that 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 would normally occur (see Penning-Rowsell and Fordham, 1994). Geipel in discussing the background of the 1988 flooding of the Danube River 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 floodwater 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. Riverine forests have been eliminated, wetlands drained and the infiltration capacity of both soils diminished by field clearance* (1993: 112).

Similarly, the 1993 floods in the Midwest United States and those in northwest Europe in Germany, the Netherlands, and France that were the worst 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, there is the attribution of the flooding to too many dikes, concrete embankments and artificial channels built along the Rhine River and its tributaries. The argument is that low lying lands should have been allowed to return to their natural states (Whitney, 1993: 4). Recent statements in the United States about the flooding in the upper Mississippi River essentially say the same.

> *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 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 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 Philippi, 1994, 1995).

a. More vulnerable kinds of populations will be impacted than in the past.

Populations in future disastrous occasions, because of social changes--some of lifestyle, others of a demographic nature--will be more vulnerable to negative effects.

(1) Lifestyle changes:

For example, changes in lifestyles can increase vulnerabilities. As an example, notions of leisure times and vacations have become very widespread in developed societies. This in turn can lead 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 people. Changes in lifestyles are leading more people to be tourists in localities at risk from such happenings. An illustration of this is that the weekend, seasonal and holiday population in the tourist resort areas on the east coast of the United States is usually 10 to 100 times more than the permanent coastal residents. A similar change in population patterns is true in Europe with respect 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.

(2) Demographic changes.

Then there are the changes occurring in the demographic characteristics of populations in current societies. These can result in qualitative changes in vulnerability. As an example we are increasingly getting an older population in at least the majority of developed countries around the world. For instance, Japan where 12% of the Japanese are now 65 years and older, will surpass Sweden as the country with the largest percentage of its population being 65 and over, reaching 24% in 2043. In addition, in some societies the retired elderly often migrate to warmer areas that however are more subject to risks such as state of Florida in the US.

Yet irrespective of where they live, it is known from studies that older people among other things are more likely to be injured in disasters as noted in the following:

> *Based on studies of previous tornadoes, persons aged > 60 years are seven times more likely to be injured than persons aged < 20 years because of factors, such as medical illnesses, decreased mobility, decreased ability to comprehend and rapidly act on tornado warnings, and greater susceptibility to injury* (MMWR Morbidity and Mortality Weekly Report, January 18, 1991).

Additionally, older victims find it more difficult to make up for property losses. In fact, the elderly have proportionately more to lose. Interestingly, however, they are not more vulnerable to psychological problems because of the stress of disasters, but this does not carry over into the economic sphere. Disasters of the future are likely to impact more heavily simply because the impacted population is likely to be older in developed societies.

In developing countries, the problem is just the reverse 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). But 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.

b. Metropolitan areas are also increasingly likely to be impacted in the future.

For a variety of reason, metropolitan areas will increasingly be subjected to disastrous occasions. 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 al systems* (1993: 29).

In general, the social characteristics of metropolitan localities will increase the difficulties in many kinds of crises. The problem here stems from two factors. One is the bureaucratic nature of a modern metropolis. The second is the diversity of urban populations.

(1) Urban bureaucracies.

I use the term bureaucracy in an analytical neutral rather than pejorative sense. Viewed that way, bureaucracies can be very efficient ways of organizing very complex tasks and are absolutely necessary for the functioning of metropolitan areas. That said, however, it is true that bureaucracies are not the most adaptive social organizations for coping with fluid and ambiguous crises, the very hallmark of emergency time periods of disastrous occasions. Disasters involve nonroutine occasions. As such, even good 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 areas for emergency shelter and accommodation, a large number of them were affected by the earthquake (see The Great Hanshin . . . earthquake of Southern Hyogo Prefecture, Japan, 1995). 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 medical system can better provide emergency medical services if they do not completely follow the bureaucratic authority structure, the usual decision making processes, and even the traditional division of labor.

When faced with serious loss threatening occasions, public and private organizations are often advised to adopt radical or frame-breaking changes. However, research indicates 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. However, such inflexible groups in the midst of crises can only magnify the problems that will appear. What might work well for everyday situations, will not do at times of disasters.

Of course, an actual situation may be more complicated than might appear at first glance. In Mexico City, 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). Yet 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. We saw this in the Kobe earthquake, where a relatively efficient national bureaucracy for everyday purposes, could not produce the quick and flexible actions necessary at times of crises (this was compounded by the fact that Japanese cultural norms are also not supportive of innovative actions by individuals).

b. Heterogeneous subcultures.

There are widespread beliefs that many segments of urban populations live in very disorganized and anomic social settings. This is incorrect. This perception usually reflects the view of dominant and majority groups when they look at the non-mainstream social groupings that increasingly live in urban areas. However, far from disorganization and anomie, what is present are different social worlds and subcultures whose members have different values and beliefs than the dominant social pattern and culture, many of these stemming from different ethnic and religious backgrounds. Many cities in developed countries such as the United States, have been the end point of migration from developing countries. A major consequence is that heterogeneity characterizes the urban way of life.

Again, diversity has its positive aspects. However, these kinds of population mix can affect disaster response in a variety of ways, make disaster planning even more complicated than usual, and generally raise the risks and vulnerabilities for the persons and groups in the mix. We cannot paint a systematic picture of all that can be involved. However, let us note some general points derived from research.

For instance, some ethnic and minority groups see hazards differently from other groups. Some assume hazards can be overcome and others assume human beings have to accept and adjust to threats. Depending on the belief, this can influence efforts at disaster mitigation or prevention. People from different cultures can also vary in their support for protective actions, with some taking a fatalistic and resigned position because of cultural or religious values. This can affect the adoption of emergency preparedness measures. Also, some groups have very extended kinship systems that provide considerable support at times of crises; conversely, other victims because they trust no one other than their own, may have few or none to turn to for social and material support. As another example, we may note that studies show minorities often have the most problems recovering from disaster 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 disaster planning or managing. Just take the fact that in the city of Los Angeles, the population speaks some 82 non-English languages and come from more than 100 different ethnic and cultural backgrounds. Simply put, a homogeneous population is much easier to plan for and will have less risks and vulnerabilities in disasters.

This is why there are also problems stemming from fundamental changes in family patterns; the form of the family and household has been changing. For example, more and more, the recent traditional type of 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 people, childless couples, both male and female single parents, same or different unmarried pairs such as heterosexual partners and gay couples, as well as unrelated roommates. Much disaster planning, at least in the West, implicitly assumes that most households consist of nuclear families. Yet this is a diminishing social pattern.

Furthermore, the other types of growing kinds of households all present different kinds of issues and

problems for disaster planning and managing. For instance, the homeless presented unexpected major relief problems after the Loma Prieta earthquake and Hurricane Hugo in the United States. This was in addition to the usual problem of dealing with the poor and socially disadvantaged in metropolitan areas. Somewhat surprising, a similar problem of the "homeless" arose after the earthquake in Kobe in Japan (The Great Hanshin . . . Earthquake of Southern Hyogo Prefecture, Japan, 1995: 16).

c. The traditional community is becoming less important in terms of human organization.

This general trend here has been increasingly observed outside the disaster arena. For example, many scholars 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 funds and financial transactions has become so internationalized that central bank systems are increasingly less able to influence their own national money supplies 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 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 involved spatially proximate populations and functions. However, we are now entering a historical period where human beings are starting to organize themselves collectively independent of local communities (just think of the new social circles created by computer networks). The public utilities, at least in this country, 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 it was going to try to manage the situation 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 nonlocal 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.

## The Possible Positive Effects

So far we have projected a picture of the future that by most criteria would be viewed as negative. Yet that is neither our intent nor is it a fully accurate projection if left at that. Some social changes that are occurring will also positively affect planning and response in the decade to come. In particular, I want to note some implication in the ever increasing importance of the mass media in social life, and in the trend toward democratization of political activities.

(1) the ever increasing importance of the mass media in social life

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. What are the implications of this for the disaster area? For one, the mass media outlets increasingly put disastrous occasions on the agenda of everyone they reach. Thus, an earthquake in Mexico City, will be noted as happening and significant not only by Mexicans but also by Americans. In a somewhat similar fashion, a Bhopal in India or a Chernobyl in Russia becomes, because of media 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.

This kind of exposure to the content of mass communication systems, particularly since much of it is depicted in very dramatic visual ways, contributes to the notion that there should be planning for disastrous occasions. This kind of mass media information dispersal supports already existing tendencies to improve planning for disastrous occasions. For example, local emergency management agencies in the US 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. Public attention will only accelerate that trend.

In addition, mass media content about disastrous occasions will continue to converge with still another major social trend. As a whole, a social change going on has been a move toward democratization of political activities. This involves changes of many different values, beliefs, activities and practices. For our purpose here, the two most important have to do with what citizens increasingly expect of their governments and the rise of citizen activism. Both 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.

For centuries in most places, populations had little expectation that their governments could or would do much to protect them against the impact of disasters. There was an acceptance of "acts of God" as inevitable, partly because of religious beliefs as well as a general fatalistic attitude about the vicissitudes of life. 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.

However, 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 citizens and 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 per se 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, if 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 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 arrival of technological disasters is accelerating the acceptance of this view, because to many, there is the perception that such dangers are 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 threat mostly although not exclusively of a technological nature (such as hazardous wastes, radioactive materials, toxic chemical substances, etc.). 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, usually in an informal way, have emerged to better prepare and respond to chemical and nuclear related hazards that might turn into disastrous occasions. There is every reason to think that such large scale citizen activism will if anything accelerate in the sense of an increase in both the number of such groups and the range of risks about which they think something should be done.

Let us conclude with three other general observations.

(1) First, 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. History does not support the notion that we can completely eliminate risks and hazards. In fact, historians examining past attempts to deal with cholera, hazardous aspects of electricity and the Dust Bowl in the United States, have written that the belief that advances in science and technology could:

> *control and guarantee . . . almost no risk, proved illusory . . . Society is no longer sure that "magic bullets" exist for every problem of risk, and new values questioning the earlier assumptions have gained increasing strength.* (Tarr 1990: 95-96).

Moreover, there is reason to at least suspect that the more risks that develop, the more likely are human beings to adjust in one sense to their presence. We are all aware that we live in a world that we perceive as being more dangerous than did past generations. Just consider all the hazards that are now associated with almost any kind of food or drink. However, despite this increase in perceptions of risks, do we really feel more at risk than generations before? I do not think so. I say this not on the basis of any hard evidence, but from more general observations. For example, when the residents around London were subjected to V-1 and V-2 missile attacks, they first were very afraid. However, the more they lived with those threats, the more and more they seemed to adjust to the danger, accepting the fact that there was risk but that life had to go on nonetheless. My impression is that as risks of disasters have apparently increased around us, the more we have accepted the fact that they could occur, but nevertheless we go on with our lives.

(2) Second, apart from what can realistically be done, is the question of what should or ought to be done. The disaster area, does not lend itself to a neat adding of pluses and minuses, or purely economic cost-benefit analyses. In fact, most social science disaster researchers would probably agree with the following said about disaster planning. It:

> *cannot be designed or implemented on a benefit/cost basis for two reasons. First, the benefits of planning are not readily quantifiable. Second, even if they were, the benefits are not comparable to the costs of responding or not responding. Establishing a plan is a value-laden activity and is done for humanitarian, not for fiscal, reasons* (Sorensen 1988: 253).

Perhaps we can further illustrate the points he has just made in the following way. For example, if we take human deaths as the major negative effects of disasters, what can be said? A recent analysis noted that while:

> *. . .the world-wide death toll is rising, it is falling in developed countries. The mean annual number of deaths from natural hazards declined by 75 percent or more in developed countries like Japan and the United States between 1960 and 1990, but it increased by over 400 percent in developing countries like India and Kenya over the same period* (Berke, 1995: 371 citing Mitchell, 1992 and Nanjira, 1991).

Of course some have argued that even the figures from Western societies may be misleading in that

with respect to hurricanes, for instance, that while it is tempting to conclude that:

> *the . . . problem is largely a matter of damage rather than loss of life because of the steady decrease in hurricane-related casualties in this century . . . However, this trend is misleading as the potential for large loss of life remains significant* (Pielke, 1995: 41)

So are disaster effects getting better or worse? Before answering, also consider the following:

> *There is also consensus that economic loss is increasing in developed and developing countries, although it is disproportionately greater for developing countries. Mitchell (1989), for example, examined selected Asian Pacific Rim countries and found that mean annual economic losses from floods and hurricanes (or cyclones) increased by 26 percent in Japan and 69 percent in South Korea between 1960 and 1990, but increased by 157 percent in India and 1,200 percent in the Philippines* (Berke, 1995: 371).

Further complicating any easy assessment of positive and negative disaster consequences is indicated in that researchers have concluded:

> *...the proportion of loss is far more important in examining distinctions among countries than absolute numbers . . . the economic costs of disasters in poor countries often exceed 3 percent to 4 percent of the gross national product of GNP . . . in . . . economically vulnerable East African countries . . . the costs exceeded over 20 percent of GNP at various times during the 1980s . . . In contrast, the $24 billion loss from the 1992 Hurricane Andrew disaster . . . which was at the time the costliest disaster in the history of the United States, represents an almost undetectable proportion of the country's $6 trillion economy. The loss has less to do with the scope of the physical impact than the relative proportion of the population and economy involved* (Berke, 1995: 372).

In my mind, the kinds of statistics cited above clearly suggest that Sorensen is quite right in indicating that disaster planning cannot be simply evaluated just in terms of reducing certain traditional kinds of losses. There are many value laden assumptions in whatever is used as criteria. Furthermore, what the authors just cited discuss, do not include the other possible negative effects of a psychological, social and political nature we discussed earlier. Furthermore, we will just mention in passing here that it is all but impossible to quantify either the costs or the benefits of preserving and safeguarding historical monuments and cultural assets.

It is therefore perhaps not a coincidence that social philosophers have increasingly started to examine the ethical issues involved in disaster planning (Bentley, 1989; Jackson and Janssen, 1990). Among other things, it suggests that perhaps enough is known about the different planning and managing that could be attempted with respect to disasters, that it becomes increasingly important to consider the various value laden criteria that can be used to consider different options and alternatives (Mitchell 1990: 152). These kinds of possibilities will necessarily be presented and assessed more by philosophers than by engineers.

(3) Finally, we should note that we have extrapolated and projected existing trends to the future. It is a reasonable thing to do. Nevertheless, we should also be cautious. We can probably assume that the future will not necessarily be all that we have forecast: it may be somewhat better or somewhat worse. Let us illustrate in two ways. First, who would have predicted the current political state of the world, even just a decade ago? The collapse of the Soviet system and the transformation of Eastern Europe coming about with remarkably little violence, were macro level social changes of the first order. Similarly, technological changes do not always develop in expected or predicted directions. Marconi thought his new radio could at best only be used for ship-to-shore communication, Thomas Watson Sr. of IBM concluded that the future market for the computer was extremely limited, and Bell Laboratories at first saw no use in patenting its discovery of the laser because it could not see its relevance in any important way to communications (for a discussion of why forecasts about technology often are incorrect, see Rosenberg, 1995). Therefore, we need to be cautious in projecting the future for as Toffler has written:

> *Most people--including many futurists--conceive of tomorrow as a mere extension of today, forgetting that trends, no matter how seemingly powerful, do not merely continue in a linear fashion. They reverse direction. They stop and start. Because something is happening now, or has been happening for three hundred years, this no guarantee that it will continue* (1980: 129).

Nevertheless, despite these caveats, we believe that we have projected a realistic picture of what we might expect in the 21st Century. Whatever variations and deviations there might be in the basic trends we have discussed, the general outcome is very unlikely to be markedly different from what has been depicted. Therefore, if forewarned is to be forearmed, we hope that we have provided some armor.

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