Part One: An Assessment of Existing Research

Natural hazards have a continuing potential for causing casualties, property destruction, and economic disruption. Reducing these risks involves a complex process of adopting and implementing a variety of hazard adjustments by a wide range of stakeholders in the community. The underlying dynamics of this three component system—hazard is a function of the physical environmental system and the human use system as moderated by hazard adjustments—have been recognized by hazards researchers for decades (e.g., Burton, Kates and White 1978; Mileti 1980; White 1974). As indicated in Figure 1, meteorological and geophysical extremes of the physical environment affect the social system, which consists of a variety of stakeholders who interact through a variety of different processes. In turn, society invests in the hazard adjustment system, which consists of four different types of risk reduction measures.

![Diagram showing the interrelationships among environmental extremes, societal stakeholders, and hazard adjustments.]

Figure 1. Interrelationships among Environmental Extremes, Societal Stakeholders, and Hazard Adjustments
This model is transactional because it emphasizes the relationships among the different components. The dominant transaction between extremes in the physical environment and societal stakeholders is the risk of disaster impacts, while the corresponding transaction between stakeholders and hazard adjustments is resource allocation or cost. The transaction between adjustments and environmental extremes is efficacy (i.e., the degree to which adjustments reduce the hazard risks). It is important to note that these are the dominant transactions with respect to natural hazard risk reduction, not the only transactions.

**Hazard Adjustments and Their Consequences**

Following White (1974; Burton, Kates and White 1978; Slovic, Kunreuther and White 1974), hazard adjustments can be defined as those actions that intentionally or unintentionally reduce risk from extreme events in the natural environment. These adjustments can be classified according to their time of implementation in relation to the time of physical impact of the hazard agent. The best known and most widely utilized adjustments are the post-impact adjustments of emergency response and disaster recovery. As Lindell and Perry (1992) have observed, emergency response activities such as warning and evacuation are conducted during the time period that begins with the detection of an extreme event and ends with the stabilization of the situation following impact, whereas recovery activities such as resettling the homeless and debris clearance begin after the disaster impacts have been stabilized and extends until the affected community has resumed routine functions. When the disaster agent’s speed of onset is rapid, these measures have little effect on the amount of direct physical damage. However, they can limit secondary impacts (such as fire), casualties, and socioeconomic consequences (e.g., homelessness and job loss).

By contrast, emergency preparedness and hazard mitigation activities take place before disaster impact. Emergency preparedness activities such as developing plans and inventorying response resources are undertaken to improve the community’s capacity to respond in a timely and effective manner during disaster impact. Hazard mitigation actions such as reducing the occupancy of vulnerable areas or strengthening structures are directed toward eliminating the causes of a disaster, reducing the likelihood of its occurrence, or limiting the magnitude of its impacts if it does occur. Unlike the post-impact adjustments, mitigation measures can have a substantial effect on the amount of direct physical damage, while preparedness measures can substantially increase forewarning and decrease response times (thus limiting casualties, secondary impacts, and socioeconomic consequences). These pre-impact adjustments of emergency preparedness and
hazard mitigation will receive the most attention here because they are the actions that have the greatest potential for reducing losses and promoting sustainable development (Perry and Lindell 1977a).

Although the specific formulations differ in their details, theorists long have accepted the idea that adjustments are implemented in stages (Burton, Kates and White 1978; Milet 1980; Perry, Lindell and Greene 1981). These phases include awareness of the hazard, awareness of alternative adjustments, adoption of one or more adjustments, implementation of those adjustments, and evaluation of the adjustments. One major conceptual issue involves the distinction among adoption and implementation of hazard adjustments. Adoption refers to an initial commitment of resources to a particular adjustment following the development of awareness of the hazard, assessment of the need for reducing risks, and awareness of the suitability of a measure. Implementation refers to a continuing allocation of resources following the initial commitment. In the case of building codes, adoption refers to the enactment of the code, while implementation involves the administrative processes of hiring, training, and assigning inspectors to ensure that plans submitted for approval and buildings constructed met the requirements of the legislation. Implementation also would include the maintenance of those structures to ensure that the level of safety did not decline as the building aged.

It also is important to recognize the role of evaluation in assessing hazard adjustments. An evaluation may be either prospective (intended to assess whether an adjustment should be adopted and implemented), or retrospective (intended to assess whether an adjustment should be modified or discontinued). One goal in evaluation is to determine if there is a need for greater levels of adjustment (hazard analysis). Another goal is to determine if current or proposed adjustments have met the criteria of effectiveness (what level of risk reduction was achieved), resource requirements (what financial expenditures and other resources were needed to achieve that risk reduction), and collateral consequences (what impacts—either costs or benefits—occurred other than those directly intended). Resource requirements also frequently act as barriers to implementation. Because no single hazard adjustment is suitable for all situations, all four categories of natural hazard adjustments (i.e., mitigation, preparedness, response, and recovery) should be considered for use as part of a comprehensive strategy, or mix of actions for achieving natural hazards risk reduction.

The complexity of the hazard adjustment process arises from the wide range of stakeholders—those who stand to gain or lose from the implementation of natural hazard adjustments—who differ in their knowledge, resources, and decision processes. The fundamental social (i.e., the house-
hold) and economic (i.e., the business) units are the ones that most directly bear the consequences of disasters. One of this country's prevailing social values, self-reliance, implies that these are the units held most directly responsible for effective hazard adjustment (Mileti 1980). According to the norm of self-reliance—as embodied in enduring cultural beliefs embedded throughout the psychological, social, economic, political, and legal facets of society—households and businesses will make adequate hazard adjustments if left to their own devices and any attempt by government to regulate these units' choice of hazard adjustments constitutes unwarranted government intrusion (Moline 1974). Moreover, it is assumed that those at risk from natural hazards accurately assess their level of risk, actively search for possible adjustments, and adopt the set of adjustments that provide what they consider to be adequate protection at a reasonable cost (Burton, Kates and White 1978). Under this model, households and businesses would avoid hazardous locations or, if a site had high locational value, would build hazard-resistant structures. Occupants would adopt preparedness measures, as well as set aside financial reserves (or purchase insurance) to guard against ruinous financial loss. Any residual losses would be borne as a reduction in standard of living until the victims had fully recovered. That is, decision makers would foresee the possibility of experiencing losses in excess of the level of protection and choose to bear those risks as a consciously adopted decision.

This idealized depiction of adjustment to natural hazards is a logical implication of the dominant cultural assumptions embodied in the classical economic postulates of decision makers with perfect knowledge, foresight, and rationality; and free markets with no transaction costs, externalities, or dominant actors (Stiglitz 1993). The cultural assumptions embodied in the American political economic ("free market") system have had many positive consequences and provide a useful model for some purposes, but are empirically untenable. To the contrary, the overwhelming scientific evidence is that decision makers are characterized by limited knowledge, competing demands for attention, short planning horizons, and bounded rationality (Abelson and Levi 1985; Feldman and Lindell 1990; Slovic, Fischhoff and Lichtenstein 1988; Stevenson, Busemeyer and Naylor 1990; Yates 1991).

These cognitive limitations would be relatively unimportant if there were unequivocal feedback from the environment and it was absolutely clear who is responsible for taking action to prevent adverse consequences. Such a situation would allow the responsible parties to adapt to their environment by making short term predictions, allocating small amounts of resources, experiencing small losses when they make errors, and adjusting
their resource allocations through trial-and-error—a process Lindblom (1959) described as incrementalism. However, extreme environmental events—such as floods, earthquakes, hurricanes, and tornadoes—defy an incrementalist approach because they are by their very nature low-probability occurrences. Thus, they affect any given household or business so infrequently that people typically are unaware of the risks they face, underestimate the risks of which they are aware, overestimate their ability to cope when disaster strikes, and blame others for their losses. As a result, households and businesses encroach into hazardous areas, underutilize preimpact hazard adjustments, and rely too much on emergency response and disaster relief.

By putting themselves and their possessions at risk from natural hazards, households and businesses who fail to adopt pre-impact adjustments require an altruistic response from undamaged bystanders when the inevitable does occur. That is, after reaping a short-term benefit from unprotected activities in a vulnerable location, the victims' plight after the disaster forces others to choose between either ignoring the victims' suffering or providing relief that allows these victims to escape the consequences of their lack of foresight. To the extent that disasters are systematically rather than randomly distributed geographically, this means that those who live in less hazardous areas implicitly subsidize those in more hazardous areas. Moreover, to the extent that the cost of a policy of hazard adjustment based upon post-impact response and recovery exceeds that of a policy based upon pre-impact mitigation and preparedness, society is impoverished. Indeed, when vulnerability is so high that potential disaster losses are a substantial fraction of social assets, exclusive reliance on post-impact recovery can become unsustainable.

Problems arise at a societal level because of stakeholders' limited ability to conform to the idealized prescriptions of normative decision theories without explicit decision aiding, and the diversity of goals, values, information, and resources each stakeholder would contribute to each of the stages in the process. For example, stakeholders differ in their awareness of their vulnerability, their perceptions of the problem's importance, and their knowledge about alternative ways of coping with the hazard. Indeed, there are even differences among hazards professionals that arise from the advancing state of scientific knowledge regarding long-term societal impacts resulting from interactions between natural event systems and human use systems.

Another difference among stakeholders arises from the decision maker's scope of problem definition, with households being responsible for the (small) probability of a disaster striking their homes and, at the other
extreme, federal personnel being responsible for the virtual certainty of a
disaster striking somewhere in the country. These problems are com-
pounded by the fact that those who recognize the nation's vulnerability to
natural hazards are limited in their ability to influence those at risk to change
their ways. Local stakeholders' lack of hazard experience makes them
resistant to hazards experts' appeals for voluntary adoption of adjustments,
while the federal political structure frustrates imposition of hazard adjust-
ments by means of national legislation.

Finally, there can be technical and institutional obstacles to taking
appropriate precautions against disaster impacts. For example, it was not
until 1980 that Californians developed relatively inexpensive techniques to
retrofit unreinforced masonry buildings built before 1933. And an adjust-
ment may not be economically feasible even when it is technically feasible;
thus, earthquake insurance became extremely difficult to obtain in southern
California after the Northridge earthquake.

In summary, our country's present pattern of adjustment to natural
hazards has arisen from a number of otherwise adaptive social, political,
and economic processes that produce perverse consequences when there
are large numbers of households and businesses located in vulnerable
locations. In some instances, failure to take action in the face of natural
hazards may be entirely rational. Poorer households and marginally profit-
able businesses are faced with the unpleasant choice between either meeting
needs of daily living or protecting themselves against a hazardous event
that may or may not occur in their lifetimes. Under such circumstances, it
may be quite rational for people to minimize the resources allocated to
hazard adjustments.

However, it is more generally the case that households and businesses
that do have sufficient resources have chosen not to protect themselves
against even relatively high probability risks. Thus, from a national per-
spective, it is clear that the existing pattern of hazard adjustment requires
modification if we are to sustain development. However, there are many
reasons why it is difficult to change the present system, one of which is
institutional inertia. Far from being a static explanation, institutional inertia
reflects a dynamic equilibrium of forces perpetuating the status quo. This
dynamic equilibrium is the outcome of the interactions of a variety of
stakeholders interacting in many different forums where they are seeking
to advance their own interests and to resolve the conflicts generated by those
competing interests. It long has been recognized that institutional learning
about catastrophic events only takes place at a national level, but not at the
individual (household and business) level (White and Haas 1975). That is,
it is only at higher levels of social aggregation that there are enough
catastrophic events per unit of time for the deficiencies of current patterns of development to be recognized.

Unfortunately, adjustment takes place mostly at the individual rather than the national level. This results in a system that is relatively stable in the short-term, but unsustainable in the long-term if a continuing stream of transfer payments is required from less vulnerable areas that exceeds the contributions of the vulnerable areas. To achieve sustainability, it is essential to understand how unconstrained "self-reliance" leads to increasing hazard vulnerability due to a fundamental disjuncture between the simple world of cultural assumptions on which our political-economic system is based and people's actual decision making processes.

This rationale suggests that the path to sustainable economic growth involves increasing the adoption of cost-effective adjustments to reduce disaster losses. Implementation of such a policy necessarily requires an adequate understanding of the processes by which the hazard adjustment adoption process works. To this end, the sections below will identify the different types of stakeholders involved in decisions about natural hazard adjustments and examine the nature of those stakeholders' capacity (their knowledge and resources) and commitment (their motivation, based upon social, economic, political, and legal incentives) to more sustainable hazard adjustments.

An especially important issue here is the pronounced variation among stakeholders in terms of their knowledge (ranging from hazards professionals to the lay public) and resources (ranging from those of economically depressed households and communities to those of the federal government and multinational corporations). The roles these stakeholders play in the adoption and implementation of different types of adjustments will also be described, although the emphasis will be on pre-impact adjustments (mitigation and preparedness) to reduce future losses. This discussion also will address the forums in which these stakeholders interact to influence the actions of others. Such influence takes the form of establishing role relationships with others, changing beliefs about hazard impacts and hazard adjustments, and creating incentives to engage in risk reduction measures. This requires a definition of roles (through either negotiation or imposition of a set of rights and responsibilities), the diffusion of knowledge from scientific and professional groups to policy makers and the public, and provision of incentives such as legal obligations, matching funds, tax deductions, subsidized insurance rates, and related actions.
Stakeholders and Their Interrelationships

Many different types of stakeholders are relevant to the hazard adjustment process. These include households, businesses, governmental influentials, economic influentials, social influentials, legal influentials, and hazards professionals. The variety of stakeholders is a problem because they differ significantly in the amount of societal assets they control that are vulnerable to natural hazards, their capacity for implementing hazard adjustments, their commitment to implementing hazard adjustments, and their power to either induce other stakeholders to accept their views or to resist others' influence attempts. Stakeholders’ power relationships can be viewed in terms of French and Raven’s (1959; Raven 1965) six bases of power, reward, coercive, legitimate, expert, referent, and information power.

Raven (1993) noted that these different forms of social power, which can be defined as potential influences upon the beliefs, values and behavior of others, can be distinguished on the basis of social dependence and the need for surveillance to maintain the desired behavior of the influence target. The most familiar bases of power (reward and coercive) rest on the power holder’s ability to impose upon the target additional positive or negative consequences that are extrinsic to the action itself. These consequences could either be tangible (money) or intangible (social acceptance). Unfortunately both reward and coercive power are socially dependent and frequently require continuing surveillance to be effective. In addition, coercive power generally elicits hostility and, as will be described later, often can be subverted by noncompliance and active deception.

Legitimate, expert, and referent power bases are somewhat more attractive because they involve little surveillance. However, they are socially dependent—they are specific to a given source. Legitimate power arises from one’s role relationship to another and can come from a formal social position (e.g., the mayor of a city), or from an informal relationship derived from norms of reciprocity, equity, or helplessness. By contrast, expert power stems from an individual’s breadth and depth of knowledge in a particular domain (e.g., a physician). Referent power is based upon the target’s identification with (or desire to identify with) the power holder.

According to Burnstein and Vinokur (1977), information power involves valid, novel, and relevant facts or arguments. Information power can be wielded either by introducing or withholding information (Mechanic 1963). Informational influence is, in many respects, the most effective basis of power because it is socially independent. That is, once comprehended, it is internalized and its source becomes inconsequential. As a result, no surveillance is required to maintain the desired behavior of the influence target.
However, information power does require acceptance of another's statements only after an independent examination of their underlying rationale. Thus, exercising information power can be quite time consuming.

The existence of these multiple bases of power should make it clear that power operates in the upward (i.e., household to local to state to federal) as well as downward direction. Thus, households and businesses can exert upward influence through lawsuits, boycotts, public ridicule, and voter pressure that allows them to actively resist other stakeholders' actions. This balance of power is the consequence of a federal political structure coupled with a market economy which produces a complex policy environment that is fragmented vertically (between different levels of government) and horizontally (between the private and public sectors, and within the latter, among agencies within a given community).

Among the different types of stakeholders, households are relevant because they are the primary living unit providing shelter from routine environmental conditions. Households' actions affect their vulnerability to natural hazards through their choice to live in more or less hazard-prone locations; to rent or buy residences that are more or less resistant to environmental extremes of wind, water and ground-shaking; and whether or not to engage in pre-impact adjustments to limit their vulnerability to disasters. In aggregate, households control a substantial amount of the social assets (especially buildings and contents) at risk from natural hazards, but these assets are controlled by a very large number of decision makers. Although households typically attach low priority to natural hazards, there is substantial variation in their commitment to risk reduction, with some substantially more aware of the hazard they face.

In addition, households vary considerably in their incentives to implement hazard adjustments, with property owners having significantly more at risk than tenants. Households also vary in their capacity to select and implement the most appropriate hazard adjustments because of differences in their financial resources, their knowledge about hazards and adjustments, and the decision processes they use to apply this knowledge. Moreover, the remaining stakeholders have limited influence over households, and rarely have the power to compel adoption of hazard adjustments.

Businesses are important because they are the societal institution for accomplishing economic activity. Consequently, destruction, damage, or interruption of businesses can have a significant adverse effect on the local, regional, or even national economy. Also like householders, business owners can choose to operate in more or less vulnerable locations, to rent or buy buildings that are more or less resistant to environmental extremes, and decide whether or not to engage in pre-impact adjustments to limit their
vulnerability to disasters. Further, private businesses control a substantial amount of the resources at risk from natural hazards, but generally give little attention to such events in their routine activities. Businesses—ranging from neighborhood stores to multinational corporations—vary in their financial resources, knowledge about hazards and adjustments, and decision processes. Businesses have significant power to resist the influence of other stakeholders. Sometimes this is because of their numbers, but also because the economic resources of a large business or industry can leverage to threaten a smaller or poorer jurisdiction that might attempt to regulate hazard vulnerability.

Social influencers include the news media, as well as celebrities and visible members of community and environmental groups. The news media are important because their coverage of disasters provides vicarious experience for those who have not had direct experience with such events. One well documented problem is the news media’s tendency to perpetuate disaster myths rather than accurate information (Perry and Lindell 1996, 1990c). The news media also are relevant for their coverage of hazard-relevant activities within the community. As noted by McCombs and Shaw (1972), the news media do not so much tell people what to think as what to think about, thus setting the agenda for community deliberations about hazard vulnerability and potential adjustments to those hazards. Few of the news media have reporters who are trained in scientific and environmental issues, so such issues receive scant or superficial coverage. When challenged to defend this situation, editors typically respond that their readers and viewers find such issues to be too irrelevant or too complex.

Consequently, they excuse neglect of such issues on the grounds that extensive coverage would risk the loss of customers. Indeed, this often creates an important role for celebrities and community and environmental groups in the process of hazard adjustment. Such groups have been known to use the news media to put natural hazards on the public agenda and to use their endorsement or opposition to a proposal to induce other members of the community to do likewise. Such groups also develop information through analyses, and provide information to other stakeholders by means of position papers, brochures, or meetings.

Economic influencers include a wide range of stakeholders. The first of these is the real estate developer, who makes the initial allocation of resources to increasing economic activity in a location that is susceptible to hazard impact. The developer is particularly distinctive in having an extremely short duration of financial vulnerability. For example, a developer who builds a structure with life expectancy of 50 years is likely to own it for at most a few years before selling it to the permanent owner. This very
short-term perspective can obviously create a conflict of interest with the ultimate owners and tenants of the structure, with developers having an incentive to minimize initial costs even if this substantially increases hazard vulnerability and, thus, long-term losses. The consequences of developers' decisions are difficult to correct because retrofitting safety features into a structure after construction is substantially more expensive than original installation.

Banks (and other mortgage holders), insurers, and businesses' bond- or shareholders also are economic influential who have a significant stake in natural hazard risk reduction, especially to the degree that a substantial portion of their financial assets are at risk from a single disaster. The prevalence of mergers among banks and other mortgage holders provides an opportunity for them to improve their capacity to assess the vulnerability of their assets and their commitment to promoting hazard adjustments by their mortgagors. While it might appear that an individual mortgage holder would have substantial power over an individual household or business because of the former's greater economic assets, competition within this industry may vitiate this apparent advantage.

Insurers may be in an even more difficult situation than mortgage holders because a major premise of insurance is to protect the mortgage value of the property. Insurers' freedom to determine coverage levels and rates is affected by state commissions who, in turn, are accountable to the electorate of that state. Other economic influential include business suppliers (or customers), whose own businesses might be disrupted if a disaster stricken business is incapable of delivering on its contracts. Such stakeholders may or may not have the commitment to reduce their indirect vulnerability to natural hazards, and are likely to vary in their capacity to influence others to adopt adjustments that would ensure business continuity.

Governmental influential include policy makers and administrators in local, state, and federal government. These stakeholders are important for three reasons. First, they directly determine the construction and protection of vulnerable assets such as publicly-owned office buildings, roads, water and sewer lines, electric and gas utilities, and the like. Thus, they need to protect themselves against capital losses. Second, unaffected households and businesses continue to need routine governmental services following disaster. Thus, government must protect itself to avoid service disruption (Perry and Lindell, 1997b). Third, government is responsible for writing statutory law, stating executive policies and administrative regulations, and enforcing the implementation of these acts.

This legal authority provides governmental influential with a significant degree of coercive power to influence hazard resistant development but
natural hazards are rarely salient in their routine decision making. Local jurisdictions are important because this is the level of government most directly affected by disaster and most directly capable of influencing the adoption of adjustments by households and businesses. Unfortunately, this is the level of government least likely to be affected by disasters in a given year. Thus, it is the level least likely make a priority of encouraging the hazard adjustment process. Localities vary significantly in their capacity to assess their community's vulnerability, but most have access to mechanisms (e.g., land use regulations, building codes, public awareness programs, emergency preparedness programs) for risk reduction. Their willingness to confront unsympathetic constituents (households and businesses) and to commit resources needed to implement effective hazard adjustments also vary considerably.

States must be considered because they are the level of government to which local jurisdictions must appeal first for disaster assistance, and because state laws and regulations frequently form the context within which local jurisdictions must act in reducing risks from natural hazards. Specifically, state law typically sets limits on land use regulations and building codes, while state guidance and funding contribute significantly to the development of community emergency preparedness (Lindell and Perry 1996c). Finally, state commissioners have a notable impact on the conditions under which insurance is written.

The role of the federal government is especially significant, as much because of its limits as because of its strength. Federal influence is largely indirect, episodic, and diffuse. It is indirect because the federal government can establish risk reduction goals and programs for reaching those goals, but the detailed implementation of federal policy rests upon actions by other stakeholders such as state and local governments, and professional associations. It is episodic because local jurisdictions often pay attention to federal agencies only in the aftermath of disaster.

Consequently, state and local risk reduction efforts are often short-lived and dependent on the flow of federal funds. It is diffuse because the enormous number of stakeholders (cities, counties, and specialized jurisdictions) precludes individualized attention and direct oversight. Moreover, problems in coping with the sheer number of local jurisdictions is compounded by the substantial variation in local jurisdictions' policy environments. Relevant factors in these environments include local beliefs about natural hazard risks (especially in comparison to other local issues) and alternative techniques for managing those risks, as well as the balance of local social, economic and political forces supporting and opposing more sustainable policies for natural hazards management. Hazard reduction
policies are unique in these respects, for our federal political structure makes shared governance more the norm than the exception in the design and implementation of hazard management policies.

Government influentials also include members of the judicial system such as prosecutors, judges, and attorneys. Prosecutors can affect the hazards adjustment process largely to the degree that they exercise discretion in filing criminal cases. Although criminal cases in this area appear to be relatively scarce, civil cases are limited only by plaintiffs' willingness to pursue and attorneys' willingness to accept such litigation. Recent history suggests that neither of these elements has been in short supply, and both seem to be increasing over time. Opportunities for substantial contingent fees resulting from the award of punitive damages, in particular, would seem to provide an incentive for some law firms to develop specialized capabilities in this area.

Hazards professionals are especially relevant through their professional associations as well as through individual practitioners because they have expertise regarding the hazards themselves and the available adjustments to those hazards. In turn, hazards professionals can be subdivided into scientific researchers who are oriented toward the development of new knowledge, educators who are oriented toward the dissemination of existing knowledge, and practicing professionals who are oriented toward the utilization of existing knowledge to solve societal problems.

The interrelationships among stakeholders in the different sectors (private and public) and at different levels within those sectors is represented in Figure 2. This illustration depicts the tendency for information and influence to flow along the lines from top to bottom although there is upward influence as well. It also is important to recognize that the nature of the power that one group of stakeholders exercises over another can vary significantly. Relationships might emphasize any one of the six bases of power. Moreover, the predominant basis of power within a relationship might change over time, say from coercive power (e.g., mandates) to information power. A final implication of this hierarchical structure is that stakeholders at the top of the diagram must mobilize the support of intermediate levels (especially local governmental agencies and elected officials) if anything is to be accomplished at the lower levels of the hierarchy.
Individual Adoption of Hazard Adjustments

The process by which stakeholders adjust to natural hazards typically has been studied from one of two perspectives. The first of these approaches, deductively derived from the axioms of mathematical economics, has examined the degree of conformity with the tenets of normative theory. Such investigations have generally sought to compare actual decision makers to a theoretical standard of how a perfectly rational individual ought to decide. Most of the studies within this framework have been conducted within laboratory settings (Kunreuther et al. 1978 is a notable exception) to probe the limits of decision makers' cognitive capacities. An alternative approach has sought to inductively develop empirical generalizations in the form of algebraic or algorithmic representations of the ways in which decision makers actually do choose a course of action. This latter approach has a less rigorous theoretical foundation but most studies, often conducted
within the framework of attitude theory, have been conducted in field settings to identify factors that influence actual decisions.

Decision Theory

Rational decision theories, which ultimately can be traced to Bernoulli’s work in the early 18th Century, argue that a decision maker should choose among alternative courses of action on the basis of the maximization of subjective expected utility. Such models of rational problem solving (Keeney 1982) call for the decision maker to identify and assess the problem, identify alternative courses of action, assess each alternative with respect to its (subjective) probability of achieving the decision maker’s goals, adopt and implement one or more of those alternative actions, and evaluate the implemented actions to assess the degree to which they actually were effective in achieving the decisionmaker’s goals.

A simple theoretical framework for deciding whether to adopt a hazard adjustment such as earthquake insurance would be to analyze the ratio of benefits to costs by assessing the probable losses to a given property in a specific year, and calculating the relative costs of purchasing insurance in advance versus paying for repairs after the fact. For this type of theory to not only guide the ideal practice but also predict the observed practice, a decision maker must seek to maximize utility or net benefits and must possess all relevant information about costs and benefits. Obviously, these conditions do not apply in any but trivial choice situations.

Consequently, over the years, these assumptions have been modified into the model of Subjective Expected Utility (SEU, Edwards 1954) rather than expected value. However, even with this modification, empirical studies dating back to Friedman and Savage (1948) have shown that decision makers fail to act in conformity with the principles of normative decision theory. Rather, the degree to which decision making is rational seems to be bounded by cognitive limitations (Simon 1957).

Since decision makers must choose among various courses of action under conditions of limited information regarding alternative actions and resultant outcomes, most decisions involve some level of uncertainty. Decisions regarding natural hazards mitigation are especially problematic because they must be made under conditions of extreme uncertainty regarding the probability of occurrence, likely impact of disaster, effectiveness of adjustments, etc. Indeed, Kunreuther and his colleagues (1978) found that potential hazard insurance purchasers had inaccurate beliefs about the hazard and about insurance, and did not even combine their inaccurate information in accordance with the tenets of utility theory.
Slovic, Kunreuther and White (1974) assessed the descriptive validity of SEU theory in terms of its relevance to the adoption of natural hazards adjustments. The evidence they gathered leads to the conclusion that decision makers' tendency to rely on standard operating procedures, incremental changes, and short-term feedback (Cyert and March 1963; Lindblom 1959; Simon 1959) may work well in static environments, but is poorly suited to coping with the risks of environmental extremes. Bounded rationality leads people to underestimate the risks of natural hazard risks which, in turn, leads to under-adjustment, followed by a crisis orientation after disaster does strike. Slovic and his colleagues (1974) noted that psychological research provides many demonstrations of decision makers' limited ability to effectively utilize probabilistic information.

Specifically, people often misperceive random sequences of data (Jarvik 1951)—believing that if a low probability event has occurred recently, it is unlikely to occur again soon (the gambler's fallacy). In a related phenomenon known as illusory correlation, decision makers frequently infer that variables are related even when nothing more than random variation exists (Chapman and Chapman 1969). Decision makers have an inadequate appreciation for the amount of error and unreliability in small samples of data (Tversky and Kahneman 1971), leading them to draw conclusions with as much confidence from small samples as from large samples.

After studying such systematic errors, Tversky and Kahneman (1974) concluded that decision makers arrived at judgments of probability through the use of heuristics, which are simple cognitive shortcuts that are prone to systematic errors. Since Tversky and Kahneman's initial work, researchers have identified a number of heuristics and conditions under which they are used (Feldman and Lindell 1990; Sherman and Corty 1984; Yates 1990). One of these heuristics, representativeness, refers to the degree to which an event appears to be similar to the category to which it belongs or the process by which it is generated.

Conversely, characteristics of the category or underlying process are attributed to the events they generate. For example, environmental phenomena such as the weather tend to be thought of as—and to a significant degree are in fact—periodic. The fact that this periodicity is probabilistic rather than deterministic is less salient or altogether unrecognized. The resulting tendency to think of rare events as occurring in long cycles leads to the well-known misconception of “100 year floods” as occurring only at 100 year intervals.

Another heuristic, availability, occurs when judgments of event frequency rely on the ease of retrieving specific instances from memory. Events that are more easily recalled are judged to be more probable than
those events which are not easily recalled. The availability heuristic has some validity because more frequent events are more easily recalled, but this heuristic can produce significant errors because factors other than the actual frequency of an event also affect recall. These include events’ recency, situational salience, and emotional impact. In addition, availability in memory also can be affected by the vividness of others’ descriptions of events. That is, residents who live in an area that is earthquake-prone but lack personal hazard experience would be expected to judge an earthquake as more likely if they have heard earthquake victims’ vivid descriptions of their experiences than if they have heard geologists talk about tectonic processes.

Use of the anchoring and adjustment heuristic also appears to influence decision making. This heuristic is most likely to be used if decision makers need to make an overall judgment on the basis of a body of information that is greater than they can process at one time. In order to integrate the information, decision makers begin with an initial estimate based upon a limited amount of information and then adjust this estimate as additional information is acquired. Unfortunately, the adjustment to the original estimate is frequently insufficient, which means that this process has a tendency to overweight the initial information. This leads to little harm when the initial information is the most important, but can cause significant bias if important information is not considered until later.

In short, the notion that individuals follow the SEU model in calculating the costs and benefits of various alternatives and deciding on some set of rational adaptations to the environment does not fit the empirical reality of decision making. Not only do individuals not have complete knowledge of alternatives, but many other factors, including patterns of consistent “errors” in risk calculation, affect decision making. The flaws in human decision performance have led to the development of a number of revised theories of human decision making.

One of these theories, Prospect Theory, contends that decision problems are solved in phases. In the first phase, the decision maker frames a problem in terms of a relevant set of alternative actions and the potential consequences of those alternatives. The set of options is edited by translating the potential consequences of a decision into subjective values and the probabilities of those outcomes into decision weights. The subjective values and decision weights are combined into a prospect value in second phase, while the third phase uses the prospect value to produce an evaluation (if there is only one alternative) or a choice (if there are two or more prospects).

Perhaps the most impressive piece of evidence in support of Prospect Theory comes from a study in which Tversky and Kahneman (1981)
presented subjects with a scenario which described a disease outbreak affecting a population of 600 people. Subjects were asked to choose between two alternative courses of actions. The first alternative would save the lives of 200 people. The second alternative offered a 1/3 probability that 600 people would be saved, but a 2/3 probability that no one would be saved. A majority of subjects chose the first alternative.

In a second condition, these same subjects were presented with the same scenario, but the alternatives were worded in terms of deaths. In the first alternative, 400 people would die, while in the second alternative there was a 1/3 probability that no one would die, and a 2/3 probability that 600 people would die. Subjects presented with this condition generally chose the latter alternative. Tversky and Kahneman (1986) report that even when shown their inconsistent responses, subjects often insisted upon their initial preferences for both conditions. The obvious implication for policy makers of Kahneman and Tversky's demonstration is the difficulty of setting an level of acceptable risk if people's conception of acceptability changes with the way that choices are presented.

Yet despite the fact that a number of aspects of Prospect Theory have been supported in experimental studies, it has failed to provide a completely satisfactory account of human decision processes (Yates 1990). Consequently, decision theorists have continued to search for models that better account for the available research results. Another response to the invalidity of the SEU model has been to propose contingent decision models (Beach and Mitchell 1978; Payne 1982) asserting that decision makers use complex strategies such as the SEU model only if the complex strategy's benefits exceeds its costs.

Specifically, Beach and Mitchell (1978) contended that people's decision strategies could be classified as aided-analytic, unaided analytic, and nonanalytic. Aided-analytic strategies are formal procedures involving rigorous methods for formulating a problem and defining the relevant data, and precise computational tools for calculating an optimal solution. By contrast, unaided analytic strategies rely on insight to identify a problem's most important features, to generate some possible solutions, to think systematically about the advantages and disadvantages of these solutions, and upon decision heuristics ("rules of thumb") to choose among the alternatives. Finally, nonanalytic strategies rely on intuitive processes to classify a relatively familiar situation, which almost automatically elicits a simple preformulated rules (e.g., "don't change horses in midstream" to justify a habitual response, or "don't make waves" to justify compliance with social convention).
Beach and Mitchell contended that the strategy applied in a given situation is chosen only after the decision maker has recognized the existence of a problem and evaluated the task to be accomplished. They further proposed that strategy selection was followed by information processing, strategy implementation, and choice of a course of action. This led them to conclude that strategy implementation depends upon characteristics of the decision problem, the decision environment, and the decision maker. Characteristics of the decision problem include its familiarity (due to experience); ambiguity of goals, alternatives and constraints; complexity of alternatives and criteria; instability of the solution attributes.

Characteristics of the decision environment include time and money constraints, and decision irreversibility, decision significance, and decision maker accountability. Characteristics of the decision maker include knowledge and ability, as well as the motivation to maximize the accuracy of the decision versus minimizing the time, effort, and resources required to make it. Many of the elements of this model and its more recently elaborated successor (known as Image Theory) have been supported in subsequent research (Mitchell and Beach 1990). Image theory elaborates upon the earlier contingency model in its emphasis on the prevalence of routine or automatic decisions (i.e., nonanalytic strategies) in everyday life.

The relevance of these laboratory phenomena to hazards adjustment has received relatively little attention from hazards researchers other than Kunreuther and his colleagues (Kunreuther et al. 1978, 1993), who have addressed their relationship to insurance purchase. They argue that individuals tend to make complex tradeoffs between such issues as the probability of the event or its likely outcomes, depending on the context of the problem and the mode with which information is communicated: people often weight these dimensions differently than would be suggested by normative models of choice such as expected utility theory or benefit cost analysis.

Moreover, people’s tendency to treat a very low probability as a zero probability is simply a conclusion that “it can’t happen to me,” which is exacerbated by a “myopic” time horizon—planning behavior that takes only a few months or years into account rather than the actual time that an individual will be exposed to the hazard. Indeed, the failure to purchase earthquake insurance is a specific example of what Hogarth and Kunreuther (1993) label “decision-making under ignorance,” where both costs and benefits are unknown to the decision maker. In such conditions, these authors argue, “people determine choices by using arguments that do not quantify the risk and may reflect concerns that are not part of standard models of choice under uncertainty” (Hogarth and Kunreuther 1993:2).
instead, people use arguments to justify their decisions that may seem farfetched or distant from “rational” models of choice.

Attitude Theory

There is a long history of research in social psychology into the degree to which people’s behavior can be predicted from relevant beliefs, values, and attitudes. For a very long time, the relationships among beliefs, values, attitudes, and behavior were considered to be quite controversial—to the point that as recently as twenty years ago some researchers contended that attitudes were most likely to be only slightly related or even unrelated to behavior (Wicker 1969). However, research conducted subsequent to Wicker’s pessimistic review has identified a number of factors that provide better prediction of behavior.

In particular, Fishbein and Ajzen’s (1975; see also Ajzen 1987 1991; Fishbein and Stasson 1990) Theory of Reasoned Action has had an especially significant impact on this topic. According to this theory, people’s volitional behaviors are largely a function of their behavioral intentions—differing largely as a result of unanticipated implementation barriers to the intended action or unexpected facilitating circumstances for unintended behaviors.

In turn, people’s behavioral intentions are determined by their attitude toward the behavior and their subjective norm for that behavior. Consistent with the findings of previous researchers, these two components take the form of an expectancy-valence (EV) model in which judgments are defined in terms of expected consequences. Specifically, an attitude toward a behavior is defined by the attractiveness (also known as valence) of its outcomes, each of which is weighted by its likelihood of occurrence. The higher an alternative’s evaluation, the more positive is the attitude toward the behavior. Similarly, people’s subjective norms reflect their normative beliefs about how specific others would view their engaging in that behavior, weighted by the decision maker’s motivation to comply with each of those others’ views.

There are a number of immediately notable characteristics of the Theory of Reasoned Action (TRA). First, the first part of the model—the attitude toward the behavior—is identical in form to earlier expectancy valence models proposed by Rosenberg and Vroom, both of which had been among the most strongly supported attitude models (see Kennedy, Fossum and White 1983; Wanous, Keon and White 1983). Second, the subjective norm takes a similar form, but recognizes the importance of normative influence from others that affects behavior independently of beliefs about the consequences of the behavior.
Indeed, TRA is quite compatible with Raven’s (1965, 1993) bases of power where Raven’s legitimate, expert, and referent power bases act directly on the subjective norm (Fishbein and Ajzen 1981). That is, other persons have normative influence because they are perceived as having a legitimate right to expect to have an influence, because they are perceived as having specialized knowledge relevant to a situation, or because their similarity alone warrants their consideration as an important frame of reference. By contrast, Raven’s information power basis acts directly on the attitude toward a behavior. Information power is used to explain what are the intrinsic (naturally occurring) consequences of a particular course of action. Finally, Raven’s two remaining bases of power—reward and coercive—can be interpreted as extrinsic consequences that are arbitrarily imposed by others or change someone’s attitude toward a behavior.

The Theory of Reasoned Action appears to provide an important basis for explaining behavior because extensive research has shown widespread support for this theory (Sheppard, Hartwick and Warshaw 1988). More recently, Ajzen’s (1985, 1988) Theory of Planned Behavior attempted to generalize TRA by addressing nonvolitional circumstances. This was accomplished by including perceived behavioral control as a measure of the extent to which individuals believe that they can wholly determine whether or not they perform a given behavior. Measures of perceived behavioral control have been found to contribute significantly to the prediction of behavioral intentions (Parker, Manstead, Stradling, Reason and Baxter 1992).

Although TRA and other EV models often have significant predictive accuracy, reviews of the research literature found evidence for significant differences among individuals and situations in the predictability of behavior from EV models. Such variations in predictability of behavior have led researchers to look for other variables that might affect the relations between people’s beliefs and their behavior. One of these factors is the correspondence between the level of specificity of the attitudinal and the behavioral measures, with general behaviors (overall hazard adjustment) being best predicted by general attitudes and specific behaviors (insurance purchases) being best predicted by specific attitudes (Perry, 1976).

Another factor concerns the conditions of attitude development that affect the relationship, with attitudes developed from personal experience better predicting behavior than attitudes developed from vicarious experience (Fazio 1985). It also is important to recognize that attitudes toward an object are not necessarily equivalent to attitudes toward an action in response to that object. Thus, adoption of hazard adjustments would be
more accurately predicted by attitudes toward the adjustments than by attitudes toward the hazards themselves.

Finally, it should be recognized that an individual's attitude toward a behavior is a function of the consequences of the behavior that are salient to the respondents, not necessarily the consequences that are salient to an investigator. Similarly, the subjective norm is a function of persons salient to the respondent, which may be different from those considered by an investigator.

Another line of research has examined the role of situational contingencies in motivating behavior. Although their theoretical statements differ to some extent, the Conflict Model of decision making (Janis and Mann 1977) and the Protective Action Decision Model (PADM, Lindell and Perry 1992; Perry, Lindell and Greene 1981) have developed similar accounts of the adoption of adjustments to environmental threat. Specifically, sensory cues from the physical environment (especially sights and sounds) or socially transmitted information (e.g., warnings) elicit a perception of threat which diverts the recipient's attention from normal activities. Depending upon the perceived characteristics of the threat, those at risk will either resume normal activities, seek additional information, pursue problem-focused actions to protect persons and property, or engage in emotion-focused actions to reduce immediate psychological distress. Which way an individual chooses to respond to the threat depends upon the individual's personal appraisal (Lazarus 1966, 1991) of both the threat and the available protective actions.

Lindell and Perry (1992) summarized previous research on natural and technological hazards as indicating that environmental threats tend to be appraised in terms of their certainty, severity, immediacy, and duration, while alternative actions (continuing normal activities, seeking additional information, protecting persons, and protecting property) generally are evaluated in terms of their efficacy, cost, time requirements, and implementation barriers.

These models provide a useful elaboration to TRA because they specify that information processing about adaptive actions is motivated by the perception of a salient threat, whereas TRA only accounts for what information is considered, not when it is considered. In addition, Janis and Mann's Conflict Model addresses the distinction between the adaptive and defensive functions of information processing. Specifically, they note that awareness of hazard vulnerability can be emotionally distressing. Thus, while such hazard awareness sometimes motivates adaptive responses to reduce potential physical consequences (Lazarus 1991 labels this problem-
focused coping), it also can motivate defensive responses to reduce the emotional distress (Lazarus calls this emotion-focused coping).

Further, unlike TRA, the Conflict Model and the PADM have identified specific perceived characteristics of the threat and of the adaptive response that are likely to affect action. Despite their differences, when considered together, these theories suggest that it is important to assess what people believe about natural hazards and adjustments to these hazards, whether people's beliefs make a difference in their adoption and implementation of these adjustments, and (assuming beliefs do make a difference) how beliefs can be changed to increase the adoption and implementation of effective adjustments.

**Informal Social Processes**

Disaster researchers have long recognized the importance of informal social processes in disaster response and recovery (Drabek 1986). Informal social influence on hazard adjustment is most prevalent when people do not have an opportunity to learn directly from their physical environment. When the physical environment is complex or rapidly changing and supplies only subtle cues for predicting threats to persons and property, *physical reality testing* tends to give way to *social reality testing* (Festinger 1957). That is, people become less inclined to test the appropriateness of their actions in terms of accuracy in predicting important events in their physical environment and more likely to try to test these actions in terms of agreement with important persons in their social environment. Severe earthquakes provide a particularly good example of this phenomenon because they are potentially catastrophic—they have the potential to cause widespread death and destruction.

However, they are unpredictable by the average person—being caused by complex geological processes that do not provide readily observable cues. Finally, they occur so infrequently that victimized households, businesses, and local jurisdictions are unlikely to have learned and applied any useful lessons by the time the next event occurs.

Learning about such hazards can take place at a societal level because scientists can detect the geological cues, devise alternative measures for reducing losses, assess the effectiveness of these measures in succeeding disasters, and suggest ways of modifying current hazard adjustments in light of this experience. The degree to which this societal learning is effective in reducing losses depends upon the extent to which those who must adopt and implement the new hazard adjustments are willing to accept the social reality defined by hazards professionals and higher levels of government. The two forms of reality diverge because the social reality defined by
hazards professionals emphasizes eventual danger while the physical reality experienced by local residents—years of geological stability—suggests safety.

A crucial element of informal social processes is an understanding of the types of information sources that exist in communities. In contrast to official sources of information and action (local, state, and federal government, and formally designated organizations such as the American Red Cross), informal sources include friends, relatives, neighbors, and coworkers, while the news media include television, radio, and newspapers (Lindell and Perry 1993). All of these sources are present during the pre-impact phase and therefore become stakeholders in the adoption and implementation of hazard adjustments.

The literature on social influence indicates that households’ and businesses’ adjustments can be affected by one of two means—informational influence and normative influence. According to Turner (1991), informational influence reflects personal acceptance or internalization of information as a valid description of objective reality. By contrast, normative influence reflects compliance with the expectations of others, based upon their power to reward or punish. These two types of influence, informational and normative, are reflected in Fishbein and Ajzen’s (1975) distinction between one’s attitude toward a behavior and his or her subjective norm.

In aggregate, individuals’ subjective norms form community-wide behavioral norms—generalized social expectations about what should or should not be done in specific situations, which in turn become “collective habits.” This equivalence follows from the notion that habits are actions taken because they seem to be the “right thing to do under the circumstances,” not because they are the outcome of thoughtful decisions. Indeed, people’s tendency to conform to the behavior of those around them (Asch 1951) creates a normative quality to many social actions. In turn, this can lead to adoption of a hazard adjustment without awareness of its value in adapting to the physical environment. In summary, hazard adjustment can occur through the superficial thought processes involved in modeling the behavior of others. This is in sharp contrast to the more profound thought processes involved in assessing the expected utility of an adjustment based upon the possible negative impacts of the physical environment.

This line of reasoning indicates that inducing people to adopt hazard adjustments in a situation where the prevalence of such behavior is very low can be conceptualized as a problem of overcoming social conformity and encouraging innovation. Both of these topics, conformity and innovation, have received extensive attention from social scientists. The first of
these, social conformity, is a tendency to match the behavior dictated by the group norm.

Conformity is especially pronounced in cases where physical reality testing is not possible and consequently the appropriateness of behavior must be judged by means of social reality testing (consensual validation). This principle is particularly applicable to natural hazards adjustment because the environmental extremes for which adjustments are needed are so infrequent. What matters in social reality testing are the opinions of the reference group, or those with whom one identifies. Conformity also is strongest in cases where there are pressures for uniformity.

By contrast, innovation involves engaging in novel behaviors that differ from those that are typical of group members. As is the case with conformity, the adaptiveness of innovative behaviors to the social environment must be distinguished from their adaptiveness to the physical environment. That is, innovative behaviors can be adaptive to both the social and physical environments, adaptive to one or the other environment, or adaptive to neither environment. Most clothing fashions, for example, are innovations that are socially adaptive (demonstrating status) without any increased value in adapting to the physical environment.

**Persuasion**

The use of persuasive communications as a technique to change attitudes and behaviors has a relatively long history. The classical approach to this technique is to view it in terms of a series of inputs and outputs, where the input or independent variable is the persuasive communication, and the output or dependent variable is attitude or behavior change. According to Lasswell (1948), communication then should be analyzed in terms of who (Source) says what (Message), via what medium (Channel), to whom (Receiver), and directed at what kind of behavior (Effect). This **classical model** of persuasion was further articulated by Carl Hovland and his colleagues (Hovland, Janis, and Kelley 1953), and has remained the predominant conceptual approach in the field of persuasion (McGuire 1969, 1985; O'Keefe 1990).

The elements of this model also provide a useful framework for interpreting most studies on warning response (Milet, Drabek and Haas 1975) and many studies investigating the effects of information on hazard adjustments (Lindell 1992). However, studies of natural hazard adjustments examined persuasion processes from a somewhat different perspective than have the more academically inclined studies. Hazards researchers have had a more applied focus. Thus, they have tended to be interested in identifying...
the different types of sources encountered by warning recipients rather than in defining what are the characteristics of those sources.

Similarly, hazards researchers have been much more interested in characterizing the nature of the message content than researchers conducting laboratory investigations of persuasion processes. Finally, hazards researchers have had to face empirical interrelationships among the theoretically independent elements of the classical persuasion model. For example, the type of message that can be transmitted depends upon the information channel, while the impact of a message depends upon the recipient's situational context, perceptions of the information source, and prior beliefs about the hazard. Such naturally occurring contingencies often are ignored in laboratory settings that are deliberately designed to isolate the independent effects of each type of variable.

The classical persuasion model is a useful taxonomic model, but it does not identify the processes by which persuasive communications achieve their effects. Specifically, information can have an impact only if it passes through a sequence of stages of cognitive processing. The boundaries among these stages are not well defined and, therefore, differences exist among various researchers in their typologies. McGuire (1969, 1985) identified these stages as attention, comprehension, acceptance, and retention. This typology of stages is somewhat similar to Nigg's (1982) distinction as to whether a message has achieved the three elements of having been heard, understood, and perceived to be relevant. Mileti and Sorensen's (1987) typology contended that reactions can be segmented in terms of the six steps of hearing, understanding, believing, personalizing, deciding, and taking action.

It appears that these information processing typologies can be integrated by noting that an individual must be exposed to the message and attend to it if it is to be processed at all. Next, it is important that the message be understood, accepted as an accurate description (or prediction) of physical reality, and judged to be personally relevant. Once a situational perception of danger has been established, whether or not this is because of an accurate understanding of a warning message, the recipient must decide to take some action. The chosen course of action may be to return to normal activities, to seek additional information, or to protect persons or property. If the protective actions are delayed, then information from the warning message must be retained (remembered) until the action is implemented.

Although this integrated typology appears to be reasonably complete, there remain some important unresolved issues. One question concerns the characterization of each stage. For example, Fishbein and Ajzen (1981) have drawn a distinction between acceptance of an argument, which implies
agreement that might have existed before the argument was presented, and yielding to that argument. They contended that yielding implies a change in belief attributable to a message that is perceived as valid (true) and relevant to the salient beliefs underlying the recipient’s attitude toward the behavior recommended by the communicator. This distinction is important because it leads them to contest the common sense notion that a message necessarily must be both heard and accurately understood in order to produce behavioral change, noting behavioral change might result if a misunderstood message stimulates receivers to think about an issue.

An alternative perspective on persuasion, the Elaboration Likelihood Model (ELM), was proposed by Petty and Cacioppo (1981, 1986a, 1986b) who postulated that persons subjected to persuasive messages process information, and thus change attitudes, using two routes. The first route is the central route, in which the person attends to, and is influenced more by, the cognitive information in the message. The second route is the peripheral route, in which a person attends to, and is influenced more by superficial cues available in the persuasive context (e.g., attractiveness of an information source). One notable feature of ELM is that it focuses on cognition and excludes emotion. Indeed, the model postulates that people are motivated to hold correct attitudes, and implies that individual differences in message processing arise from people’s ability and willingness to think about the arguments in the message. This suggests that ELM may be more applicable to situations of low threat (e.g., preimpact hazard awareness) rather than high threat (e.g., hazard warning).

One significant finding from research on this model is that distraction can lead to increased agreement with proattitudinal messages when the arguments are weak but decreased agreement when the message is strong. In both cases, the effect arises from disruption of counterargumentation. Another significant finding is that repetition has been found to initially increase and then decrease agreement with the message. The first effect comes from having additional opportunities to process the message, while the second effect occurs when tedium sets in. Finally, attitude favorability increases with personal involvement when arguments are weak but decreases agreement when the message is strong. Once again, this effect occurs because of the increased processing associated when there is a high level of personal involvement.

Chaiken (Chaiken 1980, 1987; Chaiken, Liberman, and Eagly 1989) has used a similar approach in her Heuristic Model of persuasion, distinguishing between systematic processing (i.e., influence due to cognitive elaboration of the persuasive augmentation) and heuristic processing (i.e., attitude change due to invoking heuristics such as, “experts can be trusted,” and
"more arguments are better arguments." She contends that heuristic and systematic processing are parallel rather than mutually exclusive processes and that receiver factors (such as inattention, anxiety, or lack of knowledge required to comprehend arguments) tend to impede systematic information processing more than heuristic processing. Moreover, some of the factors that impede recipients' ability to process the information may also adversely affect their motivation to try to comprehend it.

Chaiken and her colleagues also have reported that the type of information channel (broadcast vs. written) affects attitude favorability by leading recipients to increase their reliance on peripheral cues such as source characteristics. This may result from source characteristics being more salient (and thus drawing more attention), or because broadcast channels transmit messages at a forced pace, making the content of complex messages more difficult to process than impressions of the information source. Conversely, these results are consistent with Miletí's findings that written transmission of complex and unfamiliar messages is preferable because it allows recipients an opportunity to process the information at their own pace.

These information processing approaches to persuasion also report that people who have pre-existing organized knowledge structures (called schemas) regarding an issue tend to counterargue messages that disagree with their initial positions and bolster messages that are congruent with their existing beliefs. Moreover, recipients who are told in advance about a counterattitudinal message use the period between the forewarning and actual message receipt to rehearse counterarguments to the anticipated message content. Most important, these information processing theories demonstrate that attitude changes resulting from the central route (processing issue-relevant arguments) are more persistent over time, more accurately predict behavior, and are more resistant to counterpersuasion than are attitude changes resulting from the peripheral route.

Petty and Cacioppo attribute the superiority of central processing to the fact that "the issue-relevant attitude schema may be accessed rehearsed, and manipulated more times strengthening the interconnections among the components and rendering the schema more internally consistent, accessible, enduring, and resistant than under the peripheral route" (1986, p. 176). In particular, attitudes derived from personal experience are more predictive of behavior, probably because personal experience involves more central processing of the information.

This effect is consistent with other evidence showing that vivid verbal descriptions of single cases have more impact on decisions than do pallid statistical data about a large sample of cases, even when the latter are far
more diagnostic (Feldman and Lindell 1990). Here as well, the explanation seems to be that a more vivid description produces a more elaborate cognitive representation at the time of message reception. In turn, the more elaborate cognitive representation is more likely to remain salient and to produce further thought and discussion. Moreover, because these attitudes are more readily retrieved when an opportunity arises for relevant action, the correlation between attitudes and behavior is stronger.

Another important issue in persuasion research is the identification of factors that influence the response at each stage—especially what motivates people to continue to think about the hazard, to seek additional information, and to take protective action. One key explanatory variable is personal involvement or perceived relevance (Johnson and Eagly 1990; Petty and Cacioppo 1990). One way of conceptualizing personal involvement that seems particularly relevant to natural hazards adoption involves the perception of personal risk as embodied in the fear communications model. Early research on fear-arousing communications assumed that increasing fear would increase the level of compliance with a recommended protective action but a number of studies produced inconsistent results; increasing the level of fear could result in either increased, decreased, or no change in attitudes and behavior.

Leventhal (1970) proposed that messages about dangerous situations elicited two parallel processes—danger control and fear control. Danger control, a behavioral strategy for reducing actual hazard vulnerability by taking protective action, is equivalent to what Lazarus (1966, 1991) has called problem-focused coping. Fear control, which is a cognitive strategy for regulating emotional reactions to the threatening situation and reducing perceived hazard vulnerability by ignoring or denying the danger, is equivalent to what Lazarus’ emotion-focused coping. Leventhal concluded that compliance with protective action recommendations (PARs) was positively related to warning recipients’ perceptions of the efficacy of the recommended protective actions and their perceptions of their ability to implement those actions. He also reported that fear is lower and PARs are more readily accepted when the PARs are in a block following the danger warning.

Later, Janis and Mann (1977) proposed a detailed process model of emergency decision making in which the response to a credible warning is determined by the recipients’ perceptions of the severity and imminence of the threat, the perceived efficacy of available protective actions, and expectations of obtaining more information and other response resources. The Conflict Model identifies five patterns of coping with the warning—un-
conflicted inertia, unconflicted change, defensive avoidance (denial), hypervigilance (panic), and vigilance (rational information seeking).

The two emotional reactions result from appraisals of the situation as hopeless, with hopelessness about the efficacy of the protective response leading to defensive avoidance and hopelessness about the time available to implement the protective response leading to hypervigilance. Both of these coping patterns are identified as defective strategies. By contrast, the two instrumental reactions result from appraisals of the situation as hopeful, with hopefulness about the efficacy of the protective response leading to unconflicted change and hopefulness about the time available to implement the protective response leading to vigilance. Curiously, although vigilance is classified by these theorists as effective coping, unconflicted change is identified as defective.

An alternative theoretical approach to fear communications was suggested by Rogers and his colleagues in what they called Protection Motivation Theory (Maddux and Rogers 1983; Maddux, Norton, and Stoltenberg 1986; Rogers 1975 1983; Rogers and Mewborn 1976; Rippetoe and Rogers 1987). Research based upon protection motivation theory has confirmed that two characteristics of the event (probability of occurrence, severity of damage), a characteristic of the person (self-efficacy), and a characteristic of the response action (outcome efficacy) affect the initiation of protective actions. This approach been applied with some success to the adoption of earthquake hazard adjustments, but it has been difficult to determine how the key theoretical variables combine to produce attitude and behavioral change (Mulilis and Lippa 1985, 1990).

Along these lines, a more recent theory, the Person-Relative-to-Event (PrE) model (Duval and Duval 1985; Duval and Mulilis 1989, 1996b), has attempted to overcome the limitations of protection motivation theory by specifying a combinatorial rule with regard to how levels and mixes of levels of person and event variables combine in determining the persuasiveness of negative threat appeals. The combinatorial rule in the PrE model, which draws from Lazarus’ (1966, 1991) theory of coping, has been supported by recent research on earthquake (Mulilis and Duval 1995) and tornado (Mulilis and Duval 1996a) adjustments. These studies found that the model’s predictions were consistent with the outcome measures, but were significantly improved by including a measure of felt responsibility for preparing for the threatening event.

Selective Exposure and Attention to Information

Of course, not all exposure to information is initiated by an external source having an intention to persuade. Frequently, information is sought
out by those at risk either to establish an accurate appraisal of the hazard or provide protection against negative thoughts and feelings stimulated by hazard information. The type of effect desired by the individual (accuracy versus reassurance) corresponds to the two types of actions that Lazarus (1991) identified as problem-focused and emotion-focused coping, respectively. The type of goal, together with expectations regarding the likely outcome of information search, affects the sources contacted and the amount and type of information sought. The basic idea underlying selective reception can be illustrated by noting that, unlike systematic processing (which involves unbiased exposure, undivided attention, and extensive processing) and heuristic processing (which involves haphazard exposure, minimal attention, and superficial processing), selective reception involves biased exposure and attention to defend existing schemas (belief systems) by deliberately avoiding potential sources of counterattitudinal information.

Frey's (1986) review of psychological research on selective exposure to information noted that a substantial amount of the work in this area was instigated by Festinger's (1957, 1964) Theory of Cognitive Dissonance. This theory contends that cognitive dissonance arises when a person holds two beliefs that have opposing implications for behavior. Most individuals find dissonance to be an aversive emotional state and, thus, are motivated to reduce it. Research has shown that choice and commitment are necessary preconditions for the arousal of dissonance (Brehm and Cohen 1962). Moreover, dissonance increases with the number and importance of the dissonant beliefs and can be reduced by increasing the number or importance of consonant beliefs or decreasing the number or importance of dissonant beliefs. Either a cognitive or a behavioral strategy can be used to change the structure of existing beliefs. The cognitive strategy involves selective reevaluation of one's existing beliefs, while the behavioral strategy involves selective search for new information to add to one's existing beliefs.

It is important to recognize that the Theory of Cognitive Dissonance recognizes that individuals are not only motivated to reduce dissonance with existing beliefs—they also are motivated to increase the accuracy of their judgments and decisions, as well. The conflict between the two goals of dissonance reduction (which decreases as losses increase) and accuracy enhancement (which increases as losses increase) is resolved by defending existing beliefs up to a certain point, followed by accommodating external information beyond that point. Thus, dissonant information may be preferred under certain circumstances, such as when it is perceived as relevant to a later decision, or when the initial decision is reversible. The search for
information also is affected by the subsequent circumstances in which the information is likely to be used. Dissonant information is more likely to be sought by those who expect to use it to defend in person why they made their decision, while consonant information is more likely to be sought by those who expect to use it to explain in writing the reason for their decision (Canon 1964).

Seeking out and obtaining information does not necessarily mean that will be accepted; in some cases information is sought out because it is perceived as easily refutable. Similarly, information from a low credibility source may be sought out so that the initial opinion can be bolstered through source derogation. Thus, findings on the reversibility of decisions suggest, although they have not been explicitly addressed in this line of research, that dissonant information is likely to be sought for a decision whose negative consequences can be mitigated rather than completely reversed. This situation would be of particular significance to the adoption of hazards adjustments because a strong personal commitment to a hazardous location that was freely chosen would be quite likely to elicit dissonance in the face of information indicating the degree of hazard at that location.

**Innovation**

Individuals can generate innovations for a variety of reasons, not all of which have to do with their adaptiveness to the physical environment. The degree to which such innovations are adopted by others has been the subject of many studies on innovation diffusion that have pointed to a number of factors influencing this process (Perry 1991). Perhaps the most comprehensive catalogue of innovation characteristics was presented by Rogers (1983, 1987), who summarized the attributes of successful innovations as consisting of relative advantage, compatibility, simplicity, trialability, and observability. Relative advantage is the perceived improvement of an innovation over the idea it supersedes. Components of relative advantage include lower initial cost, higher profitability, lower risk, decreased discomfort, reduced time and effort, and more immediate reward.

Compatibility is the consistency between an innovation and the needs, values and past experiences of the receivers, while simplicity is the degree to which an innovation is perceived as easy to understand and use. Trialability is the extent to which an innovation can be experimented with on a limited basis, and observability is the degree that the results of an innovation are visible to others.

In contrast to persuasion, innovation processes need not necessarily be driven by an explicit motivation of one person to change the beliefs, values, attitudes or behaviors of another. Innovation can take place through social
modeling, which involves the observation and imitation of others' behavior. From the standpoint of decision theory, observation of others' behavior certainly can enlarge one's awareness of available alternative actions. Moreover, to the extent that the implementation and evaluation of the innovation are readily observable, a bystander can readily judge the advantages and disadvantages of the innovation.

Cultural Influences

Observed differences between countries in terms of residents typical beliefs, values, and especially behaviors in response to environmental hazards have generated considerable theorizing and a small amount of empirical research regarding the ways in which cultural influences affect people's hazard adjustments (Douglas and Wildavsky 1982; Sorensen and White 1987). These obvious differences from one country to another in people's reactions to natural hazards raise two problems for those seeking to explain hazard adjustment processes.

First, one clearly cannot define a general "human" response to natural and technological hazards if specific aspects of culture affect perceived vulnerability to environmental hazards or the likelihood of the adoption of preparedness. For example, the Church of Jesus Christ of Latter Day Saints (Mormon) recommends the storage of food and water, a practice that prepares church members for disasters including earthquakes. Buddhism provides another cultural perspective by suggesting that the individual take all possible measures to minimize injury or death from a natural hazard, even though this may be preordained by an individual's previous life (Lebra 1976). A third cultural perspective comes from ancient Chinese cosmology, which suggested that natural disasters were caused by bad government or a loss of virtue by the state—an explanation that provided impetus for the government to minimize disaster impacts in order to maintain the appearance of harmony between the ruling order and nature (Suttmeier 1994).

Such variations in world views make it clear that ethnic or cultural differences are important because they raise the possibility that one group of people shares a set of beliefs, values, or norms, or have similar resources and constraints that differ from those of other groups. Theoretical and practical problems arise when these cultural or ethnic differences are relevant to the adoption of adjustments because research findings obtained in studies of one group may not generalize to another. Unfortunately, only a limited amount of systematic research has been conducted that has examined the degree to which cultures throughout the world or even ethnic groups within the United States differ in their perceptions of the characteristics of natural hazards and hazard adjustments (Perry and Hirose 1991).
For example, it is not clear whether all people are susceptible to the kinds of errors in risk perception and adjustment that have been documented in American research on judgmental heuristics and risk perception. Moreover, much research on risk perception has been based on small or unrepresentative samples. In particular, a cultural difference in degree of optimism about personal well being could also affect perceived vulnerability and the propensity to adopt hazard adjustments—yet the extent to which this difference in optimism is culturally based has never been explicitly examined. Research on “unrealistic optimism” (Myers 1993; Weinstein 1989) suggests that Americans estimate that they live longer than other people and that they are less likely to die from cardiovascular diseases or accidents.

Garrison Keillor illustrates this belief when he says sardonically that all children of Lake Wobegon are “above average.” Researchers find an absence of this optimistic bias in self perception among Japanese college students (Markus and Kitayama 1991). If such differences in the degree of optimism about personal well being pervade entire cultures, they might affect perceived vulnerability and the propensity to take risk mitigating actions.

Cultural theories also suggest that the ways societies organize themselves to address different hazards helps to focus attention on some risks, such as Alar or nuclear power, while downplaying others, such as earthquakes. They also contend that the cultural context may increase or reduce awareness of risk, constrain individual decision making by enabling some alternatives while precluding others, and condition the range of acceptable responses. Repeated instances from within the United States indicate that a community’s response to scientific information about natural hazards can be significantly affected by the boosterism frequently found in local culture.

A major obstacle to identifying the effects of cultural factors arises from vagueness in the definition and operationalization of the concept of culture, and from the difficulties inherent in separating out cultural influences from those of other relevant factors. Vagueness in the concept of culture is attributable in part to lack of definition by its proponents. For example, one influential book on risk and culture neither listed the term in the index nor defined in the text what the authors meant by it (Douglas and Wildavsky 1983).

Even if culture is defined as the prevailing patterns of beliefs, values, and behavior within a society, its distinctive contribution to explaining the adoption of hazard adjustments remains elusive because a community’s hazard vulnerability is a function of the characteristics of the geophysical phenomena at its location as well as the characteristics of its human use system (Burton, Kates and White 1578). Consequently, comparisons among
groups in different locations are subject to inferential problems because differences in adjustment are likely to be a function of objective reality (e.g., site characteristics such as hazard vulnerability and event history in studies of pre-impact adjustments or disaster impact characteristics in studies of post-impact adjustments) as well as differences in social reality (the broader beliefs, values, and norms).

The potential for differences in objective reality makes it necessary to control for the possibility that people are perceiving different objects (e.g., different earthquake histories) before concluding that they perceive an object (e.g., "earthquake hazard") in different ways. This problem is compounded when comparisons are made between studies conducted by different investigators using different questionnaires, and is reduced by examining the degree to which ethnic differences are found in response to a single event or within a geographic area that is homogeneous with respect to hazard vulnerability. Even when different ethnic groups are located in the same area, inferences about cross-cultural generalizability are problematic because differences in hazard context cannot be ruled out unless ethnic groups are randomly distributed throughout the community.

Ironically, when this is the case, it seems implausible that the effects of ethnicity would not themselves be attenuated by mutual acculturation processes promoted by physical proximity. The use of multiple samples of respondents from the same cultural or ethnic groups at different locations is a useful method of ruling out these plausible rival hypotheses. For example, a study of warning response in three emergencies found notable ethnic differences in the source of first warning, source credibility, perceptions of message content, warning belief, perceived risk, and warning response (Lindell and Perry 1992). However, the differences among the three ethnic groups (Blacks, Whites, and Mexican-Americans) were not consistent across sites (flood in Abilene TX, hazardous materials in Mt. Vernon, WA and Denver, CO), suggesting that much more research is needed to distinguish the effects of site and event characteristics from those of ethnic differences.

Organizational Processes

A number of studies have examined the activities of community organizations responding (or failing to respond) to perceived threats in the physical environment. Some of these studies have investigated organizations responding to natural hazards, while others have examined the response to hazardous technological facilities. Following Dynes’ (1974) typology, some of these are established organizations (e.g., Sierra Club) having existing structures and whose normal function is pursuit of environ-
mental issues. Another category is the extending organization, which has an existing structure but new tasks (e.g., a neighborhood blockwatch organization diverting its attention from land use and crime to hazards mitigation). The third type of organization is the expanding organization, which has a new structure for existing tasks (e.g., a new set of citizens’ advisory panels comprised of citizens who are recruited to a continuing organization). The fourth type of organization is the emergent organization which typically involves an entirely new organization to address nonregular tasks.

Many of the latter are community action groups comprised of citizens who form their own organization after coalescing around a single issue, especially natural and technological hazards action groups (Cable and Degutis 1991). Another relevant organizational form is the multi-organizational network, which may develop in the course of disaster response (an emergent multi-organizational network, Drabek, Kilijanek and Tamminga 1981) or in anticipation of disaster impact (disaster planning networks, Gillespie, Colignon, Banerjee, Murty and Rogge 1993).

All of these organizational forms are of interest because they can provide the resources needed to influence the adoption and implementation of hazard adjustments. Specifically, the successful adoption and implementation of adjustments may require amounts or types of resources that a given individual lacks. Collective action may, thus, make possible adjustments that are infeasible with individual effort. Such gains may be additive (i.e., the group product is equal to the sum of the members’ contributions) or synergistic (i.e., the whole is greater than the sum of the parts). Unfortunately of course, one of the problems of collective action is the potential for process losses due to the time and effort required for coordination and, worse, the potential for social loafing that would make the product of the whole less than the sum of the individual contributions (Latané, Williams and Harkins 1979; Baron, Kerr, and Miller 1992).

Established and Expanding Organizations

Organizations with existing structures and for which preimpact hazard adjustments are a routine function are the emergency mission agencies (police, fire, emergency medical services, and emergency services). These agencies are involved principally in emergency preparedness rather than hazard mitigation. Research on these types of organizations has focused on the interorganizational structures and interpersonal strategies adopted by emergency managers. For example, early studies (Mulford, Klonglan, and Tweed 1973; Quarantelli and Dynes 1977) sought to develop typologies of strategies that emergency management organizations use to increase their
effectiveness. These studies were extended by Drabek (1987, 1990), who integrated the findings of previous disaster researchers with theoretical principles derived from the broader organizational literature to identify strategies and structures used by successful emergency managers. In testing the resulting inventory on a sample of local emergency managers, he found that the most effective emphasized the development of constituency support by actively trying to increase the resource base of all local agencies—not just their own. They relied on committees and joint ventures to involve other community organizations.

Finally, they brought in outside experts and attempted to manage conflict over controversial issues before it got out of control. In particular, they achieved more consensus with other community agencies on the mission of the emergency management agency. However, the extent of reliance on these strategies varied with community size. Successful directors in small communities used them less frequently than successful directors in large communities, but more frequently than unsuccessful directors in either small or large communities. Successful directors had more frequent contacts and more formalized interagency agreements (e.g., memoranda of understanding). Although all successful emergency managers gave considerable emphasis to coordination with other emergency-relevant agencies, they tended to give less emphasis to local businesses and (except in the smallest communities) to elected officials.

**Extending Organizations**

This category of organizations consists of businesses and government agencies that, although lacking a formally designated emergency mission, have assumed responsibility to protect their own human and material resources, or to assist others. Published research examining factors influencing adoption of hazard adjustments in such organizations is extremely sparse. This is an important oversight because the factors affecting organizations’ adoption of hazard adjustments may well be different from those affecting household adoption—clearly organizations have greater financial resources as well as the ability to maintain internal specialists who can provide them with an access to needed information.

Moreover, organizational members differ among themselves in their goals and expectations, introducing organizational politics into the decision process (Pfeffer 1981). In the absence of detailed models of the processes involved in organizations’ adoption of hazard adjustments, the few studies to date have sought to predict the adoption of adjustments on the basis of organizational characteristics. For example, an early study on organizational adjustments by Mileti (1983) examined respondents’ intended adjust-
ments in response to earthquake warnings by presenting organizational representatives in California and Japan with a hypothetical prediction and asking for their judgments of the likelihood that this information would or actually did lead them to engage in preparedness or mitigation actions.

Mileti examined the correlations of these two types of adjustments with three predictor variables—ability to act (measured by organizational size), reason to act (measured by the proportion of organizational facilities in the risk area), and knowledge to act (measured by the number of earthquake events actually experienced by each organization over the previous ten years). All three predictors had statistically significant correlations with both intended adjustments in a sample of 68 federal, state and local government organizations located in California. Ability to act and reason to act, but not knowledge to act, were significantly correlated with both intended adjustments in the sample of 76 California business organizations. Finally, ability to act, but not reason to act or knowledge to act, was significantly correlated with both intended adjustments in the sample of 32 Japanese governmental and business organizations.

More recent studies have examined actual, rather than intended, adoption of hazard adjustments. Perry and Lindell (1997b) studied organizational adoption of seismic hazard adjustments by 31 city and county agencies in the Southwest U.S. The investigators found significant variation in the degree of adoption of seismic adjustments—ranging from 87 percent planning to inventory organizational personnel and equipment, to 26 percent having a plan for personnel protective measures in the workplace. There was similar variation in the levels of adoption of communications modes—ranging from 58 percent adopting cellular telephone to 13 percent adopting ham radio relay. Overall adoption of adjustments was correlated with agency size, agency managers’ perceptions of threat, and agency information seeking.

In another study, Perry and Lindell (1996a) examined Los Angeles area hazardous materials handlers’ adoption of 13 adjustments to earthquake hazard following the Northridge earthquake. The data indicate that hazmat handlers more commonly adopted hazard assessment actions (rates of adoption ranged from 12–14%) and emergency preparedness actions (rates of adoption ranged from 14–17%) than hazard mitigation actions (rates of adoption ranged from 4–16%) following the Northridge earthquake. Moreover, there was a tendency for facilities that undertook hazard assessments in the year after the Northridge quake to engage in emergency preparedness actions (median correlation = .29) rather than hazard mitigation actions (median correlation = .07).
The study also showed that the hazard mitigation actions most frequently adopted were the least expensive and time consuming, and that the adoption of hazard adjustments could not be reliably predicted on the basis of damage experience, regardless of whether that was measured by on-site systems damage, loss of off-site systems, or occurrence of financial damages. However, size (measured by the number of personnel, the annual operating budget, and the assessed valuation of the facility) was correlated with the presence of specialized safety personnel, and—consistent with the results of Mileti (1983)—with the number of earthquake hazard adjustments.

In other research on organizational hazard adjustments, Drabek (1991, 1994, 1995) examined evacuation planning conducted by 185 tourist-oriented private firms in 9 communities throughout the U.S. He measured organizations' extent of planning in terms of the presence of a multi-hazard evacuation plan (written or informal) tailored to the specific property that emphasized the planning process (rather than just the product), and included regular staff training, annual plan revision and emergency exercise, and corporate/CEO commitment. He found that most organizations had informal (64 percent), property specific (77 percent) plans, but only a few were written (28 percent), functional (24 percent), revised annually (22 percent), incorporated regular staff training (24 percent), had a planning process emphasis (22 percent), had CEO commitment (24 percent), or provided for annual exercising (5 percent). Drabek also found that the level of evacuation preparedness was best predicted by the presence of a community disaster subculture, the number of full-time employees, managerial membership in professional organizations, managerial risk perception, assistance provided by the local emergency manager activity, and intraorganizational factors such as corporate mandates for planning.

**Emergent Organizations**

Researchers from a number of different disciplines have examined the structures and processes of emergency organizations such as community action groups. Community psychologists, who have focused upon participation in community organizations, contend that when individuals perceive social and environmental problems within a community to which they are attached, they participate in organizations expected to be successful in mitigating these problems (Chavis and Wandersman 1990; Florin and Wandersman 1984).

This approach suggests that members' sense of individual and collective self-efficacy and, thus, their motivation to continue their participation, is enhanced when in these organizations are empowered by successfully influencing actions taken by the community (Zimmerman, in press). Mem-
bers experience a sense of empowerment—an enhancement of competence and confidence—as they “gain experience organizing people, identifying resources, and developing strategies for achieving goals” (Zimmerman and Rappaport 1988, p. 727). Moreover, participation in community groups is significantly related to three types of benefits (personal, social, and purposive) and their corresponding costs (Prestby, Wandersman, Florin, Rich and Chavis 1990). In turn, participants’ perceptions of benefits and costs appear to be influenced by leaders’ incentive and cost management efforts.

A complementary approach, explored by industrial/organizational psychologists, has provided a few studies specifically on participation in voluntary organizations. For example, Pearce (1983) found that members often join and remain in a voluntary organization because they are attracted to its activities, and that volunteers are more likely than paid workers to have high intrinsic satisfaction. These findings, together with Mahoney and Pechora’s (1980) report that volunteers act more in accordance with their own values than do paid employees, indicate volunteers’ experiences may differ from those of their compensated counterparts, and suggests that members’ organizational commitment and the factors that affect that commitment are relevant to this issue.

This perspective has, however, provided an extensive literature on the closely related construct of organizational commitment, which Porter, Steers, Mowday, and Boulian defined as “the strength of an individual’s identification with and involvement in a particular organization” (1974, p.604). Porter and his colleagues further characterized organizational commitment as including: a) strong belief in, and acceptance of, the organization’s goals and values, b) willingness to exert considerable effort on behalf of the organization, and c) strong desire to maintain organizational membership.

**Multiorganizational Networks**

Just as individuals may participate in organizations because they lack the resources for task performance, so too may organizations participate in networks to enhance their capability to achieve their goals. Gillespie (1991) and his colleagues (Gillespie, Colignon, Banerjee, Murty, and Rogge 1993; Gillespie and Streeter 1987) conducted an intensive study of a disaster planning network in the Midwestern United States. Their data indicated that a large proportion of the organizations relevant to disaster response were not linked to the preparedness network.

This suggests that ways need to be found to facilitate relationships between emergency preparedness organizations and other organizations having disaster relevant resources, but whose goals do not include disaster.
preparedness. The authors noted that interorganizational linkages consist of informal contacts, verbal agreements, and written agreements, but emphasized that the existence (or even the frequency) of interorganizational contacts does not measure the importance of the relationship (i.e., that needed information, services, or resources have been established or transferred). They also found that interorganizational linkages were initiated by awareness of potential disaster demands, or by recognized needs to avoid gaps in services or duplication of effort.

Other needs included ensuring timely access to information, services, or resources; development of internal organizational response capability; and development of political influence to enhance organizational autonomy, security, and prestige. In particular, Gillespie’s emphasis on the increase in preparedness that can result when organizations know more accurately what to expect from the disaster impact and from each other is consistent with Kartez and Lindell’s (1990) contention that emergency preparedness is promoted when disaster-relevant organizations develop a “shared schema” of agreed-upon expectations about disaster demands and response capabilities.

Gillespie and his colleagues also found that interorganizational linkages are developed through active and personable individuals, pre-existing personal and professional contacts, as well as routine interagency and inter-jurisdictional meetings, drills, and exercises. However, these linkages are impeded by geographical distance, lack of funds, lack of staff, incompatible professional perspectives and terminology, lack of trust in an organization or its representative, overconfidence in one’s own capability, and unequal rewards and costs of participation for those in different organizations.

In particular, there is a need for facilitating effective relations between organizations with full-time staff members and organizations with part-time staff and volunteers by scheduling meetings at times convenient for all staff (full-time, part-time, and voluntary) that concentrate on common interests and are guided by agendas. Failure to meet these suggestions usually results in termination by neglect, not by direct confrontation over disparate values.

Other relevant studies have been conducted on factors influencing the effectiveness of Local Emergency Planning Committees (LEPCs). Lindell, Whitney, Futch, and Clause (1996) noted that although organizational scientists agree that there is no single best structure for all organizations, this does not imply that organizations of a single type will not benefit by following the same patterns of structuring. Their data from 180 LEPCs showed that, even though greater community resources, availability of funding, and higher levels of hazard vulnerability are associated with LEPC effectiveness, none of the correlations was large. They did find a significant
impact of acquiring computer resources on LEPC effectiveness, which is consistent with Drabek’s (1991) broader examination of microcomputers in emergency management, while a significant effect of paid staff replicated earlier findings by Lindell and Meier (1994).

Both of these strategies would seem to require increased funding to achieve LEPC success. In particular, the studies conducted by Lindell and his colleagues indicate that there are some structures and strategies that are likely to significantly improve the success of all LEPCs regardless of context—and especially without significant expense. While this might seem surprising, it is consistent with previous studies showing that external constraints can be circumvented to some extent by a superior planning process (Kartez and Lindell 1987). Indeed, it is precisely the purpose of an LEPC to provide this planning process.

One way in which LEPCs can achieve increased productivity is through appropriate staffing and organization. LEPCs become more effective when they seek out a wide range of knowledge, skills and interests by having a large number of agencies and organizations represented on the LEPC. In addition, technical materials provided through “vertical diffusion” from federal (DOT, EPA, and FEMA) agencies also have a positive impact on LEPC effectiveness. Equally significant is “lateral diffusion” of emergency preparedness practices and resources obtained from private industry and neighboring jurisdictions, which can provide vicarious experience with disaster demands by demonstrating the effectiveness of specific innovations including plans, procedures and equipment (cf. Kartez & Lindell, 1987). Other relevant factors affecting LEPC effectiveness include the designation of specialized subcommittees and the elicitation of significant member inputs (e.g., number of members, length and frequency of meetings, high levels of effort and attendance, and low levels of turnover).

It is especially important to note the influence of LEPC team climate—members’ interpretations of features, events and processes that take place in their work environment (Lindell and Whitney 1995). Important dimensions of team climate and individual members’ jobs include role stress, (role ambiguity, conflict, and overload), intrinsic or extrinsic rewards for emergency planning activities (job challenge and task significance), and characteristics of LEPC leadership (leader goal emphasis and leader support) and the work group itself (work group cooperation and team pride). Organizational climate presumably affects LEPC effectiveness because it influences the degree to which members’ motivation is aroused, maintained, and directed toward group goals (Lindell and Whitney in press). Team climate also is important because it is related to job satisfaction and
organizational commitment which, in turn, are related to member participation (effort, attendance, and intentions to remain with the LEPC).

The need for further examination of individual members’ perspectives was confirmed by Whitney and Lindell (1996), who discovered that members’ organizational commitment was significantly influenced by effective LEPC leadership (the ability to structure team tasks, to communicate clearly and to show consideration for team members) and the LEPC members’ perceptions of their own competence (job related self-efficacy). Other factors affecting commitment included the members’ identification with the LEPC’s goals (perceived hazard vulnerability and perceived effectiveness of emergency planning), and perceived opportunity for reward (public recognition and personal skill development). In turn, LEPC members’ organizational commitment was correlated with their attachment behaviors (attendance, effort, and continued membership in the organization).

**Economic Market Processes**

Perhaps the most important concept in economic theory is the *marketplace*, which is a metaphor for the processes of economic exchange. In an idealized marketplace, producers compete with each other in bargaining with potential customers over a fair price for their goods and services, while consumers compete with each other in bargaining with suppliers over quality goods and services for their money. Strong demand elicits an adequate supply through the pricing mechanism (Stiglitz 1993). Many of the errors in assumptions about individuals’ decision processes appear to present a problem for economic analysis of hazard adjustments because rational decision behavior comprises an important set of assumptions underlying idealized markets.

As noted in the earlier discussion of decision behavior, important flaws include imperfect assessments of the situations in which decision makers find themselves, lack of awareness of the full range of alternative actions or products available to respond to those situations, and faulty processing of the information they do possess to foresee likely states of nature and the consequences of their actions. Other flaws include failure to maximize utility, failure to appreciate the need for additional information, lack of insight and inconsistencies regarding present and future preferences, planning only for the immediate future, and forecasting that future only on the basis of the immediate past.

These flaws in decision making can have a number of quite disparate effects on markets relevant to natural hazard vulnerability. These effects include overpricing vulnerable properties, underpricing hazard adjustments, price destabilization, and otherwise inexplicable price stabil-
ity. The overpricing of vulnerable properties is related to the widely recognized problem that markets can lack perfect competition because a single individual (monopoly) or a coordinated group of producers (cartel) has disproportionate power to set prices through its exclusive control over the availability of an essential product.

A related phenomenon occurs when a coordinated group has substantial control over the availability of information that significantly would affect the price of a product. A well-known example of this problem on the stock market is “insider trading,” where those with exclusive knowledge about corporate performance, and thus likely stock prices, use that knowledge to take advantage of the market. An example from natural hazards, noted earlier, is the tendency for those who have an economic stake in a community to withhold or even actively suppress information about hazard vulnerability of the community as a whole (Meltzer 1979) or about particular properties within the community (Palm 1981). Such suppression of hazard information is not only ethically objectionable, but it also is economically undesirable because it artificially raises demand and induces greater allocations of resources to hazard prone areas.

Moreover, such a situation can result in a significant price destabilization if many people are deceived and are deceived to a great degree. In such a case, the drop in market prices is likely to be substantial if the information finally does get out. The crash occurs because, contrary to an orderly market in which individual decisions are independent (and the number of sellers is roughly equal to the number of buyers), individual decisions that have a common cause compound each other by leading many decision makers to take the same action (and the number of sellers significantly exceeds the number of buyers, causing prices to drop).

Underpricing can occur if markets do not exist because the desired amenities are not private property and cannot be exchanged. When such amenities are regarded as free, they tend to be treated as limitless, and overused. For example, subterranean water is available to anyone who drills for it. When the aquifers from which the water is drawn are exhausted, vulnerability to drought is increased. The dynamics of such situations, referred to by Hardin (1969) as the “Tragedy of the Commons,” and more generally labeled *social dilemmas* (Dawes 1980) are not easily managed by individuals seeking to maximize their own self-interest.

A related situation concerns externalities, which are benefits or costs of an amenity that are not fully captured by market transactions. Most forms of urban development in watersheds produce externalities because soil compaction or replacement by impervious surfaces diverts rainfall from percolation through the soil into surface runoff. Thus, upstream develop-
ment increases flood hazard during the rainy season and increases drought hazard in the dry season.

Decision makers' inability to cope effectively with low probability-high consequence events conflicts with the economic principle that "producers in a competitive environment seek through trial, error, imitation, and innovation least-cost techniques of production directed to consumer demands of greatest intensity" (Horwich 1993, p. 189). Thus, markets related to natural hazards inherently provide imperfect signals because the perceived benefits of effective hazard adjustments are lower than their true social benefits, thus leading to insufficient demand and, consequently, inadequate supply.

One specific problem is adverse selection in the purchase of insurance (see Kunreuther, et al. 1978). If decision makers only purchase insurance because they believe they are at risk then, assuming their risk perception are accurate, only those most likely to make claims will purchase policies. Of course, the inevitable consequence of this dynamic is that either insurance companies will fail to collect enough premiums to cover their losses or must raise prices (quite possibly beyond potential buyers' willingness to pay).

Some flaws in the marketplace model related to the nature of transactions can provide unexpected stability. For example, Dacy and Kunreuther (1969) noted that economic theory would predict that disasters cause price increases because the destruction would reduce supplies. However, altruism, which conflicts with the economic assumption that individual decision making is based upon personal self-interest, tends to reduce demand by leading people to shelter homeless friends and relatives, thus stabilizing housing prices, and to comply with appeals not to hoard, thus stabilizing food prices.

An important step toward a better understanding of these and other market dynamics can be achieved by systematically identifying all of the different types of stakeholders involved in economic transactions relevant to hazard vulnerability and hazard adjustment. As noted earlier, some of the most important stakeholders relevant to the hazard adjustment process are those who own property in a hazard-prone area and, thus, are vulnerable to economic losses through damage or destruction of that property. Some property owners hold title to the building and its contents, and thus are subject to loss of both in a disaster. Others own either the building itself (commercial property owners) or the building's contents (renters).

The distinction between the two is significant because renters' economic incentive is principally limited to protection of contents, not to engage in structural adjustments. Even among building owners, incentives for struc-
tural adjustments are affected by the duration of property ownership. That is, owners are most likely to engage in adjustments when they expect to own the property for a long time and, thus, have an extended exposure to risk.

This point is particularly germane to real estate developers because they typically hold the property for the minimum time required for development, thus giving themselves only short-term exposure and minimal incentives for hazard adjustment. In addition, real estate developers may be significantly more aware of the hazard than purchasers of the property. This disparity in knowledge about what can be considered a “hidden defect” in the property can put households and small businesses at a significant disadvantage in determining the true value of the property. Among long-term property owners (i.e., those who have an incentive to implement hazard adjustments), the issues arise as to whether the hazard and the alternative adjustments are recognized, and whether the resources are available to implement the preferred adjustments.

Households and businesses with low incomes and limited assets may not be able to afford the cost of hazard adjustments, a problem that probably is compounded by the fact that these are the stakeholders most likely to purchase existing construction, which is far more expensive to retrofit than new construction. Another relevant group consists of safety product vendors. They, of course, have a direct and immediate economic interest in promoting the adoption of certain types of hazard adjustments, especially ones that are commercially profitable.

The role of the financial industry also is significant in many ways. Insurers clearly have a direct role, but their activities are significantly constrained by the problems of adverse selection and moral hazard. According to the latter principle, people who purchase insurance will be less prone to take hazard mitigation actions to protect their property because its value already is protected by insurance. Another important financial stakeholder for households and businesses lacking the assets to purchase properties outright is the bank and other mortgage holder. Their economic stake in the property clearly gives them opportunities to exercise influence over the choice of adjustments.

Other financial stakeholders with an interest in hazard adjustment include corporate bond-and share-holders. These may be interested in natural hazards impacts only if their holdings are quite vulnerable to a single disaster (i.e., if they are concentrated in a particularly vulnerable area). This is especially likely to be true for major stakeholders with billions of dollars invested, such as pension systems and mutual funds. Probably less significant, but also relevant stakeholders are businesses who could experience
severe business disruption if their normal or exclusive suppliers/customers experienced disaster damage.

All of these problems raise questions about the need for government to intervene to ameliorate market imperfections. Few of the economic issues associated with natural hazards appear to be unique to this area; many have been addressed in other areas such as occupational safety and environmental pollution. For example, Horwich (1993) raised a number of important concerns about the appropriate role of government, private nonprofit organizations, and private for-profit organizations as providers of a wide variety of natural hazard adjustments such as emergency preparedness, emergency response, and hazard mitigation services. Unfortunately many issues remain to be resolved, ranging from the quality and price charged by private contractors, and the relative bargaining power of providers and consumers, through the relative importance of economic efficiency and social justice in natural hazard adjustment.

**Governmental Processes**

Local, state and federal governments have extremely important roles in the adoption and implementation of hazard adjustments for three reasons. First, to the extent that revenue used for response and recovery come from public treasuries, government has a responsibility to ensure that those in less hazard prone areas do not find themselves subsidizing the mistakes of those who choose to expose themselves to higher levels of risk. This, in turn, requires communities to adopt and implement hazard mitigation measures. Second, government at all levels assumes a major responsibility for ensuring that disaster response and recovery operations are effectively and efficiently implemented.

Effective emergency preparedness reduces the probability that members of the community who are not directly affected by the physical impact of disaster will be indirectly affected by an interruption of the normal flows of goods and services. Third, different levels of government are potential disaster victims because of their significant resource investments in vulnerable infrastructure located in hazard prone areas. Thus, it is of interest to determine the extent to which federal, state and local governments—as well as specialized jurisdictions such as water, sewer, and school districts—adopt hazard adjustments to protect their own human, material, and financial assets.

**Hazard Mitigation**

An overall reduction of hazard vulnerability can be achieved through the adoption of policies regarding appropriate uses of land, controls over
development, or regulation of construction in hazardous areas. However, the adoption and implementation of such adjustments is strongly influenced by the federal structure of government in the United States. This is because local government retains the most direct control over households and businesses through the adoption of land use regulations, development controls, and building codes.

Many studies point to the reluctance of local governments to adopt, or adequately enforce, strong measures for managing land use and development in hazardous areas. National studies of earthquake risk reduction measures, by Berke and Beatley (1992) and Wyner and Mann (1986), document noteworthy gaps in local policy adoption of measures for reducing earthquake and other risks. Burby and French (1981) and Burby et al. (1985) provide similar assessments of the inconsistent approach taken by local governments in floodplain management, despite the requirements of the national flood insurance program.

There are a variety of reasons why local governments often are reluctant to adopt and implement hazard mitigation measures despite their beneficial effects in reducing hazard vulnerability. First, unless governments have direct experience with devastation wrought by a natural disaster, they tend to discount the risks involved in allowing development in hazardous areas. Second, even in relatively high risk areas where losses have already occurred, other problems are often higher on local agendas. Third, hazard prone areas often are a very valuable economic resource because of natural amenities such as open topography, views of water or from hillsides, ocean frontage, and industry access to water and water based transportation. Finally, because hazard prone areas are often already well developed, remedial actions for addressing hazards are difficult and costly to implement.

The stakes in making these decisions are often large and the outcomes uncertain, making conflicts over the outcomes difficult to resolve. Diverse groups are affected by the outcomes of these decisions and are active in attempting to influence them. Thus, the decisions are politically charged and contentious. As a consequence of existing development and its economic value, local governments are sometimes reluctant to take strong steps to regulate land use, preferring other mechanisms such as structural improvements for making development in hazard prone areas less risky.

State and federal officials have a strong stake in encouraging local governments to reduce potential losses, if only to lessen state and federal outlays for disaster relief. This presents a basic dilemma in that the national and state interest (in most states) is to promote efforts to mitigate losses but, as noted above, local governments are reluctant to adopt and implement risk
reduction measures. The willingness of policymakers to require local efforts to avert losses is shaped by a variety of forces.

Among states that have developed some form of state requirements for local hazard planning, May (1994) has documented variability in requirements that reflects the nature of the hazards, differing perceptions of the seriousness of risks, and differing beliefs about appropriate state intervention. More generally, studies of state level attitudes about hazard mitigation (May 1993; Rossi et al. 1982) show that those influential groups identified by state policymakers as opinion leaders do not see hazard mitigation as an important issue. National policymakers find themselves facing pressures to reduce federal disaster relief outlays. However, they are also cognizant of strong concern among state and local officials about "unfunded mandates" along with the political power of the property rights movement.

To overcome these impediments to local control of hazard vulnerability, policymakers at federal and state levels can use a variety of means for seeking to build commitment from lower levels of government to hazard mitigation and improving these jurisdictions' capacity to carry out appropriate actions. In analyzing federal approaches to earthquake risk reduction, May and Williams (1986; May and Birkland in press) set forth four broad strategies available to the federal government. One strategy, labeled the "limited regulatory approach," entails the federal government acting as a catalyst in mandating or encouraging active state, local, or nongovernmental regulation. Examples are federal efforts to develop seismic and wind standards for new construction, existing hazardous buildings, and utility systems. A second strategy, labeled "mobilization," consists of federal efforts to call attention to risks posed by natural hazards in hopes that such efforts will stimulate subnational efforts to address hazards. This is being pursued through various regional mapping and loss estimation efforts.

A third strategy, labeled "collaboration," entails some form of federal and subnational partnership for developing and managing hazard mitigation programs. Examples of these are the creation of regional partnerships for earthquake preparedness in southern and northern California (now folded into the California Office of Emergency Services) and in the central United States. A final strategy, labeled "general regulation," entails the federal government becoming a partner with states or subnational governments in promulgating and enforcing regulations. The National Flood Insurance Program establishes a general partnership for which the roles and relationships among respective federal and subnational partners have evolved over time.

Perhaps the most important observation from this characterization of federal approaches is that there currently is a variety of federal strategies
being employed for influencing subnational hazard mitigation efforts. In pursuing any of these strategies, federal officials have a variety of tools available to them that range from policy prescription (mandating particular actions) to various legal and financial incentives for inducing action. A variety of recent research about policy design and implementation (Goggin et al. 1990; May 1991) shows that the degree of implementation effort and nature of intergovernmental relationships are shaped not only by the choice of these tools, but also by the commitment and capacity of those agencies charged with carrying out the policy. The choice of policy tools is important in setting expectations about agency actions and in signaling desired regulatory styles.

The overlay of various federal and state mandates in attempting to influence local decisions about land use and development in hazard-prone areas has created a patchwork system arising from changes in legislation over time, variation in requirements across hazards, and differences in demands from one agency to another. State efforts are quite varied, and even federal efforts are limited in focus and often incomplete. The legacy consists of evident gaps and missed opportunities for mitigating hazards. Even worse are the indirect effects of these confusing and conflicting state and federal requirements. Perhaps the most noteworthy implication is the fostering of an uneasy intergovernmental partnership.

Simply put, local governments do not like the way in which the federal government and states have attempted to draw attention to problems posed by natural hazards. Many local officials perceive federal and state environmental mandates as overly prescriptive and coercive. This is a recurring theme of major studies undertaken in the past decade by the U.S. Advisory Commission on Intergovernmental Relations (1993) and the General Accounting Office (1990, 1995). Local governments complain about the failure of higher level governments to fund the costs of implementation, the lack of flexibility in the required actions, and the shifting to them of political blame for infringement on property rights.

On the other hand, local governments are not entirely without blame. Many times, local jurisdictions have procrastinated in the implementation of programs, waiting until just before the implementation deadline to begin work. The attendant disruption and cost escalation is then blamed on the federal regulation rather than local mismanagement. Moreover, many local jurisdictions are only too happy to reap the benefits of federal programs while complaining about the associated costs. In some cases, this involves attempts to divert federal funding targeted for one purpose to another purpose that is more popular locally.
For example, although the Emergency Management Assistance grants from FEMA are 50/50 matching grants, some county supervisors have assigned their local emergency management coordinators collateral duties unrelated to emergency management (e.g., overseeing courthouse security and the county motor pool) that take up a significant portion of the time paid by the county. The net effect of these questionable actions is that the federal government is paying for 100 percent of local emergency planning, not the 50 percent envisioned by the program. Federal agencies’ response to such actions by local governments is to issue more detailed specification regarding allowable expenditures (which is denounced locally as federal “red tape”) and to provide increased scrutiny of those expenditures by requiring annual reports and conducting performance audits (more “red tape”). The net result of this uneasy partnership is a lack of trust that often is translated into reluctance to fully implement federal or state policies.

Overall, Burby (1994) has classified the factors associated with the adoption of community development management tools into eight categories that are relatively similar to those of household and organizational adjustments. The first category consists of recognition of natural hazards as a community problem (including political support and observability of victims), while the second is the presence of political catalysts (e.g., publicized accounts of objective hazard vulnerability; recent, frequent, or large hazard losses). The third category is tractability of the problem (ease of identifying hazard areas, low costs that are invisible or broadly diffused, small population to be affected, few behaviors to be changed, alternative sites available for development), and the fourth category is commitment of governmental leaders and professional staff (especially expertise, political power and the prospect of longevity in the organization).

The fifth category is capacity of governmental leaders and professional staff (jurisdiction size, staff training and professionalism—especially external integration), while the sixth category is community capacity to support land use adjustments (measured by community or organizational wealth). The seventh category is inclusion of natural hazards in community comprehensive plans, and the eighth is intergovernmental mandates from the state and federal levels.

**Emergency Preparedness**

Kreps (1991) observed that the two foundations of disaster response are improvisation and preparedness. Improvisation is an inevitable part of disaster response simply because the precise nature of the disaster impacts cannot be predicted. However, disasters require a coordinated response by many organizations which, because of the urgency and uncertainty preva-
lent during the crisis period, dictate a need for advance planning. As Lindell and Perry (1992) have proposed, the most satisfactory resolution of the conflict between improvisation and preparedness is to identify the areas in a community that are vulnerable to hazards, determine what functions need to be performed in responding to these types of emergencies, and develop programs for emergency preparedness that provide plans, procedures, and resources (personnel, equipment, materials, and facilities) for emergency response. A recurrent problem in emergency preparedness has been public apathy and, thus, a low priority assigned to this function. Consequently, responsibility for hazard vulnerability analysis and emergency planning typically has been assigned to a single part-time planner who writes plans that are formally adopted by local officials but never implemented by emergency responders.

This situation seems to be changing significantly due to the increasing professionalization of emergency managers and the development of Local Emergency Planning Committees (LEPCs). Increasing professionalization of emergency managers has been promoted by the Federal Emergency Management Agency (especially the National Emergency Training Center), professional associations (National Coordinating Council on Emergency Management and National Emergency Management Association), and state emergency management agencies. However, there appears to have been little or no research on the impact of this trend toward increasing professionalization. Specifically, staffing analyses need to be conducted to determine whether better qualified staff are being hired in areas with greater hazard vulnerability, whether these higher qualifications lead to the adoption of more effective hazard adjustments and, if so, to what extent this has had an impact on disaster response.

The development of LEPCs was addressed by Lindell (1994), who reported that many—if not most—jurisdictions have failed to fully comply with the requirements of the federal legislation (SARA Title III) that initiated LEPCs. He noted that many LEPCs have made significant progress in overcoming the low salience of emergency planning, a problem that creates a number of other obstacles to their success. They must adapt federal guidance in a way that provides them with a pattern of staffing and structure suited to their own limited resources.

In many cases, this means LEPC members must train themselves in emergency planning at the same time as they are developing training for emergency responders. Lack of funding limits access to training and equipment, time available for planning, and access to paid staff and consultants. It also has an adverse impact on individual motivation to the degree that the
most common tangible rewards for good performance, salary increases and promotions, are unavailable.

One reason for optimism about the success of LEPCs is that the planning process mandated by SARA Title III provides some significant improvements over previous methods of emergency preparedness. Recent research on LEPCs suggests ways in which the effectiveness of these organizations can be significantly increased. The first and most obvious of these is to obtaining secure funding, but other methods of increasing LEPC effectiveness also must be addressed. These include establishing a positive transfer of emergency planning resources from outside the community, enhancing support for emergency planning within the community, setting realistic priorities within the area of emergency planning, lowering the cost of emergency preparedness by reducing the workload associated with emergency planning, and enhancing the LEPC's climate and its members' commitment to the organization. Achievement of these goals can be enhanced by establishing clear criteria for judging LEPC effectiveness.

In addition, there are some very important practical consequences for the design and operation of LEPCs. Specifically, it appears that addressing LEPC staffing and organization, team climate, and LEPC member commitment are as important to its effectiveness as tasks such as developing emergency response teams, conducting hazard and vulnerability analyses, identifying emergency response resources, and analyzing evacuation routes. Yet LEPCs are currently left to their own devices with regard to development of effective group processes. A major challenge for LEPCs is to recognize the importance of these human resource issues and place as much emphasis on organizational development as on technical training and equipment acquisition. Drabek (1987) has begun to address structures and strategies by which emergency managers can enhance the success of their efforts, but this work has not received widespread adoption by emergency planners.

Preliminary results indicate that LEPC leaders can enhance team climate and member commitment by translating overall LEPC goals into specific, challenging objectives for subcommittees and individuals. In addition, they can provide paths to success by allocating tasks that utilize members' existing skills and abilities, and giving feedback by paying attention and responding to members' task performance. They also can provide rewards by emphasizing the effect of task performance on community protection, publicly recognizing effective performance, and identifying opportunities for members' skill development.

One notable deficiency in the research on emergency preparedness is the neglect of intergovernmental relations, a topic that is so characteristic
of the research on government agency adoption and implementation of hazard mitigation measures. This appears to have occurred because research on emergency preparedness has emphasized intraorganizational (Drabek 1987, 1990) and interorganizational (Gillespie, et al. 1990) processes at the local level. The potential limitation of existing research is that hazard mitigation agencies (planning and community development, building inspection) have missions and cultures that differ from those of emergency preparedness agencies (fire, police, emergency medical services, emergency management). Thus, research findings on intergovernmental relations regarding hazard mitigation programs may be inapplicable to emergency preparedness agencies.

**Governmental Self-protection**

Recent decades have seen increasing attention by emergency mission agencies to their hazard vulnerability. Thus, police, fire, emergency medical, and emergency management agencies have become more likely to locate their facilities out of hazard zones, to provide hazard-proofing for the facilities that cannot be relocated, and to establish standard operating procedures to reduce the vulnerability of equipment that must remain in unimproved facilities. As yet, there seems to have been only limited attention given to the hazard vulnerability of non-emergency mission agencies, even though the need for many municipal services can be expected to rise in the aftermath of disaster. However, as noted in the earlier section on organizational processes, there has been virtually no research on the extent to which government agencies adopt and implement pre-impact adjustments to minimize their own losses and to assure continued provision of routine government services following disaster impact.

Perry and Lindell (1997b) reported that hazard adjustments varied substantially in their levels of adoption and that agencies' overall level of adjustment to seismic hazard could be predicted in part by agency size, agency head's risk perception, and agency information seeking about the hazard. The fact that this study was limited to seismic adjustments in a single small southwestern city means that the findings should be regarded as preliminary and generalizability to other hazards and other jurisdictions should be done cautiously.

**Legal Processes**

Common law and statutory law both have contributed to the development of a definition of rights and responsibilities for individuals and groups within society. Common law has evolved from the body of judicial decisions accumulated over the centuries, while statutory law results from the
passage of legislative acts signed into law. Both of these sources contribute to criminal law, which deals with crimes against society as a whole (e.g., violent acts, property theft, etc.), and civil law, which is directed toward the resolution of disputes between private parties. In particular, tort law recognizes individual or business interests, and is intended to protect these interests against harm by providing a means for persons (or businesses) harmed by another to be compensated for their losses. Tort law provides a systematic means for analyzing and resolving claims and redistributing losses to those responsible for the harm. This protects the interests of the injured party and the actor. Consequently, tort law is relevant to hazard adjustments if aggrieved parties believe their legitimate interests have been damaged by implementation of that hazard adjustment.

There are many parties involved in hazard mitigation efforts and who may be subject to tort actions. These include public officials and employees of state and local governmental units, citizens (home owners or renters), businesses, community groups (and other interest groups), financial organizations (banks, insurance companies, bond holders, and other investors), and the federal agencies (e.g., FEMA). Each group has an interest motivating its participation such as property values, cost of operations, returns on investments or the security of the investment. Government agencies and community groups may seek to provide zoning and land use planning measures that minimize community damage from flooding, winds, or other natural hazards.

Legal disputes and claims evolve when the interest of one party is in conflict with the actions or inactions of others. Examples include claims for damages by developers, businesses, or homeowners who believe the actions or inactions of local governments have directly (or indirectly) contributed to their losses, or property damage loss of life. Claims could arise either to recover damages from those believed to be responsible for the loss, or to initiate an injunctive action to require specific action to minimize or prevent a liability loss. Prospective claims might be made to require local government to adopt local building codes, land use standards and process, hazard control or protective projects, hazard analysis initiatives, or emergency warning systems.

The courts have been quite clear in the obligations and description of local governments to adopt public programs and practices. Unless otherwise mandated by state law, developers, homeowners, businesses, and even the finance community may have no legal recourse to mandate action by local governments. The courts have been more divided concerning the financial responsibility of local governments when they fail to plan effectively, implement land use plans, enforce building codes, or provide adequate
emergency response. The courts have been reluctant to hold local governments responsible for ineffective emergency plans or response efforts. They have been more willing to grant relief when the actions of government units directly affect property losses.

The following analysis of tort claims in emergency situations clearly suggests that government units enjoy extensive immunity when involved in emergency planning, response, and recovery activities. Each of these emergency management functions is directly linked to a disaster. Hazard mitigation efforts may not fall into these traditional emergency management functions since they are far more complex and flow over to other public functions such as public works.

Many managers involved in the reduction of natural hazards perceive that there is a great risk today, possibly more than ever before, to civil claims and court judgments. For emergency management activities associated with planning, response and recovery efforts the application of tort law is quite clear; public officials and organizations enjoy significant immunity from civil claims. The courts at the state level have consistently granted immunity to public private and non-profit actors involved in emergency preparedness, emergency response, and disaster recovery activities. Unfortunately, the law is less well defined regarding efforts to mitigate the damages that are anticipated from natural disasters. Thus, it is important to examine the basic principles of tort law as applied to emergency management and specifically in the adoption of hazard mitigation measures. As state and local organizations struggle to mitigate the adverse impact of natural and technological hazards, managers must understand the legal implications of their decisions.

**Liability Under State Law**

Major changes have occurred during the past 25 years in state tort law and as a result, managers are increasingly concerned that their decisions will lead to costly liability suits and judgments. The law is a complex arena and liability depends on the circumstances in each situation, such as who is involved and when were actions taken. A tort is an act that harms another. It is committed when a person acts or fails to act, without right and as a result another is harmed, directly or indirectly. Tort liability involves a civil action under state law for personal injuries or property damage. Torts encompass a very broad area of the law including intentional acts, negligence, and strict or absolute liability (Pine and Bickel 1991). It may be viewed as dealing with civil, rather than criminal liability (American Law Institute 1965, Section 21-34).

Tort law includes three distinct areas: intentional torts, negligence, and strict liability. Intentional tort liability includes liability for trespass, assault,
battery, false arrest or imprisonment, intentional infliction of emotional distress (American Law Institute 1965, Sections 46-48, Sections 559 et seq., and Sections 652A et seq.), defamation, invasion of privacy, and invasion of civil rights. Negligence is the unintentional invasion of a person’s interest protected by law, where the actor is at fault, and where the actor’s conduct is the legal cause of the injury suffered. The fact that one causes injury to another is not sufficient to establish liability. Rather, it must be established that a person should have recognized a risk of harm to another (or a class of which he is a member), and that the conduct that led to harm to others was below a standard established by the law (American Law Institute 1965, Section 281, comment (b), Section 282).

Strict liability is known as liability without fault. It suggests that in certain circumstances people should be responsible for the consequences of their actions or omissions, regardless of their fault or their exercise of due care. Strict liability was first applied in cases involving abnormally dangerous activities, such as blasting (Exner v. Sherman Power Construction Co.), but has achieved significantly broader application in the law of products liability and in cases involving the violation of statutes creating mandatory standards of care.

For many years, states and political subdivisions enjoyed immunity from suits that sought relief for the wrongful conduct of governmental officials or employees. This immunity was based on the English common law principal of sovereign immunity and was recognized in early American law (Pine and Hollander 1985). Under sovereign immunity, individuals harmed by the action of a governmental unit are prohibited from recovering damages from the state or its political subdivisions unless the governmental unit agrees to pay the claim. In effect, the public jurisdiction is immune from suit. Until 1960 only five states allowed suits against the state or its political subdivisions. Beginning in the 1960s a series of court decisions and legislative actions at the state level eroded the principal of sovereign immunity. The law involving sovereign immunity changed in fifteen states during the 1960s; twenty-eight other states changed the law involving tort suits against public agencies in the 1970s; and three additional states addressed the issue of immunity in the 1980s. By 1995 the state legislatures or courts confronted the restrictions on claims against public organizations by opening to some degree claim against public agencies.

Negligence

Where tort immunity has been waived, government agencies are most often sued for damages for alleged negligence in the performance of their duties. Negligence indicates an unintentional action by an individual that
causes harm to another (tort), where the person owes a duty to another to exercise a degree of care. The legal standard in negligence cases has often been stated as simply, the duty to exercise that degree of care, skill and diligence that a reasonable prudent person would exercise under like or similar circumstances. However, this rule must be understood in terms of its essential elements, which include:

- The existence of a duty, recognized by law, for a person (here the governmental employee) to conform to a defined standard of care. The standard may be defined by common law (based upon judicial decisions), or by statute;
- A failure to conform to that standard of care, or a failure to carry out the duty;
- A causal connection between the act of the wrongdoer (his negligence) and a resulting injury to a third party(ies), which the law recognizes as the legal cause of the injury;
- Actual loss or damage to the interests of the injured party(ies) (American Law Institute 1965, Section 281).

All negligence cases have these elements in common, and absence of proof of any one element will defeat a finding of liability.

A duty of care may be imposed by common law, by statute, or may be created by the voluntary assumption of a responsibility. The common law generally imposes a duty of care where a person must recognize that his conduct involves a risk of harm to another. This duty requires a person to use a high degree of attention, perception, memory, knowledge, intelligence and judgment in his actions. Public entities have a common law duty to repair or place off limits premises and equipment that is a known dangerous condition. Public servants have a duty to protect persons in their care and custody, including protective custody (Narcisse v. Continental Ins. Co.). Similarly, a public works department, when informed of a road hazard, has a duty to repair defects (Acosta v. State; Specher v. Adamson Companies).

This duty or standard of conduct may also be imposed and defined by statute such as traffic acts, motor vehicle maintenance codes, work place safety statutes, medical malpractice environmental protection, or hazardous materials statutes (Ney v. Yellow Cab Co.; Harvey v. Bd. of Commissioners of Wabash Co.). Even if the statutes does not specifically mention civil liability; it may still establish a duty of care. In addition where a penalty is not specified, a court is generally free to adopt or reject the statutory standard in civil tort cases. If the statute specifically provides for civil actions or suits, the court will adopt the statute’s specification of duty and standard of care. The decisions in negligence cases are almost always
dependent upon findings of fact in the case, the particular conduct of the alleged wrongdoer, and whether the acts of the wrongdoers are the cause in fact of the injury(ies) suffered by the complaining party. Factual disparities among cases, no matter how slight, may lead to different conclusions about liability.

A city may be liable for injuries resulting from accidents which are the result of malfunctioning traffic lights, or signs, where the city fails to correct the malfunction within a reasonable time after receiving notice (Fox v. City of Columbia; Hamilton v. City of Shreveport). Property defects which cause dangerous conditions may be the basis of liability where the city has notice, or should have known of the presence of the defect and the danger it created. Where the city has notice of dangerous conditions, there may be liability if the city fails to act to remedy the defect (Dickerhoof v. City of Canton). While a natural condition is not dangerous per se, there may be liability where the city has actual or constructive knowledge of a dangerous condition (Intriligator v. City of Boston). The Supreme Court of Washington held that property owners stated a cause of action against the state for a failure to warn of a danger (Brown v. MacPherson's, Inc.).

The violation of a standard of care established by statute is negligence as a matter of law. Under this concept the injured party bringing suit (plaintiff) need only prove the applicability of the statute and that its violation by the defendant (party being sued) caused the injuries. The statute establishes duty and standard of care. Thus, for example, the failure to conduct an inspection, as required by statute, may be negligence per se (as a matter of law). The critical question in such cases is whether the legislative intent of the statute in question is to establish strict or absolute liability, or whether violation of the statute is on its face (prima facie) evidence of negligence.

**Governmental Immunity**

The liability of governmental units may be shaped by: (1) governmental/proprietary immunity for specific functions of a jurisdiction; (2) the discretionary function test for decisions of governmental officials; and (3) immunity provisions in state statutes. With regard to the first of these, fifteen jurisdictions currently retain a distinction in their tort law between governmental functions that have been performed by the government, and those functions that are proprietary in nature or performed traditionally by the private sector.

Governmental functions are activities that are essential and traditionally performed only by governmental units. Because they are governmental in nature, public officials, employees, and jurisdictions are immune from suit
in these areas. Under the governmental function theory, public safety (fire fighting or law enforcement) and similar mandated responsibilities of government are immune from liability. Proprietary functions are routine business activities such as the operation of transit systems, parking garages, hospitals, recreation services, and waste disposal (sewer and garbage).

The governmental/proprietary function distinction, as a basis for tort liability of governmental units is based on the overall nature of the activity or program. A second form of immunity, discretionary, conditions immunity on the nature of the act itself, rather than the program or type of operational activity. This form of immunity grants protection for discretionary acts as opposed to ministerial or operational ones. Discretionary immunity evolves from the judgmental decision making process of public officials and employees. The intent of discretionary immunity is to free officials from fear of tort liability if that judgment results in harm to another. The discretionary / ministerial distinction also shows a concern of courts and legislatures that they not interfere with the executive decision making process and violate the principle of separation of governmental powers. The law of tort liability seeks to provide a means for those injured by the torts of public officials and employees, but not to a degree which would discourage well qualified persons from serving in high public positions.

The decision whether to deploy response units in a particular fashion is discretionary, while the careless discharge of duties, or negligent operation of a vehicle is ministerial, and thus subject to legal action if injury proximately results. The decision to adopt a local ordinance or public program is a high level policy decision and likely viewed by the courts as a discretionary action. Officials exercising their judgment under appropriate authority may be exercising a discretionary function and thus immune.

A third form of immunity is based on state statutory provisions. Many states have included specific provisions in their state tort claims acts providing for immunity in tort claims against government units, employees, and volunteers involved in emergency management activities. Alaska, Kansas, South Carolina, South Dakota, and Utah recognize immunity for emergency activities in their comprehensive tort liability statutes. In addition, specific immunity provisions may be included in the state emergency management act. The critical element of these provisions involves the definition of an “emergency” and “emergency management.” If the emergency activity is not included in the definition of “emergency,” then the immunity provision does not apply. The state immunity provisions in state emergency management acts may be broad to include any emer-
gency management activity or restricted to actions only during designated
emergencies.

Defenses in Civil Actions

Liability may be avoided by using two major types of defenses: denial
defenses and affirmative defenses. A denial directly disputes the allegation
by the plaintiff that the defendant has acted negligently. In effect, the
defendant is implying that actions are reasonable under the circumstances.
When the defendant denies plaintiff's allegation of negligence, the burden
of proof remains on plaintiff to prove negligence: duty, breach of duty, legal
causation and injury. Although not obligated to do so, the defendant usually
offers proof of his actual conduct, to show that it conformed to the required
standard of care. Unless plaintiff's proof outweighs defendant's on this
issue, there is no finding of liability.

Affirmative defenses may allow the defendant to avoid liability, even
where his conduct is negligent. These defenses include, but are not limited
to:

- filing or bringing suit after the statute of limitations (which bars the
  action);
- the settlement of the claim;
- the person bringing suit contributed to the injury (contributory,
  comparative negligence, or
- assumption of the risk causing the injury).

Statutes of limitations are legislative enactments that impose time restric-
tions on filing a notice of a claim or the liability suit. Statutory periods of
limitations on the bringing of actions do not ordinarily begin to run until
the injured party has been harmed and has a basis for the claim. Once the
time restriction concludes, the suit is barred.

A plaintiff may not recover damages for injuries suffered as a result of
the defendant's negligence, if the plaintiff's conduct was also negligent and
contributed to his injuries (contributory negligence). Under these circum-
stances the plaintiff's own negligent conduct may bar recovery entirely,
though the defendant was negligent and that negligence contributed to
plaintiff's injury. This doctrine of "comparative" negligence does not bar
plaintiff from recovering damages for his injuries, if those injuries were
caus ed, in part, by defendant's conduct.

Rather, plaintiff's recovery is reduced in some proportion, based upon
his fault, if that fault contributed to his injuries. A "pure," form of compa-

ative negligence also may apply, apportioning recovery in direct proportion
to the relative fault of the parties. However, a modified doctrine may be
used which applies a "50 percent" system, or an "equal to or greater than"
system. Under this modified system, a plaintiff recovers, unless his negligent conduct is equal to or greater than that of defendant, in which case plaintiff recovers nothing.

Assumption of risk means that the injured parties (plaintiffs) have agreed voluntarily to take their chances of injury. The assumption of risk may be expressed explicitly in advance, or implied by taking action despite an obvious risk.

**Individual Liability**

The governmental unit may avoid liability for an employee’s actions by contending that the employee acted outside the scope of his duties, or with either malice or reckless disregard for others’ rights. When an employee acts with malice or the employee’s actions are outside the scope of the job, the employee—not the governmental unit—may be individually liable. Immunity provisions in most state statutes protect the acts of employees or representatives of the employer from civil claims except for willful misconduct, gross negligence or intentional harm to others. Willful or wanton misconduct is a highly unreasonable action constituting an extreme departure from ordinary care and where harm or injury is apparent. It involves conduct intended to cause injury to another, but must be conduct that is more than a mere mistake resulting from inexperience or confusion. It must be more than thoughtlessness or inattention (Danculovich v. Brown).