Designing Safer Products

Corporate Responses to Product Liability Law and Regulation

George Eads and Peter Reuter
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1983
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Foreword

The safety of consumer products affects all of us directly. We each risk injury or death when we use unsafe products, and the costs of product safety are reflected in the prices we pay for the products we buy. Decisions about the safety of products and their costs are made by the firms responsible for designing and building those products.

But we as a society have available to us an array of tools for influencing those decisions: Product liability law, mandatory product safety standards, and the dissemination of information about safety to consumers are all ways of affecting the behavior of firms. All three means have been used in this nation over the last two decades to deal with what many perceived as a serious public policy problem, namely the manufacture of products that may have been unreasonably dangerous to their users.

The laws pertaining to the liability of producers have been greatly transformed since 1960. Consumers now can much more easily bring and win suits against the producers of products that allegedly cause harm. At the same time, government agencies have acquired much-expanded powers to intervene in the design decisions of manufacturers of consumer products. There is a greater interest in the media in reporting information about product hazards.

Yet for all these changes, we have no way of telling how much corporations have improved their performance with respect to product safety. The papers still ring with denunciations by government officials, plaintiffs’ lawyers and public interest groups, all alleging that firms continue to place too little value on product safety. On the other side, we have a well-articulated concern, backed up by appropriate horror stories, of legal and regulatory systems run amuck, casting producers into the role of insurers, responsible for every product-related injury regardless of the diligence they exercised in designing and producing it. There simply exists no way, so far, of telling whether we have gone too far or not far enough in encouraging and directing the safety concerns of manufacturers.
But before we address the questions of how much is enough, or how
the systems ought to be changed to bring about desired results, we need
to know how our public policies are working. Regulation and product
liability rules interact with each other in complex ways; to some extent,
they are substitutes, to some extent complements. We need to know
how the current combination of legal and regulatory policies influence
firms and how changes in these policies are likely to affect their
decisions.

To do that, we must learn how firms have responded to the changes
in their environment. Enacting a law or imposing a regulation often
has consequences very different from that intended. The internal orga-
nization and values of a firm determine how it responds to external
pressures. If the firm chooses, for example, to isolate its design staff
from knowledge of product liability litigation, their design practices will
not reflect what can be learned from such litigation. While it can be
argued that firms should not respond this way—that it is simply not in
their best interests—we must accept that they may so respond, if only
because they regard the litigation system as essentially unfair and ran-
dom. Similarly, regulatory programs designed to improve decisionmak-
ing by firms may have counterproductive consequences because those
firms respond by increased bureaucratization, aimed at keeping the
regulators at bay.

In fact, firms have visibly responded to the increased pressures for
producing safe products. Most large manufacturers have formed cor-
porate product safety offices which have the ostensible purpose of ra-
ising the safety of the firm's products. As this study shows, they have
many different functions, not all of which lead to improvements in
product safety. Their effectiveness depends on many characteristics of
the firms in which they sit. By understanding how, and how well,
these offices transmit the external pressures to the design practices of
the firm, we can learn how to get firms to take safety seriously, without
imposing unnecessary costs on both firms and consumers.

This study sets out to determine just how firms have internally
transmitted the very complex and often confusing signals that society
has provided over the last twenty years. Focusing on the product
safety office, and based on interviews with the people involved in those
offices, the authors try to show us the different ways in which firms
have responded. The result is a mix of theory and observation which
shows just how difficult it is for society to obtain the results it desires
when dealing with firms. Policymakers, insurers, and executives may
all learn from the results.

Gustave H. Shubert
Director, The Institute for Civil Justice
Executive Summary

For at least 15 years, the safety of consumer products has been a national issue in the United States. The belief that too many unsafe products were entering the marketplace led to extensive programs of product safety regulation. Even earlier, courts were making it easier for injured consumers to bring suits against manufacturers whose products injured them. Manufacturers now claim that the burden placed on them to ensure the safety of their products and to compensate injured consumers have become excessive. They want the activities of the federal agencies regulating product safety scaled down and the liability rules developed by the courts clarified and narrowed.

Data do not exist to permit judgment of the reasonableness of the current system. It is not possible to measure the improvement, if any, in the level of safety of consumer goods that has resulted from changes in regulation and law. Neither is it possible to measure directly the burden placed on manufacturers.

In this study, which focuses on product design issues, we seek to contribute to the debate on the efficacy of recent product safety developments by analyzing the ways in which firms have responded to various sources of pressure to produce safe products. We believe that we can also shed light on the relationship among changes in law, regulation, and the marketplace. These elements of the corporate environment have generally been analyzed separately, though they have potentially important interactions.

THE PRESSURES

There are numerous pressures on manufacturers to ensure the safety of their products. Injured customers may file claims against the manufacturer; failure to settle those claims to the satisfaction of the customer may engender a lawsuit. Through settlement or suit, the injury will impose costs on the manufacturer.
Over the past two decades, the courts have greatly eased the burden on the injured consumer in gaining a judgment against the producer. Under the doctrine of strict liability for the producer, the injured party need show only that the product is "unreasonably dangerous." This supplants the previously applicable negligence doctrine, in which the plaintiff had faced the greater burden of showing that the manufacturer’s conduct was negligent. This change in law has occurred at the state level, mostly through judicial rather than legislative action, and states differ significantly in the standard that they impose on the manufacturer.

The insurance industry serves an important function in transmitting the product liability signal to manufacturers. By setting rates that reflect the true risks associated with the products produced by each manufacturer and by aggregating information about what design and manufacturing practices affect safety, insurers can convey the signal accurately. As product liability has become a more significant cost to firms, insurance companies have become more concerned about their ability to perform these functions. Formerly product liability insurance coverage was not, in general, singled out from other risks which the insurer offered to cover at the same time.

Federal regulatory agencies have also acquired increased control over product safety during the past 15 years. Two major new agencies have been established, the National Highway Traffic Safety Administration (NHTSA) and the Consumer Product Safety Commission (CPSC). Older agencies, such as the Food and Drug Administration (FDA), have acquired increased responsibilities. These agencies intervene at various points in the product development process, as well as collect, analyze, and disseminate safety information.

Even in the absence of regulation and a product liability doctrine that permits injured consumers to make claims against producers, there would be a pressure for firms to ensure the safety of their products. Consumer choices among producers and products is affected by the known safety of individual products. The more consumers know about safety, the better the market incentives work.

These pressures interact. If a regulatory agency orders the recall of a product, product liability suits are likely to follow and the reputation of the producer and hence his market share will suffer. Similarly, product liability suits, some of which receive considerable publicity, may trigger regulatory intervention and cause a producer to lose market share.
CORPORATE RESPONSES TO PRESSURES

Large manufacturers, the population that we studied, responded visibly to the increased pressure for producing safer products. Most such firms have set up corporate-level product safety offices, few of which existed prior to 1970. These offices provided the focus for this study.

We interviewed corporate product safety officials in nine large manufacturing concerns, as well as a number of professionals involved in product safety matters in insurance companies and other settings. These lengthy and open-ended interviews provided a great deal of detail on the role of the product safety office. All of the manufacturing firms were among those generally recognized as leaders in the safety field; our intention was not to describe how firms generally behaved but how innovative corporations responded to changes in their environment. Inevitably, we learned a great deal about what these leading firms believed distinguished them from others and hence about what other firms were doing.

The corporate product safety office transmits to the various units of a corporation information on how, and how much, they should deal with safety issues. In some cases, the role of the office may be effectively to deflect the external pressures. A corporate product safety office may seek to improve the litigative strategy for defending product liability suits or find ways to deflect regulatory interventions. By so doing, the unit signals those involved in product development that they need not increase their attention to safety issues.

But the corporate product safety office may also provide resources and incentives for the individual units to deal more effectively with product safety. The complexity of modern products and of large manufacturing firms means that product safety is achieved only through organizational coordination and investment of resources. A safety unit that imposes safety audit requirements on individual divisions, trains managers in safety assurance techniques, or intervenes in final design decisions can affect the design safety of the firm's products.

It is clear from these interviews that, except for firms subject to the maximally intrusive regulation of such agencies as the Food and Drug and the Federal Aviation administrations, product liability is the most significant influence on product safety efforts. Product liability, however, conveys an indistinct signal. The long lags between the design decision and the final judgment on product liability claims (frequently five or more years), the inconsistent behavior of juries, and the rapid change in judicial doctrine in the area, all tended to muffle the signal.

That is to say, firms learned little from the results of particular litigation about either specific design decisions or the process of design
decisionmaking. The frequency of suits and the level of awards provide some idea of the costs of failing to design a safe product and hence the level of effort that should be devoted to assuring a safe design. Nevertheless, considerable uncertainty remains about the most appropriate method of assuring safety in product design.

As our study developed, it became clear that there was no single correct model of what the corporate product safety office should do. Characteristics of the firm, managers, and product all played a role. However, the corporate product safety office had an important potential role in setting the tone for product safety efforts. Moreover, it could either clarify or suppress the signals provided from outside by product liability, regulation, etc. Our analysis of their role in this function, as well as an analysis of varied literature on different aspects of the safety problem, provide the basis for the following conclusions and recommendations.

CONCLUSIONS AND IMPLICATIONS

Product Liability

Of all the various external social pressures, product liability has the greatest influence on product design decisions. The other influences largely work through the product liability mechanism. In industries with potentially high-hazard products, but not subject to significant product-related regulation (e.g., industrial machinery), product liability probably dominates design decisions, in terms of safety considerations.

In industries subject to moderate regulatory pressures (industries subject only to CPSC regulation, for example), the influence of product liability likely overshadows that exercised by the regulators. Indeed, regulatory actions in such industries may be perceived as important or unimportant depending primarily on their impact on a firm’s liability exposure. Even recalls mandated by regulatory agencies may have their major effect in the form of more product liability suits and a weakening of the firm’s defense in such suits.

Only in a few highly regulated industries (drugs and aircraft, for example) does regulation likely exceed product liability as a design influence. Even here, the liability consequences of design decisions are seldom far in the background.

Although product liability exerts a powerful influence on product design decisions, it sends an extremely vague signal. Because the linkage between good design and a firm’s liability exposure remains tenuous, the signal says only: "Be careful, or you will be sued." Unfor-
tunately, it does not say how to be careful, or, more important, how careful to be.

Considerable interest has been expressed in the creation of a federal product liability statute to preempt existing state law. This interest reflects the belief that current product liability law creates two quite different sources of uncertainty for business. First, it is made by judges and differs among states. Businesses attempt to solve the problem by monitoring the development of the law in many jurisdictions and by assuming that the operative standard is that (or close to that) adopted by the strictest state. Second, as society's attitude toward the burden that should be placed on the manufacturer or product seller to ensure safe products and toward sharing the burden of product accidents has changed over the years, the center of gravity of the law has shifted.

Legislation now under consideration by the Congress seeks to alter both the variance and the mean of current product liability law, especially as concerns what constitutes unsafe design. It would reduce the variance by its sweeping preemption of state product liability law. It would shift the mean by making it substantially more difficult for plaintiffs to prove that a design is defective.

In practice, however, the reduction in variance of product liability law may not have much effect, at least for a number of years. To avoid overburdening the federal courts, the bill provides that a federal product liability statute would be administered in the first instance by state courts. To be sure, the state courts would be administering a federal law. In its current form, however, the bill contains numerous phrases possibly subject to a wide range of interpretation. Thus, the immediate reduction in variance might not be substantial. Only after federal appellate courts had sorted out the various interpretations—probably a matter of years—would a body of consistent law develop.

The proposed federal law would simplify the task of the corporate product safety office, which has the function of conveying to the designer the strictures contained in the current interpretations of the law. The body of law will be both more consistent and more stable. However, we were struck in the companies that we visited by how few changes in law were transmitted to those involved in design decisions. The product safety officers were unable to identify more than a few relatively minor legal decisions that had directly impinged on design and production criteria for the firm.

Uncertainty in the law is costly, if only in psychic terms. In reality, however, the connection between the law and product design is sufficiently weak that even quite major changes in the law would have little effect on the behavior of firms with respect to consumer product safety,
except to the extent that such change led to significant changes in the overall cost of product claims.

Insurance

Much of the recent debate about product liability has focused on the insurance industry. Indeed, Congress became concerned with the issue largely because of assertions that insurance rates were rising unreasonably rapidly and that small firms were unable to obtain adequate coverage. Despite the concern about product liability insurance, there have been no suggestions for reforms to improve the insurance industry's performance in this area. State insurance regulators lack relevant expertise, and there is no data base that permits judgment of the profitability of this line of insurance.

Our interviews suggest that the insurance industry is likely to play a declining role with respect to the large manufacturers that produce most of the consumer goods in the nation. These manufacturers have shifted largely to either self-insurance or policies involving high deductibles and significant coinsurance. Several factors may explain this shift. Differences in the incentives of insurers and insureds lead the latter to seek more control over decisions to litigate or settle. The flow of information may be better when the firm controls more of these activities.

Whatever the reason for the shift away from conventional insurance, the consequences may be significant. Insurers may have a smaller data base on which to develop rates and from which to draw product liability prevention expertise. This situation may lead in turn to further reliance on subjective rate making and a continuing minor role for the insurance industry in product liability prevention. Small firms may continue to have difficulty in obtaining adequate coverage at reasonable prices.

Regulation

Safety regulation consists of many instruments and strategies, ranging from control of the product development process to the collection and dissemination of postdistribution data. The proper regulatory strategy is a complex function of characteristics of the product and industry involved.

Except for a small number of high-hazard industries, product standard setting by regulatory agencies has not been effective. The agencies have promulgated few standards and those standards have frequently been successfully challenged by consumers or producers. The development of a standard under the due process requirements imposed
by the various enabling statutes, made even longer by the litigative activities of the affected firms, is not an attainable goal for many consumer products.

Regulatory agencies, such as CPSC and NHTSA, are making much greater use of their ability to require recall of products that have been identified as hazardous after entering the stream of commerce. The recall power is particularly potent because it disseminates information adverse to the firm's reputation to purchasers of the firm's product.

However, the recall has been used narrowly; i.e., either all or none of the units involved have been recalled. In cases where a recall cannot be justified on cost/benefit grounds, agencies might instead disseminate the information concerning the potential hazard to the users. The prospect that such hazard information might engender successful product liability suits for injured consumers may lead to more voluntary recalls on the part of producers, who have, in many cases, successfully prevented agency-mandated recalls.

In general, regulatory agencies seemingly have failed to make use of marketplace incentives to affect manufacturer performance. A greater stress on collecting and disseminating information that would permit consumers to make better judgments about the relative safety of particular products and producers might be the most effective strategy for regulators dealing with medium- and low-hazard products.

**Corporate Management**

Corporate product safety units were created in many large firms in response to a perceived crisis. That sense of crisis has receded as it has become evident that product liability claims will not become a significant cost to most manufacturers. This respite raises a question as to whether product safety offices are likely to and should disappear.

Considerable evidence indicates that product safety remains a serious concern among the American people. Many people believe that they are still exposed to too many hazardous consumer products. Consumers appear dissatisfied with the quality of goods manufactured in the United States.

In light of this, the need for corporate product safety offices continues. The safety of products is importantly affected by the way the design process is organized. The complexity of products means that corporate-level efforts are still required to assure that even in large organizations there is a continued pressure to ensure that safety considerations are given due weight at all points in the process.

This is not to argue, however, that the product safety organization need be highly formal. At the corporate level, the extent of resources devoted to product safety does not appear to determine the effective-
ness of the office as much as does the way in which the office is structured. Three considerations in particular affect the proper design of the office.

What appeared to us to be the most effective product safety organizations were those that were sized, located, and financed at a level consistent with the safety problems inherent in the firm’s products, with the need for higher-level supervision or monitoring of safety-related design decisions, and with the interest of the chief executive officer (CEO) in the firm’s safety performance.

A lean product safety organization that has the ear of the CEO and a good working relationship at various levels of the firm is likely to be much more effective than a highly visible unit that establishes procedures but lacks either the resources to impose them or, even more disastrous, the support of the firm’s top officers when such support is necessary.

In short, there is no single best or correct way to structure a firm’s product safety effort. Virtually every firm can use such an effort, however, even if certain of the social pressures that stimulated the establishment of such units during the 1970s recede somewhat.

As the source of a firm’s concerns changes, the firm’s product safety activities can (and should) change also. If product liability and regulatory pressures decrease in importance, firms should change the focus of their product safety organizations. But, the rise of other concerns—improved product quality, for example—provides other avenues into which the activities of such units can expand. Some of the firms that we interviewed have sensed this and have embedded their product safety activities in their overall quality assurance program.

We consider the combining of product safety and quality control appropriate, provided it is carefully done. The sources of information that both activities use are likely to be highly complementary. The nature of the intrafirm failures that lead to a suboptimization in the area of product safety appear quite similar to those that lead to similar problems in product quality. But, the change in focus should not be merely a change in title.
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I. DEFINING THE ISSUES

POLICY INSTRUMENTS AND CORPORATE RESPONSE PATTERNS

The safety of consumer products has been a major national issue for almost two decades. The belief that many consumer products unnecessarily endanger their users has led to important changes in our social institutions. The effectiveness and desirability of these changes have also been a matter of controversy.

This study examines the effect of these recent changes on the way manufacturers make decisions about how to design their products. It also attempts to suggest the appropriate roles for the different instruments that society has used to influence the safety of product design.

A variety of rules and institutions determines the costs imposed on corporations when they are judged by society to have failed to produce safe products. Liability law, i.e., the rules under which injured consumers can bring claims against the producers of defective products, perhaps, exerts the broadest influence. Its effects are directly felt by firms through claims and judgments and are transmitted indirectly through insurance prices. Government regulatory bodies, such as the National Highway Traffic Safety Administration (NHTSA) and the Consumer Product Safety Commission (CPSC), also attempt in various ways to direct the behavior of corporations so as to prevent the production and distribution of defective products. Even without product liability, market forces would, through dissemination of information adverse to the firm's reputation, impose costs on firms making defective products.

These various rules and institutions interact. Government regulatory agencies promulgate standards that have the force of law. Violating them can not only lead to severe financial penalties but can also affect the outcome of product liability suits or blacken a firm's reputation. Similarly, consumer complaints to a government agency can lead not only to increased scrutiny of the firm by the agency (including possibly a federal order that the product be recalled) but also to product liability suits. These social influences on business conduct are thus properly viewed as a collection of interactive forces that determine the operating environment of the manufacturing firm.
During the past 15 to 20 years, these elements have undergone major changes. Through court rulings and legislative changes at the state level, it has become a great deal easier for injured consumers to bring claims against manufacturers. Jury attitudes have apparently shifted, so that successful plaintiffs now receive much more substantial compensatory and punitive awards. The regulatory agencies have greatly expanded their efforts to develop standards and test products in a broad range of industries and, at least until recently, were increasingly aggressive in using their recall powers. The provision of information to consumers about the safety records of particular products and corporations has greatly increased, as a result of both private initiatives (e.g., Consumer Reports and Ralph Nader's organizations) and the activities of government agencies (e.g., automobile crash tests by NHTSA).

A number of factors contributed to these changes in the corporate environment. Public attitudes concerning the appropriate responsibilities of corporations have shifted. This manifested itself in a variety of ways, including increasing pressure for firms to adopt environmentally sensitive policies, even where not forced to by statute or regulation, and to take account of social concerns (e.g., racial discrimination) in their investment policies. The increasing affluence and education of consumers also contributed.

Clearly, the potential adverse consequences to a firm manufacturing unsafe products have increased sharply since the late 1960s. However, the fact that the cost to manufacturers of producing unsafe products has increased does not necessarily mean that firms now produce fewer of them. Neither does it necessarily mean that too many unsafe products were being produced in the first place. With regard to the former, we shall see that there are a variety of possible corporate responses to these changes in the legal and social environment. With regard to the latter, it turns out that determining the proper level of product safety is not impossible. It is unlikely, however, that the proper level of product-related accidents is zero,¹ because that would require more expenditure on safety than society desires.

To further complicate the research problem, it turns out to be impossible to measure how safe the current mix of products is. Not only are there no comprehensive data on the frequency of injuries arising from defective products (as opposed to product-related injuries, some of which are solely user-caused), but it would be difficult to

¹The cost of eliminating all design-related hazard associated with consumer product use is likely to be prohibitive. The marginal cost of reducing the low probability injury will probably exceed any reasonable estimate of the benefit.
interpret changes in such data if they were available. The composition of the population of products and users is changing over time in ways that affect the injury rate, even if firms were acting with equal care at all times. We cannot judge the efficacy of the changes aimed at reducing the number of unsafe products by analyzing accident data.  

However, in order to judge the appropriate direction of future policies, it is important to know what effect each of the various changes has had. There have been calls for major revisions in liability laws, expansion or contraction of regulatory powers, and increased efforts at disseminating knowledge to the population about product safety. Without an understanding of what effect the past changes have had on corporate behavior with respect to product safety, it is difficult to judge the desirability of the proposed changes.

This study seeks to disentangle the influences of the various changes that have occurred in the corporate environment with respect to consumer product safety. Since direct measurement of outcomes is impossible, we have chosen to focus on how firms organize their efforts to ensure that the design of products is not unsafe. We are especially interested in how changes in liability law, regulatory activity, etc. have affected these design efforts. We believe that through close study of the organizational responses of corporations and the avenues through which the different changes actually are transmitted to the corporation (and within it) we can learn something about the likely product safety effects of the changes.

An important underlying assumption is that corporations have considerable discretion in the way they respond to legal and institutional changes. While economic theory often treats firms as "black boxes" whose behavior is determined by the environment in which they operate, there is a small but growing literature that takes into account the fact that corporate executives have a great deal of choice in how they respond to particular stimuli. Even if "the market works," it does so with a long time lag and with a great deal of uncertainty. Responses that are optimal under one prediction about the future will turn out to be fatal to the firm under alternative futures, and making projections is a very risky sport. Moreover, corporations are not passive subjects of

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2Some of the analytic problems arising from this are well illustrated by the controversy surrounding the effectiveness of automobile safety regulation (Peltzman, 1973; Robertson, 1977). Changes in the age composition of drivers, the speed on highways, the quality of roads, etc. all affect the accident death rate.

3Early work in this area was carried out by Williamson (1964), who stressed the multiplicity of managerial objectives.

4For example, automobile firms have had to make design decisions based on forecasts of gasoline prices three to five years in the future. Such forecasts have been difficult to make in recent years.
policy changes. They may actively seek to alter their environment through the various political and administrative channels so patently available to them.\(^5\) Even after rules and institutional changes have been adopted, the firm may rationally respond in a variety of ways.

Some firms have probably responded to the growing number of consumer product liability claims by increasing their investment in defensive litigation, i.e., by vigorously contesting all product liability claims. Other firms may have been more cautious about product innovation in order to reduce the probability of being involved in product areas where consumer injuries are more likely to occur. Still others may have sought to keep regulatory agencies as distant as possible from internal product development and design decisions. Not all of the responses to pressures result in improved consumer product safety.

**RESEARCH APPROACH**

In carrying out the research, we had to decide which element of safety decisionmaking to focus on. Product safety results from a number of different actions on the part of the producer. A manufacturing defect, the failure to label properly, inadequate packaging, poor quality control, and design failure, each can create a hazardous product. We chose to focus on the design decision because it represents a unique challenge to all the institutions involved in product safety: courts, regulators, insurers, and corporations themselves.

**Focus of the Study: The Design Decision**

Design evolves from complex human coordination, invariably involving elements of creativity that are difficult to control in any single dimension, such as safety. While we are not suggesting that design failures are quantitatively the most important source of product safety problems (there are no data that would permit the determination of this),\(^6\) they nevertheless represent the most difficult aspect of the problem for social control. By contrast, manufacturing defects, where the injury results from the failure of the product to meet design

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\(^5\)A substantial literature, strongly associated with the University of Chicago, argues that regulation is often sought by industry so that current firms may alter their environment to their advantage, e.g., by making new entry into a market more difficult. See Stigler (1971).

\(^6\)One insurance company collected data on a sample of 500 product liability claims arising from machinery-related injuries. Only 26 percent of the claims involved a product defect, a term that includes design defect.
specification, represent a relatively straightforward control issue. The manufacturer is usually held responsible for such defects.

The design process involves elements of organization and decision-making that are poorly understood. Engineers are trained to make products work, to create products for particular functions. Design safety focuses attention on the mirror image of this, namely, the ways in which the product can fail in a manner dangerous to the user. This alone suggests the need for someone in the design process to have the function of determining how a product can fail. In fact, the problem is far more difficult.

Many contemporary products are extremely complex, requiring the separate and simultaneous development of numbers of subsystems. Not only can each have individual failure problems but their assembly creates interactions that also need to be tested for failure possibilities. The competitive pressure to bring new products to the marketplace rapidly creates complex organizational structures to ensure the simultaneous and compatible development and testing of both the whole product and the subsystems. The problem of developing an organizational structure to handle product safety effectively may particularly affect large corporations that find organizational design a major issue and changes in organizational behavior to achieve new goals difficult to accomplish.

Corporations have responded visibly to the pressures for safer products, at least in a formal sense, as the evidence presented in Section IV suggests. During the 1970s, most major corporations created a new headquarters function to deal with product safety within the corporation. While the names attached to this function varied, we shall refer to it generically as the product safety office (PSO).

The PSOs have a variety of functions. Some are located in the legal department of the corporation and fairly clearly have as their primary function the improvement of the firm's record in product liability litigation. How much they affect the safety of the firm's products is unclear. Some focus on formal elements of the record keeping in the organization with the aim of keeping plaintiffs from acquiring relevant information in litigation. Others, located in the engineering divisions, seek to improve the design process in the hope of reducing claims against the firm.

Our fieldwork, reported in Section V, focused on the PSOs. We obtained detailed information about the functioning of a small number of PSOs in firms that, rightly or wrongly, considered their product safety programs successful. The interviews with members of these PSOs illuminated the ways in which the various pressures, such as
litigation and regulation, provided information and incentives to the firm. At the same time, the interviews also enabled us to understand the problems that PSOs confront in trying to change one dimension of the behavior of numerous units in a complex organization.

This study then has two purposes. We believe that we have learned something about the problem of product safety policy and that this work can inform the debate about liability law reform, the role of voluntary standard setting organizations, etc. But we think that it should also interest those concerned with the more general issues of social control of corporate behavior. Product safety represents a number of issues for which society is seeking an appropriate mix of instruments to affect an aspect of corporate behavior that impinges on many elements of corporate life. An understanding of the difficulty of changing corporate behavior with respect to product safety is illuminating with regard to this general problem.

Two Limitations to the Scope of the Study

The conduct of any research includes certain decisions that shape the scope of the effort. Two decisions, which limited the attention we devoted in our work to two related areas, are sufficiently important to deserve mention at the outset.

The first decision was to confine our attention primarily to design issues relating to consumer, as opposed to industrial, products. Not that we have ignored industrial products entirely, but where we mention them, it is generally to contrast the behavior of their producer or users with the behavior of those who produce or use consumer products.

Aside from simplifying our research task somewhat, there are important institutional reasons for drawing the boundary of our study where we do. For one thing, to have adequately discussed safety issues in industrial products, we would have had to introduce an entirely new class of institutions and policy instruments.

The issues relating to the safety of industrial products cannot be understood without reference to the workers' compensation system, the dominant forum for claims resulting from product-related injuries that occur in the work place. Many claims that, if they included consumer products, would lead to a product liability claim are settled in the workers' compensation system, even though the employer may be an inappropriate defendant. A workers' compensation suit does not prevent the employee from bringing a product liability suit against the equipment manufacturer; however, legislation has been proposed at the

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7The Institute for Civil Justice recently published a study of the effect of the workers' compensation system on work place safety (Victor, 1982).
federal level that would require that the workers' compensation payment be subtracted from the manufacturer's liability.\textsuperscript{8} The employer may also sue the manufacturer, though only for workers' compensation costs incurred as a result of the alleged product defect.

The difference in the legal treatment of workplace injuries arising from defective products reflects important differences in the underlying setting. The intervention of the employer between the user and manufacturer of the product can have important consequences. For example, the employer may modify the equipment; indeed, in many instances, the manufacturer sells the equipment on the explicit understanding that the employer will provide the equipment with safeguards appropriate to the particular use to which the equipment is put. The employer may also be required to train the employees in the use of the equipment.

The regulatory strategy adopted by the major agency concerned with workplace safety, the Occupational Safety and Health Administration (OSHA), also reflects these differences. OSHA places less stress on the design safety of industrial machinery than on ensuring that the users receive appropriate protection. It emphasizes developing adequate safeguards, sometimes external to the machine itself so that any machine failure, whether due to design or production flaws, will not injure the worker. This contrasts with CPSC strategies with respect to consumer products, the users of which are more likely to resist the imposition of cumbersome safeguards and cannot be disciplined by a potentially liable employer.

Not only do the legal settings of product safety for industrial and consumer products differ importantly and understandably; the markets also differ significantly. The purchasers of industrial equipment are not usually individual and unorganized, as are the purchasers of consumer products. Individual large firms are significantly affected, through workers' compensation costs, by the safety of the equipment they purchase. They are thus likely to assert their interests much more effectively.

The greater involvement of industrial goods purchasers in safety issues is reflected in a number of ways. For example, the voluntary standards system is far more comprehensive for industrial than for consumer products and the purchasers are far more actively involved in the standard-setting process. Furthermore, purchasing firms are frequently involved in design decisions by equipment manufacturers.

\textsuperscript{8}This could have a substantial effect on the flow of such claims, since the probability that a contingent fee lawyer can cover his costs from his share (usually one-third) of the difference between the product liability award and the workers' compensation payment is less than the probability of cost recovery from the same share of the award itself.
The second limitation to the scope of this study stems from our decision not to examine in detail the burgeoning area known as toxic torts. This is also largely a workplace safety issue, with all of its additional institutional complications. The most prominent toxic tort to date involves asbestos. Those injured by exposure to asbestos, almost all in work places such as shipyards, have sued asbestos producers, alleging that the producers either did know or should have known of the dangers of the product. They had at least a duty to warn. The New Jersey Supreme Court held in the Beshada case that the defendant producers are liable, regardless of what they knew.

Tort law was applied to industrial disease cases only because the institutions designed to deal directly with the problem failed to address it adequately. Moreover, numerous suggestions have been made for taking such cases out of the tort system. It is agreed that industrial disease victims should be compensated. It is widely believed, though not shown, that the tort system is an extremely expensive method of providing that compensation, if indeed the defendants and their insurers can even afford it.9

Whether or not this kind of apparently unforeseeable hazard is handled through the tort system or some other way, it is difficult to see how it bears on the kind of design decision that is the focus of our research and of so much of the product liability litigation. If toxic torts remain in the existing tort system, producers will introduce new materials with greater caution and invest more in investigating the health effects of materials. The fact that these are extremely rare and catastrophic events suggests they differ from the routine issues of design and production with which we are primarily concerned.

The remainder of this section sketches the development of product safety as a public policy issue over the past 15 years. Section II analyzes the effect of the major elements of the environment in which corporations make decisions about design safety: liability law, regulation, voluntary standard setting, insurance, and the marketplace. We argue that while the product liability system is probably the most fundamental determinant of the incentives for product safety, it is essential to consider its interaction with all the other elements of the system, particularly regulation and the marketplace.

Section III considers the organization and structure of the product design process within the corporation. In particular, we focus on the relationship between the design safety decisions and the incentives of

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9The Institute for Civil Justice is currently conducting a study of the costs of handling asbestos claims in the court system. Initial results are contained in Kakalik et al. (1983).
units within the organization as a whole. Section IV reviews the existing studies of corporate product safety efforts.

Section V describes our study of the product safety offices in the sample corporations. We conclude that while the PSO can play an important and useful role in a corporation's product safety activity, the existence of a product safety office is neither necessary nor sufficient for an adequate product safety program with respect to design. Moreover, the determinants of design safety are so poorly understood that many problems result not from the lack of resources or commitment but from the strategy developed for dealing with the problem.

Finally, Section VI draws together the various strands, in particular focusing on the nature of the signals received by product safety units from the various elements of the corporate environment. The section ends with recommendations aimed at both public policy and corporate activities.

PRODUCT SAFETY AS A PUBLIC POLICY ISSUE

Product safety is a relatively new issue on the national public policy agenda. Though there is a large legal literature on the subject of product liability, the other aspects have received relatively little analysis until recently. Since the origins and the evolution of the debate over the past 15 years provides an important context for this study, we briefly describe them here.

Despite important court rulings on product liability in the early 1960s (described at the beginning of Section II), the issue of product safety attracted substantial public attention only in the context of automobile design. Most notably, Ralph Nader alleged that the General Motors Corvair, a rear engine automobile designed to compete with the popular Volkswagen Beetle, was of unsafe design. The heavy-handed response of General Motors to that allegation, especially its hiring a private detective to investigate Nader's private life, helped give credibility and prominence to the issue (White, 1971, p. 263).

Before 1965, the automobile companies treated safety simply as one of many elements considered in automobile design. In 1956, Ford chose to emphasize safety in its advertising and offered particular safety options not previously available, but the low level of Ford sales that year led to the general belief that "safety does not sell." White (1971, pp. 237-247), in a review of the safety attitudes of the automobile manufacturers prior to the passage of the National Traffic and Motor Vehicle Safety Act of 1966, comments that the manufacturers "dragged their feet, behaving as if safety did not enter into the preference functions of consumers and as if the mention of safety
considerations might well deter consumers” (p. 239). The manufacturers conducted little research on the causes of accidents or the effect of possible design changes. They were in fact vulnerable to the charges of Nader and other critics that too many unsafe automobiles were being placed on the streets and that major government intervention was necessary. The National Highway Traffic Safety Administration was created in 1966, largely in response to those concerns.

The next significant event in the evolution of the policy debate was the alarming Final Report (1970) of the President’s Commission on Product Safety. The report highlighted dramatic statistics: “Americans—20 million of them—are injured each year in the home as the result of incidents connected with consumer products. Of the total, 110,000 are permanently disabled, and 30,000 are killed. A significant number could have been spared if more attention had been paid to hazard reduction. The annual cost to the nation of product-related injuries may exceed $5.5 billion” (p. 1). It is useful to note that the statistics cited did not include such major product injury sources as automobiles and drugs.

As the quoted passage makes clear, the commission believed that it was possible and appropriate to undertake measures aimed at reducing the incidence of unsafe products. Indeed, the tone of the report was thoroughly alarmist. “The exposure of consumers to unreasonable consumer product hazard is excessive by any standard of measurement” (p. 1). Hence, it concluded that “Because of the inadequacy of existing controls on product hazards, we find a need for a major federal role in the development and execution of methods to protect the American consumer” (p. 3).

The most significant outcome of the commission’s report was the creation of the Consumer Product Safety Commission, with broad jurisdiction over the safety of consumer products that were not otherwise subject to safety regulation. The commission was to promulgate standards for potentially dangerous products, to collect information on product hazards, and to implement recall procedures for dealing with unreasonably dangerous products.10

Up to this point, the discussion had centered around accusations that manufacturers failed to take adequate measures to secure the safety of products. Industry was on the defensive, there were few data to refute broad allegations, and horror stories of product-related injuries abounded.

During this time, indeed antedating the regulatory changes just described, major changes in basic tort law made it easier for customers to bring suit against manufacturers. The number of claims grew

rapidly. Jury attitudes also changed; plaintiff awards began to climb sharply.\textsuperscript{11} Product liability insurance rates, previously a negligible item, began to rise dramatically.

The result was a major change in the tone of the debate around 1975. It was now the manufacturers who were pressing for changes in policy, with the insurance industry providing considerable support. They argued that strict liability (the doctrine that the producer's conduct was irrelevant in determining his liability; it mattered only that the product was unreasonably dangerous) must be narrowed and the law clarified. Regulatory interventions were also under attack at this time, the result of an increasing dissatisfaction with government restrictions on corporate autonomy.

The Interagency Task Force on Product Liability (IATFPL) was formed in 1976 in response to claims of a crisis in product liability insurance. “A number of manufacturers and business periodicals alleged that product liability insurance had become unavailable or unaffordable” (U.S. Department of Commerce, 1977a, p. I-1). The task force undertook a major study, which concluded that there was something less than a crisis but that changes in a number of laws and regulations were appropriate.

The task force identified three major sources of the apparent problem. First, insurance rate-making procedures were unsatisfactory; too little information was available for setting accurate rates, and rates provided inadequate incentives for firms to undertake liability prevention programs (i.e., produce safer products). Second, it rather cautiously suggested that manufacturers were perhaps not sufficiently attentive to product safety problems, even given the insurance practices. Third, it identified uncertainties in the tort-litigation system as a major problem.

Several congressional hearings\textsuperscript{12} during the following years produced a litany of complaints about the liability system. Manufacturers claimed that the cost of insurance, in at least some product lines, was still too high and blamed the shift to strict liability and the excessive awards of juries. Efforts were made to encourage legislative action at the state and federal levels to clarify manufacturers' responsibilities with respect to product safety.

The major result was the drafting by the Department of Commerce of a Uniform Product Liability Act in 1979. This act was intended to provide a model statute for state legislatures. Not only would it clarify responsibilities but it would also ensure uniformity if all states passed

\textsuperscript{11}The most systematic evidence of this is presented in Peterson and Priest (1982).

\textsuperscript{12}The major hearings were those of the House Subcommittee on Capital, Investment and Business Opportunities (1978), the House Subcommittee on Consumer Protection and Finance (1979), and the Senate Subcommittee on consumers (1982).
it. No state adopted the whole act, though some did expand the scope of their product liability legislation in line with certain of its provisions (Hollenshead, 1982, p. 87).

In fact, state legislatures, despite the great attention to product liability, have been notably reluctant to act in this area. Nineteen states still lack any statute relating to product liability, and many others have only fragmentary statutory codes (Hollenshead, 1982, pp. 86–87). Most law in this area has been made by judges reinterpreting common law doctrines to reflect changing institutional realities.

In light of the failure of state legislatures to act, there has been considerable pressure for a federal statute, preempting state authority in this area. A bill introduced by Senator Kasten\textsuperscript{13} in June 1982 has attracted a great deal of interest; it is discussed at length in Section VI. The bill is controversial both because it attempts to shift the basic liability doctrine back to negligence and because it preempts states in a major area of tort law. The debate on the propriety of both aspects has been vigorous.

During the past two years, particularly since the Reagan administration took office, there has also been a conscious attempt to reduce the intrusiveness of safety regulation, along with various other forms of social regulation. While some agencies, most noticeably the CPSC, have become much less aggressive in product safety matters, others are still reviewing their basic policies. Congress has shown some resistance to substantial deregulation in this area.

Thus, the consumer product safety debate is still very much alive. Basic legal and institutional issues remain unsettled. How corporations respond to the changes in law and policy is an important component of the matter and the focus of this study.

\textsuperscript{13}The Product Liability Act, Senate Bill 2631, June 16, 1982.
II. PRESSURES TO DESIGN SAFER PRODUCTS

This section describes and traces the evolution of a number of the social and legal pressures that, at least in theory, influence product design: product liability, insurance, direct regulation of safety, voluntary standards, concerns about firm reputation, and professional ethics. Recent events are emphasized.

These influences interact in numerous and subtle ways. Furthermore, the direction (not to speak of the magnitude) of each influence is not always clear, especially when interactions are taken into account.

We want to understand these influences because they constitute the general environment in which formal product safety organizations operate. The effectiveness of these organizations is likely to be strongly influenced by the clarity and strength of the signals that these influences generate. Of course, formal organizations may not, in certain circumstances, be capable of sensing and effectively transmitting such signals in ways that improve product design. But if the signals reaching the organization are weak or ambiguous (or both), the organization's task is that much more difficult.

PRODUCT LIABILITY

A full treatment of the development of product liability would require volumes.\textsuperscript{1} Here, we will merely sketch some of the law's major developments, focusing on aspects having the most obvious and direct impact on design decisions.

The notion that a firm may be held responsible for damages occasioned by the performance of products it sells or produces is rooted in two strands of the common law—torts and contracts. According to Prosser (1960), product liability law began with an 1842 English decision, Winterbottom v. Wright, which held that an injured party could not sue a manufacturer for damages unless he stood in a direct contractual relationship with the manufacturer. The rise of modern merchandising, which imposed wholesalers and retailers between the manufacturer and consumer, increasingly shielded the manufacturer from liability.

\textsuperscript{1}A somewhat longer, but still condensed, account of product liability law is contained in Weinstein et al. (1978, Chapter 1). A full account is presented in Frumer and Friedman (1975).
The requirement of *privity of contract* was swept away in a 1916 New York decision written by Judge Cardozo:

If the nature of a thing is such that it is reasonably certain to place life and limb in peril when negligently made, then it is a thing of danger. Its nature gives warning of the consequences to be expected. If to the element of danger there is added knowledge that the thing will be used by persons other than the purchaser, and used without new tests, then, irrespective of contract, the manufacturer of this thing of danger is under a duty to make it carefully.²

That a manufacturer might be found negligent for the inadequate performance of his product did not mean that injured parties collected damages easily. Negligence was difficult to prove. Therefore, injured parties attempted to find relief through breach of express or implied warranty. If breach of warranty could be shown, then negligence need not be demonstrated—conduct was immaterial.

Until 1960, however, this avenue to plaintiffs’ recovery was largely barred by the privity requirement. This bar was struck down in a New Jersey case, *Henningsen v. Bloomfield Motors*, in which the court stated:

Under modern conditions the ordinary layman, on responding to the importuning of colorful advertising, has neither the opportunity nor the capacity to inspect or to determine the fitness of an automobile for use; he must rely on the manufacturer who has control of its construction, and to some degree on the dealer who, to the limited extent called for by the manufacturer’s instructions, inspects and services it before delivery. In such a marketing milieu his remedies and those of persons who properly claim through him should not depend "upon the intricacies of the law of sales. The obligation of the manufacturer should not be based alone on privity of contract. It should rest, as was once said, upon ‘the demands of social justice’" (*Mazetti v. Armour & Co.*, 1913). "If privity of contract is required," then, under the circumstances of modern merchandising, "privity of contract exists in the consciousness and understanding of all right-thinking persons."

Accordingly, we hold that under modern marketing conditions, when a manufacturer puts a new automobile in the stream of trade and promotes its purchase by the public, an implied warranty that it is reasonably suitable for use as such accompanies it into the hands of the ultimate purchaser. Absence of agency between the manufacturer and the dealer who makes the ultimate sale is immaterial.

Even this was not considered to provide the product user with adequate protection. The view grew that consumers were completely unable to judge (or to affect through their actions) the safety of the

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products they purchased and that manufacturers were in a better position than product users to bear (and pass on the costs of) product-related injuries. Thus was born the doctrine of strict liability in tort.

According to Section 402A of the Restatement of the Law of Torts (2d), first applied in a 1963 California case, Greenman v. Yuba Power Products, Inc.:

1. One who sells any product in a defective condition unreasonably dangerous to the user or consumer or to his property is subject to liability for physical harm thereby caused to the ultimate user or consumer, or to his property, if
   a. the seller is engaged in the business of selling such a product, and
   b. it is expected to and does reach the consumer without substantial change in the condition in which it is sold.

2. The rule stated in subsection (1) applies although
   a. the seller has exercised all possible care in the preparation and sale of his product, and
   b. the user or consumer has not bought the product from or entered into any contractual relationship with the seller.

During the 1960s, strict liability became the ruling standard in two-thirds of the states. By 1981, all but four states had adopted some form of strict liability.3

THE CONSEQUENCES OF STRICT LIABILITY

The consequences of the shift from negligence to strict liability show up most clearly in the class of cases known as manufacturing defects. The classic manufacturing defect case is the exploding soda pop bottle. Under the negligence doctrine, if a consumer of soda pop was injured by an exploding bottle, the bottler could avoid liability by showing that he exercised reasonable care in the manufacture of the bottle or in filling and capping it. In the manufacturing defect context, reasonable care meant that the manufacturer had an appropriate inspection and quality control program to detect and weed out defectives. If a bottle got through this quality control process and still exploded, the costs were borne by the injured party.

Strict liability meant that the consequences of such a failure rested on the manufacturer, regardless of how good his quality control process was.4 If one considered an occasionally defective product as the price society had to pay for modern methods of mass production, then it

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3The exceptions, Massachusetts, North Carolina, Virginia, and Wyoming, still hold to an explicit negligence doctrine.

4Weinstein et al. (1978, p. 31) argue that manufacturing defect cases "spurred the development of strict products liability."
was appropriate that all users of the product, and not merely the unfortunate victim, pay.

Imposing strict liability on the manufacturer brought this result about. It placed him in the role of an insurer against production defects. He in turn passed the costs of accidents forward to the users in the price of the product. It was also believed that the manufacturer would have an incentive to improve his quality control process and thereby reduce accidents and their associated costs. Moreover, there was no corresponding potential response by consumers, since manufacturing defects led to injuries independent of the consumer’s actions.⁵

In the other class of product liability cases—design defect—the consequences of the adoption of strict liability were not as straightforward. As a number of commentators (e.g., Birnbaum, 1980, p. 600) have observed, to apply strict liability literally in design defect cases would make the manufacturer absolutely liable for all accidents occasioned by his products. But the courts have uniformly refused to apply absolute liability in design defect cases, arguing that the result would be socially undesirable.

Certain products—knives, drugs, and automobiles, for example—are inherently dangerous. To turn the manufacturer of such products into an insurer against all accidents associated with their use would be to encourage an inefficiently small amount of risk-taking in our society. Products that informed consumers would willingly purchase, knowingly incurring a risk in their use, would not be produced if the expected cost of the “insurance policy” that would inevitably accompany their sale, under this doctrine, was excessive.⁶

Courts, therefore, have struggled to develop liability rules for design defect cases that, on one hand, are not rooted in the conduct of the manufacturer (thus implying a negligence standard) but that, on the other hand, do not impose absolute liability on the manufacturer for design defects. The result has not been a model of clarity.

The original statement of the doctrine of strict liability noted the difference between design and manufacturing defect cases. Comments

⁵Shavell (1980) presents a formal analysis showing that strict liability is preferable where customers may have imperfect knowledge of the risks; this is one interpretation of the manufacturing defect instance.

⁶Consider a population with two classes of consumers. The first class consists of persons who can use knives responsibly; they have a low probability of incurring an injury when using a well-designed knife. The second class consists of persons who correctly assign a high probability of injury from their use of a well-designed knife. Under any doctrine but absolute liability, many of the second class will be discouraged from purchase of knives, since they must self-insure. Under absolute liability, the producer will have to buy insurance to compensate a mix of the two classes. That may be high enough to drive out some of the low-risk users. The problem is a mirror of the “lemons” problem of Akerlof (1970).
(i) and (k) of the Restatement of the Law of Torts (2d) qualified the notion of strict liability as follows:

i. Unreasonably dangerous. The rule stated in this Section applies only where the defective condition of the product makes it unreasonably dangerous to the user or consumer. The article sold must be dangerous to an extent beyond that which would be contemplated by the ordinary consumer who purchases it, with the ordinary knowledge common to the community as to its characteristics.

k. Unavoidably unsafe products. There are some products which, in the present state of human knowledge, are quite incapable of being made safe for their intended and ordinary use. [Cites drug examples.] Such a product, properly prepared, and accompanied by proper directions and warning, is not defective, nor is it unreasonably dangerous. The seller of such products is not to be held to strict liability for unfortunate consequences attending their use, merely because he has undertaken to supply the public with an apparently useful and desirable product, attended with a known but apparently reasonable risk.

This interpretation led courts to adopt some form of risk-utility balancing test, i.e., to compare how a change affects both the danger to the user and the utility of the product. But, consistent with the doctrine of strict liability, this test was not to focus on the reasonableness of the producer's behavior, but on the results of this behavior as embodied in the product. As several commentators (e.g., Henderson, 1973) have noted, this distinction has not turned out to be particularly useful.

The creation of a risk-utility balancing test has, in the view of some, forced the courts into an area that they are not equipped to handle. Design decisions are "polycentric"; a change in one element of a product affects many other elements in ways that are difficult to predict. The understandable unwillingness of courts to impose absolute liability for design decisions—especially conscious design decisions—has led them to adopt a de facto (but often confused) negligence standard.

Moreover, in actuality risk-utility balancing has resulted in "battles of experts." One expert proposes a design that, if it had been adopted, might have prevented the harm in question. The opposing expert argues that such a design was impractical or, if adopted, would have severely reduced the utility of the product and perhaps caused some other harm. Both judges and juries have difficulty ascertaining the correctness of these positions in interpreting whether the product was unreasonably dangerous.

The courts have also changed their interpretation of the role of the plaintiff's conduct when assigning liability. A defendant can defeat a claim brought under negligence doctrine by showing that the plaintiff
was "contributorily negligent," judging the plaintiff’s conduct by community norms. Under strict liability, the defendant bears a much heavier burden: he must show that the plaintiff "voluntarily and unreasonably encountered a known risk. It is not enough to prove that a reasonable person would have discovered the risk. The defendant must establish that the plaintiff himself saw the risk and unreasonably encountered it" (Weinstein et al., 1978, p. 20).

The test is highly subjective. It requires probing the perception of the plaintiff. It also requires judgment of the reasonableness of the injured party’s conduct not against community norms, in itself a vague enough standard, but against some much more narrowly and imprecisely defined class, those similarly situated to himself.

**Extensions of Liability**

Three recent extensions of liability deserve mention for their possible effect on design decisions: the extension of liability to crashworthiness in automobile cases; the breaking of the link between the manufacturer and the harm; and the erosion of the bar to evidence on postmanufacturing design changes.

**Crashworthiness.** Until 1968, courts limited a manufacturer’s liability to harm related to a production or design defect that caused an accident. That year, however, beginning with the federal case *Larsen v. General Motors Corporation*, some jurisdictions began to extend liability to include injuries unreasonably enhanced or aggravated by a particular design feature. Since the bulk of these cases involved features of automobiles that affected the seriousness of injuries once a collision (not caused by the performance of the component in question) had occurred, the duty created has been labeled *crashworthiness.* However, as has been pointed out by commentators, the issue is not limited to automobiles (see Hoenig, 1981, p. 634, n. 4).

Under this liability requirement, the court must not only decide whether a manufacturer has designed and manufactured a product that does not cause accidents; it must also consider the performance of the product when an accident occurs. This complicates further the risk-utility balancing that juries must undertake when examining conscious design choices. A change that reduces the severity of injury from an accident may raise the probability that an accident will occur.

**Breaking the Link between the Manufacturer and the Harm.** Until recently, a plaintiff seeking to recover damages had to be able to identify the manufacturer of the product allegedly causing harm in order to be able to collect damages from that manufacturer. In a California case, *Sindell v. Abbott Laboratories*, the plaintiff was unable to
identify the manufacturer of the drug DES that her mother had taken many years earlier that caused the plaintiff's cancer of the cervix. This was held not to bar recovery. Instead, the court decided to apportion damages by market share (at the time the medicine was taken) on the theory that approval of the drug by the Food and Drug Administration (FDA) was jointly sought by all manufacturers. A manufacturer could escape liability only if it could prove that it was not producing DES at the time the plaintiff's mother took it.\textsuperscript{7}

**Introduction of Evidence of Postmanufacturing Changes.**

Many years may elapse between the time a product is produced and an injury involving its use occurs. Several additional years generally elapse between the injury and the trial relating to that injury. During this period, the producer may have altered the design of units similar to the product alleged to have caused the injury, and some of these changes may be related to the characteristics of the product that allegedly caused the injury. For example, the plaintiff might allege that an automotive manufacturer's introduction of a safer door latch should be admissible when considering liability for an injury resulting from a child's fall from a moving vehicle of an earlier model when the door became unlatched.

Courts have generally been reluctant to admit evidence of post-manufacturing changes as indicating that the original design was defective, fearing that to do so would discourage manufacturers from making improvements relating to safety.\textsuperscript{8} Recently, however, this barrier has been weakening.\textsuperscript{9}

Indeed, this position has been codified in Federal Rule of Evidence 407. Courts now argue that changes in economic conditions have weakened the claim that admitting postmanufacturing changes as evidence would deter manufacturers from making remedial changes. They point to the importance of all the other factors that provide an incentive for introducing changes to reduce a hazard, especially the size of punitive damage awards, the likelihood of numerous suits if a hazard has been established for a particular product, and the costs to the defendant firm in terms of loss of reputation (Weil, 1982, p. 167).\textsuperscript{10}

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\textsuperscript{7}Strictly, the test was whether the firm could show that it could not have produced the DES consumed by the mother. In fact, given the fungibility of the product, the only way to demonstrate this was to show, as one of the original defendants did, that it began production after the plaintiff was born.

\textsuperscript{8}Design changes that occur postproduction but before the accident are generally admissible. The manufacturer might, in light of such changes, be deemed knowledgeable of the potential danger and to have acted, perhaps through recall, to avert the injury.

\textsuperscript{9}The leading case is Ault v. International Harvester.

\textsuperscript{10}The move has been challenged by some courts. For example, the Second Circuit Court of Appeals in Conn v. Ford Motor Co. upheld the applicability of Rule 407, excluding postincident remedies as admissible, even under strict liability doctrine.
Increases in the Number of Cases and the Size of Verdicts

Considering the nature of the changes that have taken place in product liability law since the early 1960s, it is not surprising to find that the number of product liability cases has been increasing. A recent Rand Institute for Civil Justice study of Cook County (Chicago) civil jury verdicts (Peterson and Priest, 1982) found product liability cases increasing both in absolute numbers and as a proportion of all civil cases (exclusive of automobile) between 1960 and 1979. Indeed, the proportion of these cases in the total caseload increased in each five-year period over the 20 years covered by the study. From 1960 to 1964, there were 95 product liability cases, constituting 2.3 percent of civil trials; from 1975 to 1979, the 234 product liability cases were 5.8 percent of the total.

The number of trials are but the tip of the product liability iceberg. Only a small proportion of product liability insurance claims filed (4.8 percent of bodily injury claims and 3.4 percent of property damage claims in a 1977 study by the Insurance Services Office) result in a trial.11 The total number of product liability claims filed by year is not known, but statements that it was approaching one million per year by the mid-1970s have been thoroughly discredited. The Final Report of the Interagency Task Force on Product Liability put the figure for 1976 at between 60,000 and 70,000. How fast this figure has been growing recently is not known.

The increase in the number of product liability claims and suits has been accompanied by an increase in the average size of jury awards and settlements. The Cook County study (Peterson and Priest, 1982) showed the median product liability award (in 1979 dollars) rising from $143,000 over the 1960-1964 period to $377,000 over the 1975-1979 period (p. 43). The 90th percentile award (again in 1979 dollars) rose from $496,000 to $791,000 between these two periods. Verdicts in excess of three million dollars ceased to be rarities during the late 1970s and early 1980s.12

11The changes in product liability law and jury award behavior have ambiguous effects on the percentage of claims that will be settled prior to litigation. Defendants will be motivated to make higher settlement offers but plaintiffs’ expectations will also be higher. The net effect depends on numerous unknowns. This also implies that one cannot predict the net effect of the changes on the probability of the plaintiff prevailing at trial.

The Effect of Product Liability on Design Decisions

Numerous theoretical studies attempt to model the effect of various liability standards on the incentives facing manufacturers and users of products. The results of these studies are extremely sensitive to the assumptions made concerning the amount of information on product performance available, the risk aversion of various parties, and other such factors. Yet, the studies generally show that moving in the direction of strict liability from negligence ought to increase the incentive of manufacturers to design safer products.\(^\text{13}\)

What level of effort is optimal from a social point of view depends on one’s assumptions.\(^\text{14}\) Economists usually argue that absolute liability is inefficient in that it induces manufacturers to devote too much attention to safety, while simultaneously inducing product users to devote too little attention to how they use products (Oi, 1973).

Applying strict liability literally to design would create absolute liability, as has been generally recognized by courts. Yet, there is strong resistance to backtracking from the concept of strict liability in the design area, since negligence places such a heavy evidentiary burden on the plaintiff. Courts still try to fashion tests that look like strict liability but avoid imposing absolute liability. In doing so, they often sow confusion concerning what test is being applied (see Henderson, 1979).

Designers must therefore attempt to discern the tests that are being applied—or that may be applied in the future, since future law applies to injuries involving products currently being designed—in arriving at their decisions relating to risk-utility trade-offs. Were the consensus to be that absolute liability for design defects will eventually rule, their task might, paradoxically, be easier, simply through the elimination of uncertainty.

Further extensions of liability, such as for crashworthiness; the breaking of the tie between a manufacturer and the performance of its own products, as in Sindell; and the erosion of the bar to introducing cases of postmanufacturing changes all complicate the design task even further. The first imposes a new responsibility—to make certain that characteristics of products do not add to injuries even if the products themselves do not directly cause injuries in the first place. The second makes determination of reasonable design behavior much more difficult. How much care must be exercised when the care a competitor exercises

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\(^\text{13}\)Even this intuitive result holds only under quite stringent assumptions. Shavell (1980) finds that strict liability for customers produces efficient results where customers have full information and customers’ behavior (which is altered by the liability rule) can affect the probability and severity of accidents.

\(^\text{14}\)For example, Epple and Raviv (1978) find that “The desirable liability rule . . . depends on the amount of information available to the consumer” (p. 80).
may affect your own liability? The third increases caution concerning design changes. If a new and safer design can be introduced, should it be? Or will failure to introduce it, if discovered, also incur liability?

Perhaps the major complaint about the current product liability system, treated as an institution rather than an abstract set of rules, is that it is so uncertain. That uncertainty has a number of sources; the major ones are variation among states at a given time, changes in particular states over short periods, and the unconstrained vagaries of jury behavior. As Professor Henderson noted, “Courts in various states have come up with widely differing standards for judging the adequacy of product designs. Even the best of these standards are so vague that juries are free to, and do with regularity, react purely out of whim. Punitive damages, which once were a special sanction treated with the same respect as capital punishment, are now quite commonplace—much as was the guillotine in revolutionary France” (statement before U.S. Senate Subcommittee for Consumers, 1982, p. 22).

Finally, it is important to note that product liability incentives operate largely through the profit motive. The firm is induced to exercise care in the design of products by the fear that future profits will be reduced by more than the additional design effort would cost. Putting matters this way focuses attention on another aspect of the incentives created by product liability. To the extent that injuries (and claims, suits, and awards accompanying them) occur only far in the future, and to the extent that these costs can be reduced by firm actions other than increased design efforts related to safety, the incentive to design safer products is undercut.

INSURANCE

Unsafe products represent a source of risk and uncertainty to the manufacturer, since the flow of injuries, claims, and payments depends on a number of factors only partially under the firm’s control. To reduce the resulting uncertainty, the firm may purchase insurance to cover the costs of providing compensation to those injured by the firm’s products. The insurance company may also provide a number of clerical services to the firm, usually including claims investigation,

15The Sindell rule, of course, applies only where the product is generic, i.e., all producers turn out a product which is, at least in the relevant dimensions, identical.
16On the other hand, any senior executive who has been involved in a major recall or suit is likely to have considerable concern about the personal toll on himself arising from such incidents. This is probably not a trivial motivation at the highest corporate levels.
settlement negotiation, and claims processing. It may, in addition, provide technical advice aimed at reducing the product liability costs, including insurance payments, of the firm.

The issue of insurance industry actions with respect to product liability, in particular the methods used to set premiums, has been a central concern in the recent debate over product liability. In this study, we have only a relatively narrow concern with insurance, namely the impact of insurance industry practices on the incentives and capacities of insured firms to improve the safety of their products, particularly with respect to design practices. We shall analyze how insurance premiums are set (focusing primarily on the incentive effects of these policies), how information may be transmitted between the insured and the insurer, and the role of insurers in product liability prevention activities.

Let us begin with a simple paradigm for the setting of product liability insurance premiums. The firm seeking insurance is assumed to produce a constant mix of products, the designs of which change slowly and which are used by large numbers of customers in a relatively few types of settings. Over time, in an unchanging litigation environment (with respect to legal doctrine, jury attitudes, plaintiffs' bar competence, etc.), there will be a stream of claims, jury verdicts, and settlements associated with each of the firm's products. The insurance company acquires information about these streams through insuring a number of firms manufacturing the same products. The insurer can thus set a premium, per unit of each product, for insuring some portion of the firm's costs of compensating persons injured by the product. Aggregating these across product lines, the insurer sets a total premium for the firm.

In this simple and highly idealized setting, the insurer has two advantages relative to the firm. First, it is able to spread the risk over a larger universe of related activities, thus reducing the uncertainty arising from this source. Second, it may have an information aggregation advantage\(^\text{17}\) that enables better prediction of the total liability costs of the firm.

But information aggregation not only permits insurers to make better predictions; it may also permit them to learn what affects the firm's record with respect to product liability claims. Assume that the same insurer insures 100 producers of a particular type of valve. The insurer observes that the insured firms fall into two classes: high injury rates per unit sales and low injury rates. Further observation shows the insurer that low-claim firms integrate design and production,

\(^{17}\)By receiving data from a number of firms, the insurer is better able to estimate probability distributions of events.
while high-claim firms separate the two functions. The insurer can then use that information both to set rates that reward the firms that have low claims and to provide information to high-claim firms as to measures they might adopt to reduce the flow of claims and thus their premiums. It may charge firms for providing this advice.

In this world, the insurance system improves the functioning of the product liability system. Though insurance reduces the variation in financial fortunes to which product liability claims can subject the firm and thus reduces the cost of product defects, the insurance industry efficiently aggregates the signals transmitted through the system, disseminates information, and through rate setting, provides the incentives for good practices that will lead firms to make innovations that reduce their incidence of unsafe products.

This is the idealized world. Now let us consider the factors that, in reality, complicate the role of the insurance industry in mediating between producers and the product liability system. We begin with some problems that arise from the nature of the existing insurance system and then separately consider the impact of change in the environment of product liability litigation.

Systemic Problems

Insurance is an extremely complex and diverse industry, so that simple questions, like How are rates actually set?, turn out invariably to have complicated answers. There is no simple answer to the rate-setting question in part because there are at least six different types of rates. For expositional purposes, we shall outline the determination of the two simplest classes of rates.

The two rates are calculated by the Insurance Services Office (ISO), a statistical organization formed by the insurance industry. ISO aggregates information for the industry as a whole. The rates that it calculates are not binding on any insurer, and later we shall touch on the nature of adjustments made by the individual firm.

The first class of rates is called manual rates. These are rates for products on which there is a sufficient data base to permit calculation of an actuarial loss ratio, using past experience. That is, the ISO can estimate the insurer’s expected costs per unit of sales on an objective basis. Typically, the products involved are relatively homogeneous and have low accident rates and many units in the population. The ISO

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19Cost here includes the cost to the firm of uncertainty. The fact that the firm is willing to pay the insurance premium, which has a negative actuarial value to the insured, provides evidence that this is preferred to the uncertainty of “going bare.”

19A clear description of the various types of insurance policies is presented in U.S. Department of Commerce (1980, Chapter 4).

20Other organizations, such as the Alliance of American Insurers, perform some similar functions for large subgroups.
publishes manual rates for some 30 percent of all product classifications. However, because they are low accident rate items, these account for only 10 percent of total product liability premiums (U.S. House of Representatives, 1978, pp. 14-15).

The second major class of ratings has the curious name (a)-rated.21 These are products for which there is insufficient data to develop a statistically based rate. Instead, ISO uses a panel of experienced underwriters to set a rate based on their own experience and judgment. The product involved may be one for which there is such variability in claims experience that it is impossible to establish a meaningful rate, or for which there is simply insufficient experience.

An example of the variability problem was provided in recent congressional hearings. "Example, valve manufacturers. You might have a valve that is involved in a washing machine, you might have a valve in a jet aircraft. The exposures within that class are so different and so heterogeneous..." (U.S. House of Representatives, 1978, p. 19). These rates are usually applied to small firms because their experience provides too little information for other adjustments. They account for about one-third of premium income.

For large firms, rate setting is generally more complex. The firm's own loss experience plays a significant role. Indeed, many policies involve retrospective payments, i.e., the premium for, say, 1976 will depend on payments made by the insurer for claims relating to that year. The premium for 1976 may be adjusted over successive years in light of the flow of payments made in those years. The insurance contract in this form is clearly a risk sharing by insurer and insured.

The insurance industry has been criticized for its inability to provide more objective justification for ISO rates. The problem is difficult to analyze because the appropriateness of insurance rates depends on the reserving practices of insurers, i.e., how much money they put aside at the end of a policy year to cover future contingencies and how that money is handled in the firm's accounts. Though esoteric, the subject merits a brief discussion.

At the end of a policy year, the insurance firm will have paid some claims arising from incidents during the year. Some other incidents will have resulted in claims during the year, but these claims will not have been settled yet; i.e., the insurer will not yet know how much it will have to pay these claimants. Some other claims will be made after the end of the year but will be charged against the year because they

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21 The term comes from the fact that in the publication listing rates for each product class, an (a) is placed before those that are judgment-rated.
are the result of incidents this year. To take account of these future costs, the insurer sets up reserves.

These reserves represent capital that the insurer may invest until they are used for settlements (including administrative expenses associated with those settlements). Traditional state regulation of the insurance industry has not included these investment incomes in determining insurance rates.

Spurred on by the rapid increase in returns available from relatively safe investments, this practice has come under considerable criticism. The problem is particularly acute for product liability insurance because so many of the settlements are made many years after the end of the policy year. The ISO found that over 50 percent of payments were made more than 3-1/2 years after the end of the policy year. In an era of 12 percent returns on Treasury notes, this means that insurers can earn substantial income on their product liability reserves.

In 1980, the Department of Commerce Task Force on Product Liability and Accident Compensation analyzed the investment income generated by a simulated version of current settlement and investment practices. It concluded that:

*The product liability underwriting losses complained of may be significantly offset by these substantial amounts of investment income.*

In connection with this ... conclusion, it should be observed that from the present information available it is virtually impossible to make an appropriate allocation of investment income to the product liability subline or even line 17—miscellaneous liability (which contains the bulk of product liability experience on the annual convention statement). (p. 140)

The high proportion of reserves that are placed in the *Incurred but Not Reported* (IBNR) category has also created concern. The number of future claims that will arise out of this policy year is extremely difficult to project, particularly when the pattern of claims generally is changing. What these claims will eventually cost the insurer is even more difficult to estimate. Some companies have allocated as much as 70 percent of all expected payments to the IBNR category, while others have allocated only 25 percent. As a congressional committee noted, given the lack of detailed information, "these differences remain merely a curiosity." Indeed, the only conclusion that one can draw about

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22 A good discussion of the issues involved is contained in U.S. Department of Commerce (1980, Chapter 8).

23 Detailed figures on insurance reserving practices are presented in U.S. House of Representatives (1978, pp. 28–29).
insurance premiums in the product liability area is that it is impossible to determine their appropriateness.\textsuperscript{24} If a manufacturer's insurance premium were determined solely by its product mix, then insurance would indeed attenuate the signals provided by the product liability rate. No firm would be able to reap the full return for expenditures that reduced the flow of claims arising from its own products, because its premium would have been determined by the collective experience of all producers of the same items. This is, of course, a standard concern about the efficacy of insurance generally, not just in the product liability area.

The ISO rates are merely advisory, however, and adjustments can be made for individual firms, both in light of their actual experience (flow of past claims) and their current practices (with respect to product liability prevention). Firms with good records or good practices may be rewarded by reduced premiums, just as drivers who have not had accidents for some time receive lower rates than others in the relevant insurance category. For large companies, as already mentioned, experience rating is indeed a common practice; the ISO rates may play some role in negotiations but the prime consideration is the past record of the firm.

For small firms, though, the lack of product volume means that they can provide little credible evidence to justify a rate lower than that published in the ISO manual. Indeed, the complaints about rates for product liability insurance that surfaced in congressional hearings mostly concerned small manufacturers who felt themselves to be penalized for the problems of others; a firm that has not made a product liability claim in a period of years is naturally outraged by a tenfold increase in rates, though that may reflect product liability problems of other firms in the same line of business.

The experience rating problem is well understood, though little has been done to address the apparent inequities that small business faces as a result. The problem becomes particularly acute in a time of rapidly changing liability costs. But before getting to that we should consider another element of the insurance rate-setting system, namely the responsiveness of rates to practices of the insured.

In some areas of insurance, the insurer develops considerable skill in distinguishing the components of firm behavior that will affect the risk associated with it. For example, Bardach and Kagan (1981) assert "Casualty insurance companies have played a major role in developing standards of fireproofing in construction and insisting on the installation of sprinkler systems" (p. 10). The insurance industry, precisely because it aggregates experience, has a comparative advantage in

\textsuperscript{24}Some of the differences among insurers with regard to their IBNR shares may result from differences in the nature of the products they insure. However, one experienced underwriter argued that two experts might disagree substantially about the appropriate IBNR level for a given set of data.
developing the relevant expertise, and it has incentives to transmit that expertise.

The Interagency Task Force on Product Liability (U.S. Department of Commerce, 1977a, Chapter 4) collected some data on the product liability prevention activities of insurance companies. Those data showed that the vast majority of firms received some such service from their insurer. For medium and large firms, the task force found that 72 percent in their sample had received some loss prevention services in the previous two years. About 45 percent of those receiving such services had been given advice about changes in manufacturing and related practices as a result. Most of these changes concerned labeling and quality control, rather than design practices. The task force report suggested that respondents felt the changes to be of quite limited utility.

**Dynamic Problems**

As has already been mentioned, some basic determinants of the costs incurred by producers (or their insurers) from the production of unsafe goods have changed dramatically. The spread of strict liability doctrine has increased the probability that the plaintiff will prevail in a litigated claim. Consumers apparently are increasingly willing to bring a claim for bodily injury. Juries are awarding larger sums (even in constant dollars) for a given injury. Plaintiffs’ lawyers have become increasingly expert. Thus, the costs resulting from a defective design have increased markedly.

For insurers, the problem is not just that changes have occurred but that the process of change has not ended. The insurer assumes responsibility for future claims arising from all injuries caused in the current year. Many, if not most, of those claims will not be settled until later years, by which time the determinants of jury verdicts, which ultimately determine nontrial settlements as well, may have changed. In setting rates for this year’s coverage, the insurer must make projections concerning these determinants. This is indeed an extremely complex task.

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25 The categories in the study were annual sales less than $2.5 million (small), $2.5 million to $100 million (medium), and more than $100 million (large). The survey used 1975 sales figures.

26 This can be stated only as a conjecture. We lack data on either the number of injuries or the number of claims. No one we talked to disputed this suggestion.

27 Peterson and Priest (1982, p. 26) found that the average jury award, in 1979 dollars, rose from $143,000 in 1960–1964 to $377,000 in 1975–1979. These data do not control for changes in the mix of injuries for which jury awards are made; the claim as to increase for a given injury is again impressionistic.
The Insurance Services Office, in its study of closed claims,\textsuperscript{28} pointed to some of these problems.

It is possible that an accident from 1965 would not have occurred in 1976 due to changes in the legal environment, social attitudes, business expectations, government, etc. ... the incidents that occurred in the past and were settled today may not provide a completely accurate measure of what is actually taking place today. (p. 141)

In light of this, the ISO presented two separate estimates of the insurers’ costs arising from claims. One gave actual costs (i.e., costs on claims actually closed during the survey year); the other gave \textit{trended} costs (i.e., projected costs for the survey year taking into account likely trends in law, litigant behavior, and jury behavior). The differences are dramatic and worthy of comment (see Table 1).

Little detail was provided concerning the method used for trending the data. The detail suggests that linear trends were estimated for a number of components of costs, such as wage loss, medical expense, and product recall liability, i.e., it was assumed that each of these components would increase by a fixed percentage each year. However, the report does not seem to have included projections as to the number of claims or the probability of plaintiff success (i.e., either settlement or jury verdict favoring the plaintiff). For purposes of the ISO study, these were secondary (since it was intended to provide information on

\begin{table}[h]
\centering
\begin{tabular}{lcc}
\hline
 & Untrended & Trended \\
\hline
Average paid per claim & 3,592.08 & 9,180.62 \\
Average paid per incident & 6,691.90 & 17,903.90 \\
Average paid per successful claim & 5,443.10 & 13,911.44 \\
Average paid per successful incident & 9,719.54 & 26,004.23 \\
\hline
\end{tabular}
\caption{COSTS ARISING FROM BODILY INJURY}
\end{table}

\textbf{SOURCE:} U.S. House of Representatives (1978, p. 34). The table is derived from closed claims survey raw data (trended and untrended) set forth in report No. 1 (12,382 incidents [B1]; 8,525 successful incidents; \$82,859,122 actually paid; \$221,686,199 trended paid) and report No. 2 (12,524 claims [B1]; 8,331 successful; \$45,346,453 actually paid; \$115,896,169 trended paid).

\textsuperscript{28}This study analyzed data concerning 24,452 product liability claims, settled (through payment, trial or withdrawal of claim) by 23 major insurers during 1976 and early 1977.
costs per successful claim). For the insurers, however, these are of central importance.

The so-called panic among insurers in the mid-1970s reflected this difficulty of making projections. The insured firms complained of rates that seemed grossly disproportionate to the number and size of jury awards.\textsuperscript{29} However, insurers making rates this year to reflect claims that, on average, would not be settled for perhaps another three years (ISO, 1977, p. 80) could point to accelerating rates of change to justify extraordinary increases.

These changes should also be put in the context of total insurance costs. Even after the rate changes of the mid-1970s, total product liability insurance costs, at least for large corporations, remained quite modest. A study by the Risk Insurance and Management Society (RIMS) in 1979 provided data on a sample of about 500 large corporations (42 firms in the sample had 1978 sales of over $3 billion).

The RIMS survey, which was based on a questionnaire that lumped product liability costs together with a variety of other liability costs, found that for the sample as a whole insurance premiums (for the group of liabilities) amounted to 0.115 percent of sales in 1978. Adding in unreimbursed liability costs (i.e., settlement and administrative costs of the firm not covered by insurance) raised the 1978 figure to 0.169 percent. Of course, the figures varied substantially among industries. The highest industry average for premiums plus unreimbursed liability costs was hospitals (2.35 percent). In manufacturing, the industry with the highest figure was rubber and plastic (.58 percent). Table 2 presents some of the key data.

Although several years old, these figures probably remain valid, as premium rates have increased little since 1978. Indeed, the Insurance Services Office reports declines in manual rates (the only ones for which data are available) from 1978 to 1981. For most large corporations, product liability insurance apparently represents an extremely modest component of total costs.\textsuperscript{30}

Product liability insurance costs represent not only a small component of manufacturers' costs, but also a relatively modest portion of the liability and casualty insurance industry's premium income. This

\textsuperscript{29}A collection of such complaints can be found in U.S. House of Representatives Hearings (1978, Vol. 1). Their typicality was never well established.

\textsuperscript{30}It has been argued that the relevant measure is product liability costs as a share of profits; clearly, it then assumes a greater importance. However, the relationship to profit is an appropriate measure only when the product liability burden varies greatly among competing firms. For example, if domestic manufacturers faced higher product liability insurance rates than their foreign competitors, then product liability insurance as a share of profits would give a better sense of the consequences of the differential, at least for the relative success of the two groups.
Table 2
TOTAL LIABILITY RISK COSTS AS A PERCENT OF REVENUES, 1978

<table>
<thead>
<tr>
<th>Industry Group</th>
<th>Lowest Value</th>
<th>First Quartile</th>
<th>Median</th>
<th>Third Quartile</th>
<th>Highest Value</th>
<th>Industry-Wide</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture, paper, etc.</td>
<td>0.09</td>
<td>0.18</td>
<td>0.38</td>
<td>0.53</td>
<td>2.12</td>
<td>0.34</td>
</tr>
<tr>
<td>Mining</td>
<td>0.05</td>
<td>0.41</td>
<td>0.75</td>
<td>1.44</td>
<td>8.56</td>
<td>1.84</td>
</tr>
<tr>
<td>Construction</td>
<td>0.26</td>
<td>0.30</td>
<td>0.69</td>
<td>1.00</td>
<td>2.03</td>
<td>0.55</td>
</tr>
<tr>
<td>Food, tobacco, etc.</td>
<td>0.10</td>
<td>0.24</td>
<td>0.42</td>
<td>0.60</td>
<td>1.21</td>
<td>0.30</td>
</tr>
<tr>
<td>Textiles, apparel</td>
<td>0.05</td>
<td>0.22</td>
<td>0.26</td>
<td>0.38</td>
<td>1.85</td>
<td>0.32</td>
</tr>
<tr>
<td>Printing, publishing</td>
<td>0.10</td>
<td>0.15</td>
<td>0.30</td>
<td>0.51</td>
<td>0.60</td>
<td>0.36</td>
</tr>
<tr>
<td>Chemicals, allied products</td>
<td>0.05</td>
<td>0.25</td>
<td>0.50</td>
<td>0.78</td>
<td>2.46</td>
<td>0.42</td>
</tr>
<tr>
<td>Petroleum</td>
<td>0.02</td>
<td>0.09</td>
<td>0.17</td>
<td>0.59</td>
<td>1.49</td>
<td>0.12</td>
</tr>
<tr>
<td>Rubber, plastic</td>
<td>0.24</td>
<td>0.51</td>
<td>0.59</td>
<td>0.84</td>
<td>1.01</td>
<td>0.58</td>
</tr>
<tr>
<td>Metals</td>
<td>0.04</td>
<td>0.34</td>
<td>0.46</td>
<td>0.70</td>
<td>1.28</td>
<td>0.36</td>
</tr>
<tr>
<td>Machinery</td>
<td>0.00</td>
<td>0.37</td>
<td>0.47</td>
<td>1.15</td>
<td>16.23&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.56</td>
</tr>
<tr>
<td>Transportation</td>
<td>0.10</td>
<td>0.19</td>
<td>0.51</td>
<td>1.11</td>
<td>2.02</td>
<td>0.20</td>
</tr>
<tr>
<td>Communications, utilities, etc.</td>
<td>0.02</td>
<td>0.23</td>
<td>0.40</td>
<td>0.61</td>
<td>4.32</td>
<td>0.36</td>
</tr>
<tr>
<td>Wholesale, retail</td>
<td>0.01</td>
<td>0.15</td>
<td>0.22</td>
<td>0.38</td>
<td>1.32</td>
<td>0.29</td>
</tr>
<tr>
<td>Finance—banks</td>
<td>0.06</td>
<td>0.09</td>
<td>0.14</td>
<td>0.27</td>
<td>2.45</td>
<td>0.11</td>
</tr>
<tr>
<td>Finance—other</td>
<td>0.01</td>
<td>0.02</td>
<td>0.05</td>
<td>0.07</td>
<td>0.54</td>
<td>0.07</td>
</tr>
<tr>
<td>Real estate</td>
<td>0.05</td>
<td>0.45</td>
<td>0.97</td>
<td>1.60</td>
<td>2.11</td>
<td>0.63</td>
</tr>
<tr>
<td>Services</td>
<td>0.07</td>
<td>0.51</td>
<td>0.87</td>
<td>1.22</td>
<td>4.02</td>
<td>1.07</td>
</tr>
<tr>
<td>Government</td>
<td>0.04</td>
<td>0.47</td>
<td>0.88</td>
<td>1.76</td>
<td>5.15</td>
<td>1.64</td>
</tr>
<tr>
<td>Hospitals</td>
<td>0.15</td>
<td>1.20</td>
<td>1.63</td>
<td>2.20</td>
<td>3.90</td>
<td>2.35</td>
</tr>
<tr>
<td>Conglomerates</td>
<td>0.13</td>
<td>0.24</td>
<td>0.44</td>
<td>0.71</td>
<td>1.76</td>
<td>0.38</td>
</tr>
<tr>
<td>Other</td>
<td>0.02</td>
<td>0.29</td>
<td>0.48</td>
<td>0.78</td>
<td>5.62</td>
<td>0.38</td>
</tr>
</tbody>
</table>


<sup>a</sup>An unusual case; the next highest was 3.07 percent.

is reflected in the fact that product liability insurance was not a separate item in the standard forms used by state regulators of the insurance industry, at least until 1977. Nor could the insurance firms produce figures on revenues and costs specific to product liability lines of insurance. While there have apparently been some changes intended to bring the product liability figures more clearly into view, the fact that so little attention was paid to economic performance in this area—even after the “explosion” of product liability rates—is an interesting observation.

The product liability coverage typically provided by insurance has some important limitations. The insurance coverage may not include punitive damages that can be imposed on the manufacturer in a
product liability suit. In states where the courts have spoken on the issue, including California and New York, they have disallowed such coverage; no legislation addresses the issue. As one commentator has noted, “there is some support (with conflicting precedents on the point) for the proposition that as a matter of public policy, liability insurance contracts will not be treated as covering punitive damages assessed against an insured” (Keeton, 1978, p. 184). Given the growth in the frequency of punitive damage awards by juries (Owen, 1982), this may have important consequences for relations between insurers and manufacturers; we shall explore these consequences later.

Two other consequences of product defects are not covered through insurance: the loss of the manufacturer's reputation and the cost of recalls. In the first case, the difficulty of estimating the extent and value of reputation loss in an objective manner in part inhibits the development of such insurance policies. In the second case, the limitation is not inherent but appears to be a common feature of product liability insurance. A manufacturer who decides to recall a product because of concern about possible defects will bear most of the costs.

Again, we shall defer to a later section discussion of the effect of these insurance limitations on the behavior of the firms.

REGULATION

The actual and perceived problems of the product liability system have led to more direct government intervention in product safety. Federal agencies have acquired responsibilities for setting some individual product-related standards and for monitoring (and second-guessing) producer safety decisions for a wide variety of products.

The growth of the government’s involvement in this area has itself become a major issue over the past 15 years. Critics have argued that, whatever the purported failures of the product liability system in theory, the regulatory agencies have, in practice, caused as many

31Owen (1976) argues that precisely because insurance reduces the penalty incurred by a manufacturer, coverage for punitive damages, whose sole purpose is deterrence, should not be permitted.

32Recall coverage can be purchased. Not many do. It is a limited coverage. It covers only advertising costs and the cost of recovery. It does not pay for the cost of replacement. It does not pay for the cost of destroying the product that is recalled. It is always written with a large deductible and, generally, there is also participation above the deductible” (MAPI, 1972, p. 97; statement by Joseph Myers).

33One recent recall has generated an interesting coverage issue. The manufacturer of Tylenol recalled the product because of a number of instances of tampering. The product was reissued in a tamper-proof container. The firm is now seeking coverage of these recall costs under its product liability insurance, arguing that the recall reduced product liability costs.
problems as they have solved. Interventions have been seen by some as rushed, arbitrary, heavy-handed, and by others as excessively timid and unreasonably slow. Some have ascribed this to regulation per se; others to the political weaknesses of regulatory agencies in the U.S. political and legal system. While few defend the actual record of regulatory agencies, some see the solution in better legislation and more aggressive regulation; others believe that there is a need to retreat.

In this section, we lay out the rationale for government regulation of product safety. This is followed by a taxonomy of the major safety regulatory agencies and possible interventions. The third subsection discusses the problems of evaluating the success of regulatory efforts. The section concludes with a discussion of the interaction of regulation and product liability.

Rationale

As has often been noted (e.g., National Commission on Product Safety, 1970), the tort law system is concerned directly with the compensation of victims and only indirectly with the avoidance of unsafe products on the part of manufacturers. It may work powerfully on manufacturers' behavior precisely because the cost of compensating accident victims can be very high. Producers are given incentives for acquiring information about possible injury consequences of particular designs and avoiding those designs or developing mitigating design features.

However, the system clearly works imperfectly. Under some circumstances, the tort system may expose the consumer to unreasonable risk for a considerable period of time. For complex hazardous products purchased by final users with only a modest amount of information and a limited capacity to evaluate that information, direct government intervention may be appropriate.

The risk that a product reaching the market will seriously injure many consumers before enough is known to lead to its withdrawal is too high. For example, the drug Elixir Sulfanilamide, introduced into the market in 1937, before the FDA had authority over drug-testing procedures, led to the death of over 100 persons before being withdrawn. A single failure of the product liability system with respect to pharmaceuticals, automobiles, or aircraft can impose substantial costs on society.

One rationale for government intervention then is to ensure that the producer acquires sufficient information so that the consumer is not

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34A detailed account of this incident, which materially aided the passage of the Food, Drug and Cosmetic Act of 1938, is provided in Jackson (1970, pp. 252–270).
exposed to unreasonable risk. In that role, the government is both regulating the actual safety of products and ensuring that manufacturers generate adequate information for informed decision on the part of the consumer, who is presumed to be risk averse.

Much of the criticism of FDA regulation, in particular the claim that it unreasonably retards the introduction of new drugs, arises because the FDA is more risk averse (i.e., requires more testing for potential hazards) than important segments of the drug-using population, in particular those who are acutely ill or in pain (cf. Weimer, 1982). These people may be willing to take more risks than the FDA is willing to permit them to take.

Risk and information are not equivalent. In some situations, the government intervenes by specifying product characteristics to ensure that consumers are not exposed to certain risks about which they are unlikely to collect information. It may require that all automobiles have certain kinds of safety equipment to ensure that occupants will suffer limited harm in the event of an accident. To carry out this function effectively, the government may require the generation of information not generated by market forces; i.e., it may require testing that firms would not otherwise carry out.

Regulatory agencies collect and disseminate information relevant to product safety decisions of both consumers and producers. Without regulation, each producer receives information only on the safety performance of his own products.36 A public agency, by aggregating information from all producers, may be able more accurately to determine the characteristics of this class of product that affect its safety. The aggregation may also enable producers to make better safety decisions. Similarly, the aggregation function serves the customer population; by making this information available to customers in a way that enables them to better evaluate product safety performance, the regulator ensures that the market for safety works more efficiently.

Performance

Numerous agencies have some product safety responsibilities.36 The jurisdiction of most of these is confined to one industry (or at most a few industries) producing especially hazardous products. The Food and Drug Administration (FDA) was created in 1906 in response to growing

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35 Industry associations might perform the same function. Apart from the difficulty of ensuring that all relevant firms join, the association may face antitrust problems in exchanging information.

36 The list includes the Nuclear Regulatory Commission, Occupational Safety and Health Administration, Department of Agriculture, Environmental Protection Agency, and Federal Energy Regulatory Commission, as well as the four discussed in the text.
evidence that pharmaceutical manufacturers were putting dangerous
and ineffective products on the market.\textsuperscript{37}

The Federal Aviation Administration (FAA) was created in 1958,
inherting responsibilities for the safety of aircraft design and airline
operation that had previously been held by the Civil Aeronautics
Administration. The latter had been established partly in response to
the industry's concern that potential investors be assured of the safety
of the relatively novel product. The National Highway Traffic Safety
Administration (NHTSA) was created in 1968 following great concern
about the safety aspects of automobile design. Only the Consumer
Product Safety Commission (CPSC), created in 1973 following the
report of the National Commission on Product Safety, has broad prod-
uct responsibilities.

During the past two decades, the powers of the old regulatory agen-
cies have been substantially expanded and new agencies created with
varying degrees of product safety responsibilities. No matter how one
measures it, the extent of regulatory involvement in product safety has
increased substantially in that period. This expansion has generated
controversy about the proper role of regulation in safety issues.

Regulation is not a single instrument but rather an array of methods
for monitoring the behavior of firms. Broadly speaking, the following
three types of intervention in order of intrusiveness in the firms’
decisionmaking may be used for safety regulation: product develop-
ment regulation, standard setting, and postmanufacturing procedures.

\textbf{Product Development Regulation}. An agency may intervene
from the early stages of product development, requiring that even then
the firm demonstrate the safety of the intended product. The FDA
regulation of the drug development process provides a pure example of
this.

The first step of the process is the submission of a [new drug investiga-
tion] application by the drug sponsor that must include all data
from preclinical testing on animals, relevant literature on toxicity
and pharmacology, and detailed plans for the proposed clinical test-
ing, with protocols for each investigator. (Weimer, 1982, p. 247)

The manufacturer must provide, even at this early stage, massive
documentation to support its claims. After the testing by the manufac-
turer, the regulatory agency further evaluates the test results.\textsuperscript{38} FAA
regulation of aircraft manufacturers comes close to this extreme.

\textsuperscript{37}Quirk (1980, pp. 192–198).
\textsuperscript{38}Under this procedure, where testing is always carried out by the firm rather than
the agency, the producer retains liability.
Standard-Setting. The agency may avoid direct involvement in producer decisionmaking and merely promulgate standards with which the product must conform in order to be marketable. The standards may involve design specification or performance standards. The CPSC, in its few standard-setting activities, acts in this way. It has, for example, set out in great detail how rear reflectors on bicycles must be located in relation to the rest of the frame (design specification). It has specified that mattresses meet certain flammability standards, without specifying how this is to be done.\textsuperscript{39} The sale of products that fail to meet these standards will lead to mandatory recall and the imposition of fines.

Postmanufacturing Procedures. Finally, agencies may promulgate procedures to be followed after information concerning a product hazard has been generated in the marketplace. The agency will specify that, once a hazard has been identified, the producer must follow certain procedures to ensure that those currently exposed to the hazard be given adequate warning (perhaps in the form of a recall) and that efforts be made to prevent further distribution of the hazardous product. The CPSC, for example, through Section 15 of its Act, has extremely broad powers to set recall procedures and penalize firms that fail to notify it promptly. It may also simply ban a class of products, once it has determined that they cannot be produced without exposing users to unreasonable danger.

The intrusiveness of regulation determines the extent of its influence on corporate product safety behavior; i.e., more intrusive agencies have greater influence on the product safety efforts of the firms they regulate, inducing them both to acquire more safety relevant information and impose tighter standards. Clearly, the FDA’s policies heavily condition (and, indeed, may control) the drug companies’ product safety decisions.

In contrast, the producers of most household durable products are subject only to rather weak design specification requirements and post-manufacturing recall procedural requirements. That is, although they are, in the broadest sense, subject to safety regulation by an agency (CPSC), “white goods” manufacturers retain considerable discretion in making their safety decisions in the design process.

\textsuperscript{39}Neither CPSC nor NHTSA provides a general specification of testing criteria for manufacturers. What percentage of the product may fail the test without the firm being found out of compliance is unclear, despite the fact that all manufacture and testing are subject to some uncertainty. Of course, this creates no problem for product liability suits; the plaintiff’s showing that the specific item did not meet government standards will carry considerable weight.
Evaluation

It is difficult to tell how well safety regulation has worked, given the absence of any clear benchmark. Much of the controversy about safety regulation has focused on elements of the process rather than on the results. While that approach may enable one to identify some losses arising from the inefficiency of particular regulatory strategies, it does not permit the determination of the net effect on the safety of products manufactured by the regulated firms. For example, how does one determine what drug firm safety policies would be in the absence of FDA intervention but with the existing product liability system? What are the aggregate costs, including those arising from reduced innovative activity, of complying with FDA regulation?

The problem of evaluation is exacerbated by the fact that regulation is not imposed at random on industries. For the reasons given above, regulation is most ubiquitous in areas where the hazard of products is most evident. Drugs, aircraft, and automobiles obviously present major hazards to many users. Without regulation but with a product liability system that provides plaintiffs with easy access to compensation, firms themselves will likely invest heavily in product safety efforts. This implies not that regulation is unnecessary but that evaluating the effect of regulation is difficult.

Moreover, while the traditional capture theory of regulation seems to have less and less support as a general proposition (Wilson, 1980b), interaction between regulator and regulated permits the regulated firm to affect the nature of the regulation. Product safety officials in the regulated firms often have close working relations with their regulators and may use the latter to influence the behavior of their own adversaries within the firm. The regulator and the regulated often share the same concerns to ensure that the existing system does not come into disrepute through a major safety failure.

Regulation does not replace the product liability system. Regulated firms have no protection from product liability suits even if they comply with regulation. But, regulation may help them to surface

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40Delays, arising either from agency decisions or from procedural elements imposed by due process requirements, are often cited. See Wardell (1979) for a discussion of FDA delays, arguably due to excessive testing requirements. The use of inappropriate criteria is also a frequent complaint. See Lave (1981) for a discussion of this in a number of contexts.

41See Peltzman (1973), analyzing the 1962 Drug Amendments, for an example of the difficulties involved in evaluating the impact of safety regulation.

42In some cases, this is the result of an agency having responsibilities both for safety regulation and for promoting development of an industry. Poole (1982b) makes this point with respect to the FAA.

43Heaton, Allar, and Maier (1981) assert that a regulatory statute "can create private rights of action by which individuals can sue violators to compel compliance or collect
safety-related concerns early and to clarify requirements of due care.\textsuperscript{44} It also reduces the variability in the quality of safety efforts undertaken by different producers. Indeed, it has been argued that large pharmaceutical manufacturers welcomed the creation of the FDA because it drove out from their industry the fringe producers who did not adequately test their products prior to marketing (Quirk, 1980, p. 193).

Aircraft, drug, and automobile producers, although highly regulated, are still subject to numerous product liability suits. In the case of pharmaceuticals, most suits involve warning labels.\textsuperscript{45} Plaintiffs rarely allege that the firm has, except for its instructions to users or prescribers, failed to exercise due care in putting the product on the market. The heavily regulated aircraft industry, in contrast, has been subject to suits that allege basic design negligence.

The McDonnell Douglas Corporation has recently been sued for negligence in the design of its DC-10. It has been alleged in court, and argued elsewhere, that under time pressure the manufacturer made fundamentally flawed design decisions (involving the placement of the hydraulic systems)—decisions that led to a number of fatalities. FAA behavior in the licensing process has been subject to considerable criticism as a result (see Eddy, Potter, and Page, 1976).

Similarly, the automobile manufacturers, subject to a relatively high level of safety regulation, have been sued on basic design decisions that are alleged to have produced fatal accidents, the Ford Pinto being the most prominent instance (De George, 1982). NHTSA standards have sometimes been ignored by juries, which have accepted plaintiff arguments that an alternative design, violating NHTSA regulations, should have been adopted (Hoenig, 1981).

Regulation and product liability are mutually reinforcing. The threat of product liability suits surely increases the effort that firms make to comply with regulation. Similarly, regulation provides information relevant to product liability suits; indeed, it is not uncommon for a regulatory action to initiate numerous suits by persons who damages. More indirectly, the promulgation of a new regulation tends to change the liability of private parties by implicitly establishing new societal norms of conduct” (p. 3).

\textsuperscript{44}Heston, Aller, and Maier, surveying appellate cases involving a variety of safety regulations, express some surprise at the lack of use by plaintiffs of regulatory information. “The extent of defendant use of regulatory information is surprising, given the purpose of the statutes. By far the most frequent purpose for which regulations were introduced was to establish the appropriate standard of care” (p. 28).

\textsuperscript{45}The doctrine of strict liability, as presented in the Restatement of the Law of Torts (2d), gave pharmaceuticals as an instance of the inherently dangerous product for which the producer’s liability was vitiated if he exercised proper care and provided adequate warning; thus, the litigative focus on the warning provided users and prescribers.
believe themselves injured by the product defect identified in the regulatory action.

The threat of regulatory agency intervention may affect firm behavior more than actual interventions. On the one hand, regulated firms are induced to exercise great care in the unregulated aspects of their decisionmaking so as to avoid problems that might lead the agency to increase the range of its regulation. On the other hand, the same concern with limiting the extent of regulatory intervention may lead firms to adopt formalistic approaches to regulation. All dealings with the agency may be channeled through a section of the legal unit, with the firm attempting as far as possible to insulate the operating divisions from interactions with the agency. The effect of regulation on safety decisions is thus reduced.

Regulatory performance with respect to information deserves separate discussion. In some cases, regulatory agencies have created information bases that permit better safety performance. The Fatal Accident Report System (FARS) of the National Highway Transportation Safety Administration is one such information base. Though the information used in FARS was generally accessible to insurers, no effort had been made prior to the creation of FARS to gather it in a form that permitted design decisions to reflect past accident problems in a systematic manner. FARS has helped spur insurers to more aggressive positions on automobile safety, as shown by the development of finely tuned premium rating systems for different types of automobiles.

In other cases, most prominently the National Electronic Injury Surveillance System (NEISS) of the Consumer Product Safety Commission, the collection apparently has been too poorly targeted to produce a useful data system (Heiden, Pittaway, and O'Connor, 1982). Similarly, some agencies have given considerable emphasis to the information aggregation function while others have not.

All this suggests just how difficult it is to determine the effect of regulation on the safety performance of firms. Regulation is not imposed randomly; it is a response to a perceived problem. Agencies may use a great variety of instruments to influence the safety behavior of the firms. Firms may respond with equally great variety to any particular regulatory regimen.

**VOLUNTARY STANDARDS**

Government agencies are not the only (indeed, not the primary) source of safety standards for products. A large array of private associations, jointly referred to as the voluntary standards system, also promulgate standards. Many voluntary standards are adopted by
government agencies and thus made mandatory. Some observers argue that the voluntary standard-setting system can largely replace regulatory activity in this area.\(^4\)

Here we describe the operation of the voluntary standards system and how it interacts with product liability law and regulation. We conclude with an argument that the system has limited potential and actual roles in influencing the design decisions of manufacturers.

Voluntary standard-setting organizations have existed since the late nineteenth century (Hemenway, 1975). They jointly promulgate standards that apply, for the most part, to standardization of products (such as the length of beds) rather than safety. Nonetheless, they are responsible for several thousand standards that are explicitly aimed to assure the public of safe products. A few institutions, most prominently the American National Standards Institute (ANSI), serve as clearinghouses for the promulgation of standards, often initiated by more narrowly focused trade or professional associations. Other organizations, such as the American Society for Testing and Materials (ASTM), facilitate the formulation of standards.

Although the major voluntary standards associations follow a relatively elaborate procedure for promulgating standards (Cropper, 1980), these standards are not legally binding on any producer, except when formally adopted by a government agency. It is widely believed, however, that standards issued by the major organizations are almost universally adhered to,\(^4\) thanks probably to the role that such standards play in the product liability system. Failure to comply with a voluntary standard, where that failure can be shown to have caused the injury, is virtually certain to result in a finding for the plaintiff. This linkage leads the vast majority of producers to conform to such standards.

Many voluntary standards are also adopted by government agencies at various levels of government. For example, most municipal building codes include reference to voluntary standards, which then become requirements for new buildings to be certified for occupancy in those municipalities. Government agencies may also apply the standards to their own procurement, again restricting the market for producers who do not conform to the standards. Finally, federal regulatory agencies may adopt voluntary standards, thus making them mandatory (see Johnson, 1982, p.2).

\(^4\)For example, Meiners (1982, p. 306) suggests that relaxing antitrust laws so that producers in an industry could enter into a legally enforceable contract to conform to a standard might lead many industries to adopt and enforce high standards of safety without regulation.

\(^4\)This conclusion is based solely on discussions with informed lawyers and executives. No research or data appear to be available on this point.
Voluntary standards often also serve a preemptive function. In a number of cases, it is believed that industry developed voluntary standards in order to avoid the adoption of perhaps more stringent standards by a federal agency (Johnson, 1982, p. 13). If that is the motivation, the individual producer has an even greater incentive to comply with the voluntary standard, since a low compliance level may lead the regulatory agency to create a new mandatory standard, perhaps less acceptable to producers.48

We are concerned here with how voluntary standards affect design decisions of manufacturers. Two issues are relevant: the time it takes to promulgate a standard and the nature of the standards themselves.

In recent years, the process by which voluntary standards are created has come in for a great deal of scrutiny (Federal Trade Commission, 1983). Accusations have been made, though rarely sustained,49 that large manufacturers have used the standard-setting process to restrict competition (Nader and Mayer, 1978). One consequence of that has been an apparent increase in the cumbersomeness of the standard-setting process itself. More parties are now involved in discussions of the standards and more steps are necessary before the standard becomes final (Johnson, 1982, p. 8).

Standards are typically issued some years after the need for the development of a standard has been established. It is not unusual for the process to take five or more years for the initial standard.50 Most manufacturers comply with the standard even before it is finalized.51 Their compliance can reasonably be ascribed, at least in part, to the standard-setting process itself; i.e., the involvement of the firm in technical discussions of the standard will lead it to move closer to the projected standard level. Nonetheless, it seems that the standard-setting process frequently lags the market substantially, in the sense that much product innovation occurs before there is a relevant standard.

Another limitation on the effectiveness of the voluntary standard system is the use of design rather than performance standards. "A performance standard is stated in terms of the problem to be solved or the goal to be reached, whereas a design standard details how something must be built" (Harter, 1979, p. 171). Design standards, though clearly less desirable in most situations (since they constrain the

48The incentive varies with the producer's share of the relevant market. A large producer not in compliance is more likely to induce regulatory intervention than a noncompliant small producer.

49One exception is Hydrolevel v. American Society of Mechanical Engineers. The Supreme Court ruled that the ASME had set a standard that effectively excluded the Hydrolevel product from the market and that this was intended to lessen competition.

50Safety standards, as promulgated by ANSI, have an automatic review. After five years, the standard must be reviewed or it lapses.

51This statement, again, is based on discussions with informed participants. There exist no studies of the timing of compliance with voluntary standards.
manufacturer's choices in trying to achieve a given level of safety), are easier to formulate.

The adequacy of voluntary standards is challenged by a finding of the Interagency Task Force on Product Liability. The task force, investigating internal company standards that differed from the promulgated voluntary standards, found that 15 of the 20 firms visited used their own standards or similar criteria (Industry Study, Vol. 1; cited in Hammer, 1980, p. 47). While no firm is likely to violate any existing voluntary standard, such standards only slightly constrain the design choices for product innovation. That is, firms appear to develop their own more stringent standards, perhaps building on voluntary standards.

Yet another limitation of the voluntary standards is the restricted domain of information used in the standard-development decisions. Johnson (1982) found that, for numerous reasons, neither the product liability system nor insurance claims contributed to the data base formally used by the committees involved in standard development.

The time delay between an accident and the emergence of all the information in a product liability suit can be many years. In some instances, even at the end of the case substantial ambiguity remains about the cause of the accident. Johnson ascribes the lack of information from the insurance industry to the legal risks that would be incurred, as the result of the Consumer Product Safety Act, Section 15(b). According to Johnson:

If the disclosure of closed claims information to a standard-setting body were to disclose subsequently a claim in settlement of a defect that could "create a substantial hazard" or in other ways showed that the insured had earlier failed to comply with the provisions of Section 15(b), the insured firm could be subject to penalty by the CPSC. (p. 63)

Voluntary standards may well reflect a substantial part of the industry's knowledge from product liability suits and insurance claims. Nothing constrains individual participants from using this knowledge in the discussions. However, the reluctance to disclose the precise information to other participants in the course of discussion must to some degree limit its utility and certainly prevents its use in formal analysis.

Formal cost-benefit analysis, of the type that is increasingly imposed on federal standard-setting processes, is also rare in the voluntary standard-setting system. Given the great cost of assembling and analyzing all the relevant information, together with the considerable uncertainty that surrounds the outcome, this is scarcely surprising.

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52 Some participants in standard-setting procedures assert that though the minutes of proceedings and other file records do not reflect insurance and product liability material, these are informally introduced into discussions.
Linneman (1980) demonstrates the difficulty of assessing benefits and costs in analyzing the CPSC's 1973 Mattress Flammability Standard; he estimates benefits to be between $21 million and $1,060 million, with costs between $5.5 million and $66 million. Johnson (1982, Chapter IV) shows how little the results of cost-benefit analysis influenced the development of a particular voluntary standard that he studied. The concern that the CPSC might develop a standard itself was more important than adverse cost-benefit ratios.

The voluntary standards system undoubtedly serves a useful function. For all the cumbersomeness of its decision processes, it may function more rapidly than the regulatory standard-setting process (see Cornell, Noll, and Weingast, 1976, p. 495, concerning delays in regulatory standard setting). While the processes allow for inputs from consumer groups, they are less formally adversarial than regulatory proceedings and may thus be more efficient in their use of information.\footnote{They may also fail to include all valid professional inputs. For an example of a critique of a standard developed by a committee that did not include a human factor expert, see Meagher (1982).}

Nonetheless, such standards affect product safety only modestly. The need for consensus can be a major problem, leading either to a watering down of the standard or to a long delay in its formulation. For example, with respect to the formulation of a standard for chain saws, the major producers adopted alternative safety approaches; as a result, proceedings have gone on for more than a decade without the promulgation of a final standard.\footnote{The protracted development of a chain saw standard is described in Heiden, Pittaway, and O'Connor (1982).} Moreover, legal and competitive considerations limit the domain of information used in proceedings.

PROFESSIONAL ETHICS

Some professions have developed putatively strong codes of ethics that can be used to punish deviant behavior on the part of members of that profession. The medical association of each state has a mechanism that it occasionally uses to deprive doctors of their membership and hence of their right to practice as doctors. The bar association in each jurisdiction serves the same function for lawyers.

The professional ethical codes of those involved in product design might also play an important role in assuring that substantial effort is made to prevent the production of unreasonably dangerous products. For example, design engineers might require members of the profession to subscribe to a code of ethics that specifies the minimum precautions to be undertaken to prevent design defects before the engineer will permit the product to be manufactured. The failure of the firm employing
the engineer to carry out these practices could then lead the professional association, after attempting to persuade the firm to withdraw the product or change its decision processes, to blacklist the firm as a place of employment for members of the profession. Such blacklisting has been used by the American Association of University Professors to enforce their professional rules concerning academic freedom and a number of related issues, though not very effectively.

Professional ethical concerns apparently influence the design decisions of corporations, but we believe that there is little possibility, and certainly no current realization, of a role for professional associations of the type that we have just described. Better articulated ethical codes may increase the individual engineer’s sensitivity to safety issues and his organization’s responsibility for considering them. Firms might enhance the performance of their employees with respect to safety by creating forums in which their ethical concerns are given a proper role. But there is little to suggest that the raised ethical consciousness of professional groups involved in product design is likely to have a major influence on the safety performance of U.S. manufacturers.

Perrucci (1982) suggests that the professions that have most successfully created a role for the professional association in the enforcement of ethical behavior are those in which the professional, rather than an organization with other concerns, predominates in dealing with clients. Though doctors work for hospitals, even in hospitals, “the organizational structure of hospitals and the routines of hospital work are shaped by the practice of medicine as it is taught in medical school” (p. 119).

Engineers, who form the dominant group in the design of products, usually work in different organizational settings from those of doctors. The engineer works in an engineering department that is part of a large commercial organization the dominant concerns of which are not those of engineers. The engineers are seen as one group among many that must serve the interests of the firm as a whole; the firm does not exist for the purpose of providing them with a means of practicing their professions.

Moreover, engineers are not a single professional group. Many efforts have been made to unite the various subgroups of engineers (Pletta, 1982). An umbrella organization, the American Association of Engineering Societies, exists, but it has never acquired a major role for the individual professional groups. Given the fragmentation of the profession and the different settings in which the various groups practice their skills, it is unlikely that an effective set of ethical rules can be created covering all those involved in product design in corporations.

A recent analysis of the role of professional associations in the enforcement of their own codes supports this negative view. In reviewing the activities of licensing boards and professional societies in recent
years, Wilson (1982) found that only about one-fifth of practicing engineers are licensed, since numerous exemptions are made from the licensing requirements of these boards. The most important exemption, for our purposes, concerns employees of industrial companies, even those who work for a professional engineer. The codes are aimed at the independent professional, whose responsibility is most easily ascertained in a particular incident.

The canons of the model law for professional engineering ethics, which has been adopted in many states, are admirably unambiguous about the role of safety:

[Engineers] shall hold paramount the safety, health and welfare of the public in the performance of their professional duties. . . . If their professional judgment is overruled under circumstances where the safety, health, property or welfare of the public are endangered, they shall notify their employer or client and such other authority as may be appropriate. (Wilson, 1982, p. 91)

Wilson finds little evidence that boards have acted against engineers for violation of these canons, though he suspects that such violations are reasonably numerous. He concludes that “without redirection in the law and proper funding it is probably unrealistic to expect effective control of engineers’ conduct by engineering boards” (p. 92).

Wilson is equally pessimistic about the role of professional societies. An examination of 57 cases in the mid-1970s showed that almost all were concerned with advertising or fees. No cases dealt with gross negligence. After analyzing a recent case in which the American Institute of Architects had been forced to back away from a mandatory ethical code by the threat of a lawsuit, Wilson concluded “it is unlikely that the professional societies will ever be able to develop a strong internal system to deter and punish gross negligence or to ferret out incompetence in the profession” (p. 98).

Perhaps the most fundamental problem is that the safety of a product is not a matter that can be readily determined by a single individual involved in the design process. The typical product goes through many stages of design review; each individual is responsible for only some component of that review. Later changes in the design may be made without his knowledge, perhaps as the result of subsequent review of interactions with other subsystems not considered at the initial design decision.

It could still be argued that a professional society might, nevertheless, specify a procedure that had to be followed in order for the society to approve a firm as a potential employee of its members. The product liability system might provide the enforcement tool for this policy. Firms not approved by the professional societies might find their
positions in product liability suits much weakened. This assumes that in fact it is known how to describe an adequate product safety program. The great variety in the nature of product hazards, organizational forms, and legal settings, however, contradicts this assumption. Indeed, the fieldwork in this study indicated that, at this point in the development of organizational understanding, uncertainty continues to plague the generation of sound product review.

The weakness of professional ethical pressures is further evidenced by the lack of any serious effort to incorporate ethical issues in the education of the design professions. Indeed, the whole issue of product safety is given little attention. Flores (1982c) reports on interviews with chemists and engineers at Monsanto. "Many noted that if safety was mentioned at all it was given a low priority by their college teachers" (p. 24). Without an effort to include explicit analysis of the ethical problems likely to face engineers or chemists in the course of their professional activities, it is unlikely that even a more significant effort at creating and enforcing professional ethical codes would be effective.

CORPORATE REPUTATION

Consider a world in which injured consumers had no legal rights to compensation from producers of defective products and in which there were neither regulatory agencies with safety responsibilities nor voluntary standard-setting associations. Even in this world, manufacturers would have certain incentives to incur costs to avoid the production of goods that might possibly injure the consumer. The marketplace generates this incentive by giving consumers the opportunity to choose among products and among producers of a given product. The perceived safety of a particular good or a particular producer's good is one factor in that choice.

The strength of these marketplace incentives depends on certain characteristics of both the product and the marketplace. In this section, we explore the circumstances under which firms receive strong signals from the marketplace to invest in safety. In particular, we suggest that advertising and brand name differentiation are likely to be associated with high investments in product safety. We also consider the interaction of the marketplace, product liability, and regulation.

This discussion deals with an area of economic analysis that has only recently been developed. So far, research on the market for product quality, of which safety is one aspect, has produced results of limited power (Shapiro, 1982). The formal analytics turn out to be extremely complicated. Nonetheless, it is useful to set out some of the factors that economists have identified as influencing the marketplace for safety.
In the absence of government intervention, media interest, or the development of voluntary consumer associations (i.e., organizations that sell information about products), consumers have three sources of information about product performance: their own experience, experiences of friends, and the advertising statements of producers. We shall assume that advertising is regulated to the extent that producers are not permitted to make false statements. The producer may emphasize the safety performance of his product in his advertising, but he must represent it accurately.

Critical to an understanding of the role of reputation is the fact that consumers often cannot ascertain the safety of the product by observation. Other characteristics of a good, such as its price or volumetric capacity, may be ascertained by observation. Safety, however, can frequently be ascertained only through experience (one's own or someone else's) with the product. Automobiles and power mowers exemplify this class of good.

Consumers can choose the amount of resources they will devote to comparing the safety level of alternative purchases. They do this by altering the amount of time spent in asking acquaintances about their experience with alternative products and in reading advertising materials. How much time they are willing to spend in doing this is important for producers and is related to certain characteristics of the potential purchase.

The larger the purchase, the greater the potential return from search. A consumer will spend more time ascertaining the performance of a $10,000 automobile than of a $200 lawn mower. The return to the producer from emphasizing safety features, assuming that the hazards associated with the two products are similar, will be greater for the automobile producer.55

However, frequency of purchase also affects consumer choices about products and their safety characteristics. Since safety is an attribute detected through experience, more frequent purchases increase the consumer's (and his friends') knowledge about relative performance. Whereas the cost of the purchase affects the intensity of search, the frequency increases the availability of information. More frequent purchases will ensure that information about product defects will be transmitted more efficiently. That provides an incentive for the producer of frequently purchased products to invest heavily in avoiding defective products.

55The private production of safety information will also be positively affected by the cost of the purchase, since individual consumers will be willing to pay more for information on larger purchases.
Search and experience become less effective as the product innovation rate increases. As new producers and new products enter the market, previous experience may be considered less relevant in making choices among the new products. Manufacturers may place less emphasis on safety when the return to safety investments is defrayed over a shorter production run.

Search and experience provide information about two factors—the product and the producer. In the course of learning about the performance of Black and Decker lawn edgers, the consumer also learns about Black and Decker. Presumably that knowledge affects his decisions about other Black and Decker products when he makes decisions about other product purchases.

Producers may also choose to assure the consumer of the safety of their products through warranties, contracts sold with the product that state the producer’s willingness to accept certain obligations above those contained in the general doctrine of implied warranty. Spence (1977) argues that the primary function of the warranty is to indicate to the purchaser the manufacturer’s belief that his product is no more likely to be defective than those of competitors.

If two producers offer the same warranty terms, the producer with more defective products will incur higher costs in meeting his warranty obligations. A modest amount of empirical work (Gerner and Bryant, 1981) supports this proposition. Priest (1981) developed and tested an alternative theory that sees the warranty as a contract optimally allocating responsibilities, between consumer and producer, for making investments in prolonging the lifetime of the good. In Priest’s view, the warranty is not a signal of quality or safety.56

Characteristics of the consumer population also affect manufacturers’ investments in safety. Some consumer populations have uniform attitudes toward risk; others have diverse tastes. Parents purchasing cribs for infants are likely to be uniformly averse to risk. The population of automobile purchasers include some who are relatively unconcerned with safety and others who care a great deal. Manufacturers of baby cribs have strong incentives to create very safe products, while some automobile producers may be able to sell cars that are known to involve relatively high hazards for the drivers.57

56 For a sharp critique of Priest’s analysis, see Whitford (1982). Priest (1982) defends his results against Whitford’s methodological attack.
57 Indeed, the act creating the National Highway Transportation Safety Administration explicitly accepts the idea that purchasers can be allowed a choice with respect to the degree of safety in automobile construction. On the other hand, products affecting infant safety, such as toys, are generally subject to stringent safety standards. This would appear to be inconsistent with the hypothesized uniform risk aversion of purchasers of toys, since customers might be relied on to search out only safe products.
These propositions suggest the difficulty of predicting what level of safety would be supported in a market untouched by government intervention. The competitive structure of the market may further complicate the problem. Again, there are no robust theoretical propositions about the consequences of different market structures.

In a highly competitive market, safety may be enhanced if a producer is able to effectively communicate to purchasers, at least some of whom value safety highly, that he has a safer product. In contrast, if firms fail because of competition and if it is difficult to provide valid short-run signals of product safety, a low level of safety may result (Akerlof, 1970). Firms with market power, as in the automobile industry, may make safety decisions that represent perceptions about both the responses of their competitors and the distribution of safety-conscious consumers in the market population. We can compare the consequences of different structures only with strong assumptions (see Schmalensee, 1978).

Indeed, the structure and role of safety may interact; i.e., producer and consumer decisions concerning safety may influence the structure of the market. Consider a situation in which drugs were sold without any regulatory control on their safety. Consumers are presumably aware that some drug-related hazards have a long latency period; i.e., they will not be able to learn about the safety of a drug from the experiences of their friends, because some health effects will reveal themselves only months or years after use.

Assume that a new drug is developed by a firm new to the drug market. Consumers may be unwilling to purchase that drug in the absence of information about the firm’s permanence in the drug market; the firm might, after all, be skimping on safety and be relying on the long latency of the problems to provide profits before its failures become known. In contrast, consumers will be more willing to purchase from existing drug companies because the companies have acquired a good reputation. This interaction suggests that the unregulated drug market might have fewer producers than the regulated market in which a minimum level of safety is assured by the government.

Despite the lack of robust theoretical results, some evidence suggests that corporate incentives for assuring that their products are safe may now be increasing. Reputation is becoming an increasingly important asset for firms. At the same time, the institutions, both public and private, that disseminate reputationally relevant information with respect to safety are growing.

Government intervention may be justified by the subtlety of hazards arising from children’s use of products.
Firms invest in corporate-level advertising, independent of specific products. Such investment includes the sponsorship of public television programs and advertisements that describe the company without trying to sell particular products. Their objective is to provide an image of firm performance that will raise the desirability of all the firm's products for the general population or for broad subgroups (such as those who watch public television cultural programs).

The growth in recent years of national markets where before there had existed only local or regional markets has contributed to the increase in corporate-level advertising. Many consumer durables, the class of goods most relevant to our discussion, are sold by a small number of firms that are units of larger firms having other units that sell other consumer durables. The corporate name may be attached to a large bundle of goods bought by one household. In fact, some firms emphasize just that point in their corporate advertising.\(^5^8\)

This linkage raises the cost to the manufacturer of a defective product, since the major cost of a defect may be the loss of "reputational capital." Not only are consumers deterred from buying a product that has been found to be defective, but they are also less likely to buy other products of the same firm. An externality, so to speak, is captured within the firm. A major product safety problem can lower the firm's market share for all its products.

Moreover, lawsuits and regulatory proceedings generate a great deal of reputationally relevant information, which the news media disseminate. They report mandated recalls, major product liability suits, and verdicts adverse to the producer, particularly if these involve large awards to the consumer. The media thus provide an important link between the role of reputation and the two other major influences on the firm's product safety activities: product liability and regulation.

Finally, several other organizations collect information concerning defective products. While Consumers Union emphasizes product quality rather than safety in rating different goods, it also deals occasionally with the safety performance of durables. Other public interest groups, notably some associated with Ralph Nader, also generate information about defective products, which is publicized in various media.

None of the above implies that the marketplace alone will generate incentives for adequate levels of safety. It suggests, however, that changes in the structure of U.S. business, coupled with the liability and regulatory system and the increasingly aggressive news media, have improved the market incentives for producing safe products.

In sum, numerous influences external to the firm may affect its behavior with respect to product safety. Three of them may work

\(^{5^8}\)For example, Ford Motor Company in recent years has been advertising the fact that one of its subsidiaries is the nation's second largest plate glass manufacturer.
directly on the behavior: regulation, professional ethical concerns, and voluntary standard-setting. The first attempts to intervene directly in firm decisionmaking and has considerable significance in some settings. The other two are weak influences. The voluntary standards system, to the extent that it affects firm behavior does so indirectly, through product liability concerns.

Three other instruments work indirectly, through financial incentives: product liability, insurance, and concern for maintaining reputation. These operate through financial incentives. The greater ease with which injured consumers can bring suit, under the doctrine of strict liability, raises the expected cost of a product defect. This increased cost is reflected in product liability insurance rates. We have suggested that the potential loss of profits caused by a firm's loss of reputation because of a product safety problem has become more important. To a large extent, the effect of product safety failures on corporate profits determines corporate product safety behavior.
III. ORGANIZATIONAL INFLUENCES ON
PRODUCT DESIGN DECISIONS

This section discusses the internal workings of the firm. Unlike many economists, we do not treat the firm as a black box. We want to know how the firm perceives external stimuli and transmits them internally. We especially want to learn how organizational entities charged with various goals—such as enhancing product safety, aiding the firm to defend itself against product-related litigation, and effectively representing the firm’s interests before various regulatory bodies—affect the firm’s overall product safety performance.

To accomplish this, we examine how firms organize product development processes, since product safety is only one element of product design. The section thus provides the framework for discussing the results of published studies (summarized in Section IV) and information obtained from our field interviews (Section V).

DESIGN DECISIONMAKING IN THE MULTIPRODUCT,
MULTIDIVISIONAL FIRM

Decisions to develop or modify products are central to any firm’s survival. The process of developing or modifying a product involves a wide range of technical skills and the attention of different levels of management within the firm.

In their book, Research and Innovation in the Modern Corporation, Edwin Mansfield and his colleagues provide information, obtained from surveys taken during the 1960s, concerning the cost and time involved in new product development. The cost data are by now outdated, and development lead times may, in some cases, now have been lengthened as the result of increasingly stringent regulatory requirements. Still, Mansfield’s findings may be used to characterize the product development process and the role that various parts of the organization play within it.

According to Mansfield, the innovation process begins with the initiation of research concerned directly with the development of a product (i.e., basic research is excluded) and ends when the new product

\[^1\]The Wall Street Journal (July 23, 1982, p. 1) reported just such concerns with respect to new aircraft development.
becomes available for sale and delivery. He breaks down the process into the following five stages:

1. Applied research
2. Preparation of project requirements and basic specifications
3. Prototype or pilot plant design, construction, and testing
4. Production planning, tooling, construction and installation of manufacturing facilities
5. Manufacturing start-up.

These stages do not necessarily occur sequentially. Figure 1 shows the average timing and overlap of each stage of Mansfield's sample of 38 innovations introduced by 15 firms drawn from the chemical, machinery, and electronics industries. Note that the typical innovation

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**Fig. 1—Timing of five stages of innovative process (from beginning of applied research to marketing)**
required 17 months from the beginning of applied research to the marketing of the product. This period can be much longer for products that are mechanically complex (such as automobiles, where lead times of at least three years are typical for evolutionary model changes) or require major regulatory approval (such as drugs, where lead times may be as long as a decade). However, the innovations in Mansfield’s sample, as is true of most new industrial products, involved only relatively minor advances in the state of the art.

Table 3 shows the proportion of project cost incurred in each of the five stages and in the subsequent marketing start-up. Except for the

<table>
<thead>
<tr>
<th>Stage</th>
<th>Mean</th>
<th>Standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Applied research</td>
<td>16.9</td>
<td>17</td>
</tr>
<tr>
<td>Mean</td>
<td>3.0</td>
<td>5</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>3.9</td>
<td>6</td>
</tr>
<tr>
<td>2. Specifications</td>
<td>13.1</td>
<td>17</td>
</tr>
<tr>
<td>Mean</td>
<td>3.5</td>
<td>6</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>2.9</td>
<td>3</td>
</tr>
<tr>
<td>3. Prototype or pilot plant</td>
<td>12.6</td>
<td>8</td>
</tr>
<tr>
<td>Mean</td>
<td>40.9</td>
<td>17</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>44.0</td>
<td>17</td>
</tr>
<tr>
<td>4. Tooling and manufacturing facilities</td>
<td>41.4</td>
<td>29</td>
</tr>
<tr>
<td>Mean</td>
<td>37.1</td>
<td>10</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>30.4</td>
<td>18</td>
</tr>
<tr>
<td>5. Manufacturing start-up</td>
<td>8.3</td>
<td>8</td>
</tr>
<tr>
<td>Mean</td>
<td>4.5</td>
<td>6</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>13.6</td>
<td>9</td>
</tr>
<tr>
<td>Marketing start-up</td>
<td>7.4</td>
<td>12</td>
</tr>
<tr>
<td>Mean</td>
<td>11.0</td>
<td>12</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>5.5</td>
<td>2</td>
</tr>
</tbody>
</table>

SOURCE: Mansfield et al., p. 118.

Panel on Invention and Innovation, which reported to the Department of Commerce in 1967.

White (1971, p. 29) observes that in the late 1960s, the time from preliminary design sketches to model introduction actually increased to between four and five years.
case of chemicals, by far the greatest product development costs occur after the research stage. Only at the prototype and tooling stages do large sums begin to be spent. It is not surprising, therefore, to find higher-level management becoming much more actively involved once decisions must be made to advance projects to either of these stages.

To learn how these stages correspond to design activities, we link the Mansfield data to descriptions of the product design process provided by both Kolb and Ross (1980, pp. 100–105) and Anderson (1982, pp. 161–165) to obtain at least a partial picture. These authors break the product design process into three phases—the conceptual (or preliminary) phase, the intermediate phase, and the final preproduction (or detailed design) phase.

The output of the first phase is, according to Anderson,

> a somewhat general description of the functional performance of the product, a determination of the product features, estimate of the cost to produce the product, estimates of product reliability/life time, a description of the environment in which the product will function, some preliminary specification of the manufacturing processes to be used, and a description of any special characteristics that may be associated with the product (e.g., packaging, shipping, installing, etc.).

(p. 163)

Anderson’s first phase, then, corresponds to the early part of Mansfield’s stage 2. At the completion of this phase, a design review—the first of three—is conducted, preparatory to a decision of whether to proceed with the design.

In the intermediate design phase, according to Anderson,

> [S]uch things as mechanical layouts, electrical schematics, specifications, etc., are reasonably complete; but no specific hardware design, tooling for manufacturing design, or commitment to facilities has been made. (p. 164)

Rough prototypes probably have been constructed to test the concepts developed during the preliminary design phase and to further refine cost estimates. This phase roughly corresponds to the early portion of Mansfield’s stage 3.

The intermediate design phase also ends with a formal design review. At this point, issues of tooling, packaging, installation, instructions, and maintenance are considered. Following this review, a formal decision concerning whether to proceed to final design is made. If the product is a major one for the company, it is likely that higher-level management (i.e., management above the division level) will be involved in this decision.
The detailed (or final) design phase develops all information needed before the design can be released to the unit within the organization that will actually produce it.

Detailed schematics, detailed mechanical layouts with tolerances, finishes, materials, detailed computer software specifications, etc., must all be complete at the conclusion of this phase. Basic manufacturing processes must also be specified during [this] phase of the product design. (Anderson, p. 164)

During this third design phase, issues of manufacturability (including packaging and shipping) will have been fully explored. Engineers in the division that will manufacture the product (assuming final go-ahead is obtained) will be heavily involved in these discussions, as will officials in charge of quality control. Advertising, labeling, and associated literature will have been developed and checked for adequacy. Necessary certifications (such as that of Underwriters Laboratories) will have been obtained. The phase will end with a final, detailed review to ensure that the product is ready for manufacture.

This phase corresponds to portions of stages 3 and 4 in Mansfield's layout. The final design review and the decision concerning whether to release the design for production occur during stage 4. Construction and installation of actual manufacturing facilities complete this stage.

The above description applies to the development of new products. Minor product modifications probably would go through a shorter design process. Yet, even with minor modifications, the elements of the detailed (or final) design stage would be included. The more the product redesign involves new manufacturing methods or new technologies, the more likely it will require the complete design sequence.

This description has a number of organizational implications. First, several different organizational units are involved in one phase or another of the design process. During the course of its gestation, the product idea will move from its point of origin (a corporate-level research and development [R&D] laboratory, perhaps), through engineering (possibly at the group or division level), to the specific division that ultimately will manufacture the product. Individuals from departments such as marketing, quality control, legal, and insurance will be involved at various stages.

Top management may examine the product proposal as a strategic investment decision and perhaps may help determine the market niche at which to aim the product (a decision that is crucially affected by the product's proposed price and quality attributes). A "product champion"—an individual (or small team) responsible for moving the product through the various research and design stages and into
manufacturing—may have been appointed. Or the design and its associated decisions may have been passed along through the various layers of the corporate bureaucracy. The number of individuals having an interest in and affecting the design of the product is likely to change considerably, depending on the design stage of the product.

The second organizational implication is that certain key decision points mark the product gestation process. The values and concerns of the individuals included in the various design reviews and the subsequent “go” or “no-go” decisions will likely affect the character of the product that ultimately emerges (and, indeed, whether a product emerges at all).

Third, unless a specific decision is made to incorporate them in the design reviews and associated design activities, there is likely to be no way of assuring that safety considerations are surfaced and resolved appropriately. To be sure, virtually every decision that is made concerning the product will have potential safety ramifications. It is by no means clear that these ramifications will be recognized during, for example, an argument between engineering and marketing concerning the product’s external physical characteristics, its packaging, the instructions that will accompany it, or the design of the advertising that will be used to merchandise it.

Furthermore, if the product is built up from specific components, synergistic safety problems might well not surface during design reviews, especially if the product is viewed by its designers as incorporating proven components. Where the design involves adding a new feature (possibly incorporating a new technology, such as electronic controls) to a proven model, attention may focus almost exclusively on the new feature itself, to the neglect of safety hazards possibly introduced into other elements of the product by the new feature’s incorporation.

In short, in developing the design for new or modified products, safety is everyone’s business—and, therefore, may turn out in practice to be nobody’s business.

THE ROLE OF ORGANIZATION IN ENSURING GREATER ATTENTION TO SAFETY

Even without formal attention, safety considerations will play a significant role in the product design process. The “culture” of the designer and engineer assures that they do. Traditional concepts such as the margin of safety are consciously or unconsciously incorporated in decisions concerning the strength of materials to use and even the
choice of specific materials. Indeed, some engineers argue that the culture of their profession ensures that safety receives appropriate weight in design decisions and that further efforts are at best superfluous and at worst counterproductive. Kolb and Ross (1980) state the argument well (though disagreeing strongly with it):

Many engineers believe that a good design is by definition a safe design and that there is little need for safety organization and structure as long as engineers of competence are involved. "If product safety becomes part of the job and applied to the job, your program will be a success," said one safety engineer. "If a separate product safety group is established to serve as the watchdog and only the watchdog of the various corporate functions then your program is doomed to failure. Hence the importance of designing safety from the beginning." (p. 77)

The baseline against which the efficacy of formal organizational efforts within the firm focusing on safety must be measured, therefore, is not zero. Instead, such efforts must demonstrate that they can effectively strengthen an already existing concern for safety, reveal safety-related trade-offs that otherwise might not be noticed, and influence the resolution of these trade-offs in the direction of safety.

Means of achieving these safety goals—at least partially—can be introduced into existing design practice with little or no organizational change. Although most engineering students even today apparently receive little or no training in hazard identification and analysis, handbooks exist to provide this knowledge. These same handbooks show how safety issues can be incorporated into existing design reviews.

Nevertheless, the authors of these handbooks—and, indeed, all safety professionals whose works we read or to whom we talked—conclude that more is required. Specifically, they stress the importance of having some organization within the firm specifically devoted to safety issues. It is not that they consider improved knowledge and responsibility on the part of the individual design engineer and design decisionmaker to be unimportant. Rather, they argue that, without a formal organization, this improved knowledge will not be appropriately used and the proper amount of safety information will not be generated.

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3Kolb and Ross is one such source; Hammer (1980) is another.
The Need for Organization

The argument of these authors rests on three premises: the complexity of most current products, the subtlety of the hazards that can be generated during product use, and the conflicts generated by the multidivisional organization of most manufacturing organizations.

Product Complexity. Products today are made of exotic materials, incorporate complex and sensitive control devices, and must sometimes operate in extremely hostile environments. Often they are built up from subsystems that are themselves extremely complex products; the modern automobile is a prime example. They must be capable of being packaged in containers that serve multiple objectives: protecting the product during shipment, storing the product often over an extended period, and, ultimately, attracting the consumer to the product. It is not enough that each individual element of the design is safe; all of the components and packaging together must be safe—that is, they must not interact in complex ways to generate hazards where none were apparent.

Two examples from our fieldwork serve to illustrate this point. A major appliance manufacturer was redesigning its top-of-the-line version of a particular product to incorporate electronic controls. During this redesign, certain changes were made that, despite the manufacturer’s strict design review procedures, in service produced a potential electrical shock hazard. The manufacturer fortunately discovered the potential hazard before any injuries had actually occurred, and recalled the product.

The second example concerns a manufacturer of consumer durables who also had a strict program of safety design review. In this case, the method in which the product was inserted into its shipping container created a potential hazard. Again, the hazard did not turn up during normal review and did not result from either the product or the packaging but from their interaction.

Hazard Subtlety. The problems created by growing product complexity are magnified by changes in consumer use that generate subtle but potentially dangerous hazards. Today, many consumer products are sold by mass merchandisers whose salesmen are not familiar with the product and its intended uses. Some consumers also use products for novel (and unintended) purposes. But even where products are used as intended, the growing knowledge of how product design features can create an unsafe condition that overwhelms the ability of the user to cope with it—or, worse, creates cues that lead to the reverse
of the proper response—suggests the importance of formal identification and analysis of hazards.

Organizational Pressures. In the early part of the century, several rapidly growing manufacturing firms faced a major management problem. They were becoming so large that it was impossible for the chief executive officer, or even a small group of executive officers, to oversee all aspects of the firm's operation. To try to do this diverted management from the task of guiding the firm's strategic destiny. Yet, the firm would not manage itself.6

To solve the problem, large firms adopted a multidivisional form of corporate organization. Under this structure, operating units were grouped into divisions and given substantial autonomy in controlling their day-to-day affairs. Performance was monitored through financial controls based on a relatively small set of indicators, including return on investment, market share, and growth of sales.

Critical strategic issues were transmitted upward through the firm's structure, often being examined at different levels. By the time decisions reached the apex of the organization, many of the subsidiary issues connected with them ought to have been dealt with. Only the most difficult or controversial decisions were to remain for top management.

As we noted earlier, product introduction decisions are among the most important strategic decisions that management must make. Since the existence of a substantial safety risk in a product being considered for introduction is certainly a factor that would bear heavily on the product's likely profitability, it seems reasonable to expect either that all such hazards will have been detected and corrected before the product is presented to top management for a go-ahead decision or that any unresolved safety issues will be brought to management's attention as part of the decision.

In practice, this is not so. The structure that is set up to insulate top management from minor details may work to prevent it from learning about safety problems.

Few, if any, managements of large industrial enterprises would knowingly introduce an unreasonably dangerous product into the

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4Classic examples of this occur in aircraft accidents in which pilots act in ways that seem rational, yet thereby contribute to the accident. These accidents were attributed to pilot error until the interaction between pilot and aircraft were recognized. The pilot was receiving too much information from the vast array of instruments in the cockpit; unable to process it all in an instant, he sometimes made the wrong decision.

6On the evolution of management in large corporations, see Chandler (1962).
The question, therefore, is whether subordinate parts of the organization, operating semiautonomously under the influence of limited financial controls, can be trusted to surface and satisfactorily resolve all significant safety hazards without specific oversight to ensure that they do.

Consider, first, the number of individuals and units that must work together to design a product and ready it for production. As the description earlier in the section indicates, these individuals and units are spread throughout the firm—some in operating divisions, some at group level, some in corporate staff functions. Although a product manager or product champion is sometimes appointed to see that these diverse individuals and units from various parts of the organization work together effectively, complex or subtle problems may nevertheless receive inadequate attention, especially if no one has been assigned responsibility for their resolution.

Furthermore, one of the greatest pressures during design and tooling is to get the product ready. As Mansfield’s data indicate, 1–1/2 years typically elapse between the start of applied research and the beginning of marketing. In many cases, the time is much longer. During this entire preintroduction period, the product development process drains the firm’s earnings.

Actions that either add to direct cost or require additional time increase the probability that the product will fail to earn its required return in the marketplace. Especially if there is an attitude that safety problems are being handled by “someone” and that safety is not a problem as long as competent engineers are involved, there is likely to be resistance to taking the time and resources required first to surface subtle or complex hazards and then to redesign and retest to assure that they have been properly dealt with.

The Benefits of Good Organization

Product safety organizations can (and often do) exist at several levels within the organization. In this discussion, we concentrate on

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6It has been alleged that Johns-Manville, the major producer of asbestos products, was aware of the health hazards associated with its products and suppressed the relevant data. For a summary of the issue, concluding that Johns-Manville did not act improperly, see Epstein (1962, pp. 18–19).
what seem to us to be the most important locations: the division level and the corporate level.\textsuperscript{7}

\textbf{The Divisional Product Safety Organization.} The prime responsibility for actively ensuring that safety factors are adequately considered rests with the division producing the product. Even if the idea for the product originates outside the division (in the corporate R&D laboratory, for example) and even if certain of the marketing and engineering responsibility is at corporate or group level, the division performs the bulk of the actual detailed design work required to prepare the product for manufacture.

The interaction of such things as manufacturability, quality control, and packaging can be perceived at the division level. The division is most likely to know about the product's underlying technology and conditions of use. Finally, the division's financial performance is likely to be most directly affected by the failure to adequately deal with safety issues during the design phase. It will typically bear the cost of any necessary recalls, of warranty work, and, possibly, of product liability claims and suits.

A division may assign an individual the responsibility for overseeing its safety activities. This individual makes certain that engineers in the division know and use appropriate techniques to identify, evaluate, and deal effectively with hazards. The safety officer may generate checklists incorporating safety issues to be used in design reviews, see that these checklists are used, and participate in design reviews. He may provide information on how to resolve difficult safety issues and on the implications of current law and regulations. Within limits (as discussed below), divisional product safety officers may help individual engineers deal with the conflicting pressures of product safety, on the one hand, and the rush to get the product to market within the anticipated budget, on the other.

\textbf{The Corporate Product Safety Organization.} While the divisional product safety organization probably will have the primary operational responsibility for assuring adequate attention to product safety in individual cases, all commentators agree that the corporate-level function plays a critical role in the firm's overall safety effort.\textsuperscript{8} In a large company, however, the corporate-level product safety manager cannot, because of time constraints, participate in all product safety

\footnotesize{\textsuperscript{7}The intermediate (or group) level in most large corporations generally plays a minor role in safety matters. The reasons for this are discussed in Section V.}

\footnotesize{\textsuperscript{8}The statement of [safety] policy should . . . come from a high level in management. Separate policies for design, production, and marketing simply will not do. These groups are, to some extent, mutually antagonistic in their immediate goals" (Kolb and Ross, 1980, p. 73).}
decisions. Even if “hands-on” responsibility were possible, the involvement of a corporate-level staff member in operational issues at the divisional level violates the principle of divisional autonomy. How is this dilemma resolved?

In *The Structuring of Organizations*, Mintzberg discusses the difficulty of linking diverse and normally autonomous parts of complex organizations so that they can focus on a particular objective. He terms organizational structures aimed at this goal *liaison devices* and divides these into three levels: liaison positions, task forces and standing committees, and integrating managers. These three levels correspond to the formality of control desired and the permanence of the problem being dealt with.

We believe that the corporate-level product safety activity is best seen as a liaison device. As will become clear in Section IV, organizations structure their corporate-level activities at different points along the spectrum of liaison devices, depending upon their management philosophy, the perceived criticality of their product safety problem, and the nature of their business. All such units, however, seem to fall into the category of liaison devices.

A description of the functions that corporate-level product safety units may perform illustrates their liaison role. First, corporate-level units, like divisional units, may educate. They may organize training for managers and engineers to acquaint them with new techniques for hazard identification and hazard elimination. They may inform managers and engineers of legal and regulatory developments and even conduct mock trials to show engineers the type of issues that arise in actual product liability cases. This could help to sensitize these engineers to what may be expected of their designs when the products enter the marketplace.

The safety units may inform each part of the organization about the safety activities of the other parts. In large corporations, where divisions are often geographically separated, this intrafirm diffusion of knowledge may be important. It is one thing for someone to know what a textbook says can be done to identify and eliminate hazards; it is quite another thing to be shown that someone else in the company has put such theory into practice.

Second, corporate-level product safety officials may perform the task of auditing, i.e., ascertaining that division officials are conforming to the corporation’s policies. We noted earlier that divisional product safety officials can develop checklists, make sure that they are used, and even sit in on design reviews. Checklists can—and perhaps for
legal reasons should—be developed at the corporate level.\textsuperscript{9} It is probably not practical, however, for the corporate-level product safety officer to participate in design reviews for all new products.\textsuperscript{10} Some sort of auditing function seems essential.

Third, corporate-level product safety organizations may transmit and reinforce top management's commitment to product safety. All commentators underscore the importance of top management's commitment to the success of a firm's product safety program. Among the things universally recommended is a formal corporate policy statement on safety. But these same commentators emphasize the uselessness of such statements and other professions of commitment if they are not followed up effectively.

The corporate-level product safety activity may be the principal channel for following up the firm's commitment to safety. If top management supports the implementation of recommendations by corporate-level product safety officers in the field, this provides a strong signal of the seriousness of management's commitment to product safety. If the corporate product safety officer can introduce indicators of safety performance into the measures used to judge the performance of operating divisions so that the consequences of poor safety performance are reflected in the division's profitability (and division executives' bonuses), this also sends a signal.

Finally, the corporate-level product safety officer can act as a court of appeals when a safety issue arises. We noted above that divisional product safety officers may help to overcome organizational pressures to slight safety considerations in the interest of saving money or time during the design phase. A corporate-level safety officer who stands ready to back up division-level safety decisions or, if necessary, to carry them directly to the highest levels of the company may be an important factor in assuring adequate consideration of safety. A corporate product safety officer who cannot do these things sends the opposite signal.

Flores (1982c) stresses the importance of the corporation's cultural setting as a factor in ensuring adequate attention of lower-level design engineers to safety issues. He notes that because engineering schools give inadequate safety training even today, young engineers must learn safety techniques primarily in the corporation. Furthermore, the general attitude toward safety, of which the firm's formal safety program

\textsuperscript{9}The corporate product safety officer should at least see that checklists developed and used by divisions do not differ significantly and that divisions do not differ inappropriately in the degree to which such checklists—and other safety techniques—are used.

\textsuperscript{10}We encountered one case in which he attended at least the final design reviews.
is an important part, critically influences how seriously individual design engineers view safety problems. Based upon his interviews of engineers in a number of companies, Flores concludes:

It is apparent that the attitude which engineering supervisors, management, and safety officials take toward safety has an influence that permeates each of the tools already mentioned above [formal safety reviews, checklists, etc.]—so much so that inadequate commitment to developing safe products can directly undermine the seriousness with which design engineers take safety reviews, safety standards, etc., meant to insure product safety. Conversely, the genuineness of management's commitment to product safety will be reflected in the actions, decisions and policies it implements and may be meaningfully reinforced by design and safety standards, manuals, procedures, reviews, and other formal institutional requirements promoting safety in design, which engineers must satisfy. Where that commitment is genuine, the design practices of engineers will exhibit a conscientious concern for product safety. This is simply because as far as management is concerned designing for safety is one of the design engineer's important role-responsibilities. In short, failure to pay adequate attention to safety means unsatisfactory performance of an engineer's duties, with consequent institutional penalties. Thus, where there exists a clear commitment to producing safe products, this can produce an atmosphere which encourages engineers to vigorously pursue questions relating to safety of the designs they are required to fashion. (p. 183)

Management decisions which opt for increasing product safety convey the view that it is concerned "to get the job done right." And when it accepts the financial burden this implies, it is a clear statement in favor of safety which cannot be misunderstood. (p. 184)

The corporate-level product safety activity, through its access to top management as well as to the divisions, may well be a central factor in setting this atmosphere of safety in the firm.

**THE POTENTIAL FOR CONFLICTING PRODUCT SAFETY GOALS**

Thus far in this section we have not taken explicit account of the various external social pressures affecting firms' decisions regarding product design. We have discussed whether, owing to the organizational complexity of the modern multidivisional corporation, the technical complexity of the products it produces, and the subtlety of the hazards these products can sometimes generate in the hands of users, there might be an argument for creating somewhere within the firm a unit (or units) whose principal task is focusing on product safety
issues. We have left unstated the underlying motivation. It could be short-run profitability, effective management control, or the production of quality products. It doesn’t really matter. We have argued that such a unit (or units) could indeed play a useful role in assuring adequate attention to product safety issues.

We saw in Section II that the number and kind of social pressures on the firm to improve its product safety performance have been growing over the past decade or so. These pressures often have implications for the firm’s profitability. Therefore, they may be expected to reinforce tendencies on the part of firms to adopt organizational responses as a partial cure for their product safety problems.

Here, we examine whether certain of these pressures—specifically the growing volume and expense of product liability litigation and the need to represent the firm’s interests effectively before various federal regulatory bodies—might not create their own independent pressures to establish within the firm organizations with potentially conflicting safety policy goals. We argue that they do and, indeed, that there is some logic in combining these duties with the sort of “operational” duties we described earlier in this section. However, doing so may produce conflicts.

At least in principle, the organizational arrangement that best defends the firm against product liability claims and suits or provides the most effective regulatory liaison may differ from the organizational arrangement that best reinforces the incentives of those involved in product design to direct adequate attention to issues of product safety. We describe what some of these conflicts might be, setting the stage for our analysis of published survey data and of our own interviews in Sections IV and V.

**Improving the Firm’s Ability to Defend Itself against Product Liability Claims and Suits**

An organized product safety effort may improve a firm’s defense posture in several ways. A product safety unit may be assigned the task of processing and settling product liability claims and tracking product liability litigation in which the firm is involved.

Units at the division level (or below) may be expected to know especially about individual products against which claims or suits have been filed—how the products were designed, tested, and manufactured; how they should or should not be used; the characteristics of users, etc. The participation of these units in the early stages of product development, their closeness organizationally to individual design engineers,
and the probable training of these participants all assure their ability to deal effectively with a flow of claims against a single product.

Where liability suits involve many different products, a corporate-level product safety unit can serve as an aggregator of corporate experiences in dealing with product liability issues. Such units can help divisions faced with claims but lacking experience in their handling and tap the services of staff units—the legal department, corporate research and development, etc.

An organized product safety unit may also bolster a firm’s defense posture by ensuring that the firm’s own standards and procedures are being followed. Nothing weakens a firm’s legal defense faster than the revelation that such a slipup has occurred.\(^1\) For this reason, product safety units, especially at the higher levels of an organization, are often assigned auditing functions.

To be sure, an effective product safety audit procedure can serve objectives other than merely enhancing the firm’s legal defense. As we have already noted, firms that lay great stress on modifying their design procedures to assure product safety should be expected to employ audits as a tool. But audits differ, and some might be more defense-oriented than others. An audit may be designed primarily to ascertain that specific procedures have been followed and that required documentation exists (or does not exist if not required)—a defense orientation. Or, an audit may be designed to examine whether safety-related decisions were reasonable, regardless of the specific procedure followed—a more operational orientation.

Finally, a safety unit can improve a firm’s defense posture by investigating product safety failures. Many observers stress the importance of an active investigation effort to defend against fraudulent or inflated claims, and stories are common of allegations that, upon investigation, proved unfounded.\(^2\)

This activity, too, may contribute to an operationally oriented product safety program, but it need not. A clue to the firm’s principal interest in accident investigation may be whether it had formal procedures to feed such information back to its design activities, or whether it employed such information solely for litigation purposes. If the firm employed its own engineering personnel to conduct investigations, rather than contracting such work to outsiders, this also might be a sign that the accident investigation function had an operational as well as a legal orientation.

\(^{11}\)We cannot cite cases precisely because the manufacturer will rarely contest, let alone appeal, such a case.

\(^{12}\)See, for example, Nelson (1980, pp. 614–616).
The operational and legal objectives of a firm's product safety activities may therefore conflict. Given current legal incentives, such conflict is all but unavoidable. The operational objective requires increased formalization and documentation of design-related decisions; it requires the disclosure and satisfactory resolution of difficult safety-related trade-offs. These requirements may endanger the legal objective. As one pair of commentators noted, "the manufacturer's records are often a two-edged sword that can be turned against the manufacturer to establish liability on the manufacturer's part" (Williams and Spoto, 1980, p. 712). Subsequent sections will discuss how companies resolve this difficult dilemma and the role that liability laws play in helping to enhance or reduce conflict between these two objectives.

**Representing the Firm's Interests before Federal Regulatory Bodies**

Dealing with the regulatory agencies—learning about their proposed activities, developing company responses, ensuring the implementation of regulatory requirements, and, inevitably, keeping regulatory records—is an important function of many product safety units. To a degree, this liaison serves a purpose akin to that of the legal function—it is defensive, although in another arena. But more than "damage limitation" may be involved, especially for the company that structures its product safety program appropriately.

The activities of federal regulatory agencies extend far beyond their primary rule-making function. Many such agencies collect and disseminate important information on the characteristics of product-related accidents. Given potential problems of competition and litigation, the manufacturers often do not themselves collect and exchange detailed data on product performance.

Federal regulatory agencies such as CPSC and NHTSA also have the power to force manufacturers to recall products that they (the agencies) deem defective. The exercise of this authority sometimes seems—and, indeed, may be—highly arbitrary. However, the requirement that firms be able to locate and notify their customers of potentially serious product defects and to refund the customers' money or repair or replace the product reinforces manufacturers' incentives to monitor the performance of their products in the field.

This requirement regarding product defects may cut two ways. The law requires firms to inform the government of a potential defect as soon as it is discovered. However, determining whether a particular incident can be linked to a pattern of similar incidents, thereby
creating the presumption of a defect, sometimes requires considerable investigation. Fearful of an arbitrary response, the firm may be reluctant to inform the agency before it has completed its investigation. A firm may deliberately distance its accident investigation function from the individual responsible for regulatory liaison. In an effort to counteract this trend, agencies have been broadening the definition of "responsible individual" for purposes of defect reporting.

The Consumer Product Safety Act also requires the maintenance of records to ensure that firms are complying with its provisions and grants the CPSC access to these records. This requirement may encourage formalization and documentation of design-related decisions, or it may be seen as enhancing the danger to the firm's defense posture posed by potentially incriminating "paper trails." Much depends on how the commission chooses to exercise its powers in this regard and on how a firm's product safety managers choose to interpret the requirement.

Federally established standards play a mixed role in product safety activities. Although they provide goals for the firm, meeting them has provided little or no protection in a product liability suit, while failing to meet them, even if they make little sense, has been treated as prima facie evidence of liability.\footnote{Under the Department of Commerce's proposed Model Uniform Product Liability Act, compliance with governmental and regulatory safety standards would be admissible as a defense in product liability litigation, but this defense could be overturned by a showing that a reasonably prudent product seller could have taken additional precautions. According to Birnbaum (1980a, p. 24), this merely restates existing common law. Several states have gone beyond this and have made compliance with governmental safety standards an absolute defense.}

The regulatory liaison function of product safety units may therefore also conflict to some degree with the operational requirements for improved product safety. Whether such a potential conflict turns out to be serious in practice, and how government agencies and firms themselves might act to reduce it if it is, are subjects to which we shall return.

Product Safety as a Multiple-Objective Activity

The formal product safety activities of an individual corporation, as we have seen, serve multiple objectives. They may attempt to improve the quality of design decisions by helping to surface important safety-related trade-offs, establishing design audit procedures and then ensuring the substantive use of these procedures, and transmitting the message that product safety matters throughout the organization. They
may also coordinate the firm’s product liability defense efforts. Finally, they may play an important regulatory liaison role.

As we have also seen, effective regulatory liaison or product liability defense may conflict with making the operational changes required to improve design practices. Furthermore, the nature of the particular product safety problems that a firm faces—including whether product safety became an issue within the firm because of an important lawsuit that the firm lost, a clash with a federal regulatory body, or a decision by a high-level executive that increased attention to product safety might be good business—likely determines where the firm’s product safety units are lodged organizationally, how they are staffed, and what mix of objectives they seek to fulfill.

These hypotheses are illustrated in Fig. 2. One of three sorts of stimuli—regulation, litigation, or what we label voluntary efforts—or, more likely, some mix of the three, shapes the firm’s particular perception of the product safety problem. The firm may see it as a legal problem (an increased exposure to product liability claims and suits); a regulatory problem (the need to designate a responsible person for CPSC purposes, to keep certain records, to deal with recall issues, to argue against and, if necessary, shape any standards affecting the firm’s products that federal agencies may propose); or an operational problem (the need to reduce the rate of unsatisfactory products produced by the firm, to enhance the firm’s reputation for quality, etc.).

The firm’s perception of the product safety problem will color the organization, placement, and staffing of the firm’s formal product safety efforts, giving them a legal orientation, an operational orientation, or a regulatory orientation. “Pure” cases are unlikely; a mix of orientations, with a resulting emphasis that could be characterized as primarily legal, regulatory, or operational, appear to be more common. This orientation will affect the changes (if any) that the firm makes in its design and manufacturing practices and, ultimately, the changes (if any) in the safety of the firm’s products.

The changes that might result from an operational orientation and their ultimate effect on product safety are the most obvious and, indeed, are the changes hoped for by those who argue that the creation of product safety units is socially valuable. But, to the extent that either the legal or regulatory orientations do not totally conflict with the operational orientation (or themselves generate perverse changes in design and manufacturing practices, such as defensive documentation or defensive engineering), product safety organizations having these primary orientations might still be expected, on balance, to bring about operational changes that ultimately would lead to safer products.
Fig. 2—Model of product safety improvement

However, the implicit hypothesis that more product safety organizations inevitably mean safer products cannot be maintained without an investigation of the intervening relationships shown in Fig. 2. We now turn to that task.
IV. ORGANIZATIONAL RESPONSES TO PRODUCT SAFETY PRESSURES: SURVEY AND CASE STUDY EVIDENCE

In this and the next section, we discuss evidence concerning the role that formal safety organizations actually play in large manufacturing firms. We use three types of information: first, two large-scale surveys, one conducted by the Machinery and Allied Products Institute (MAPI) in 1976 and the other by the Conference Board in 1978; second, case studies of safety organizations conducted by a group of academics; and third, the results of interviews that we conducted in 1981 and 1982 with product safety officials and other knowledgeable individuals in ten large manufacturing firms.

This body of information suggests that formal product safety efforts, carried out through organizations specifically created for that purpose, play an important role—at least in some firms—in improving product safety. However, not every firm would be better off if it established such an organization. While product safety organizations, if appropriately structured and effectively integrated into a firm's design activities, can enhance product safety incentives, they can also undercut those incentives in subtle ways.

EVIDENCE FROM LARGE-SCALE SURVEYS

Large-scale surveys provide useful information about broad patterns of corporate perceptions and responses. Fortunately, we have available the results of two such surveys.

The Machinery and Allied Products Institute Survey

In 1976, the Machinery and Allied Products Institute, a group long interested in product liability issues because of the frequency and size of claims against its members, published the results of a survey of its members conducted earlier that year (U.S. Department of Commerce, 1977c).\(^1\) The institute received responses from 210 firms. The

\(^1\)The institute had long stressed both the need to get the product liability problem under control and the value of organized efforts to prevent product liability. Several of
respondents varied widely in size, but 26 reported sales volume of greater than $1 billion per year. Most companies (91 percent) reported that their output was "limited primarily to industrial products."

Approximately 80 percent of the MAPI survey companies reported that they had an individual or committee "having special responsibility for product liability." Some 117 companies reported a committee (38) or individual (79) at the corporate level; 47 reported such an organization at the division or subsidiary level; 50 reported coverage at both corporate and division levels. Most committees or groups operated only part-time.

These groups and individuals had the following responsibilities:

<table>
<thead>
<tr>
<th>Task</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Approval of product design</td>
<td>57%</td>
</tr>
<tr>
<td>Approval of a product for manufacture</td>
<td>52%</td>
</tr>
<tr>
<td>Approval of advertising</td>
<td>58%</td>
</tr>
<tr>
<td>Recall of a product</td>
<td>55%</td>
</tr>
<tr>
<td>Settlement of product claims</td>
<td>65%</td>
</tr>
<tr>
<td>Control of product liability litigation</td>
<td>72%</td>
</tr>
<tr>
<td>Insurance coverage</td>
<td>66%</td>
</tr>
<tr>
<td>Approval of instruction manuals</td>
<td>74%</td>
</tr>
</tbody>
</table>

Other duties mentioned in the survey (but without data concerning their frequency) included special responsibility for regulation and codes; approval of warning signs and labels; tracking and investigating claims; accident investigation; selection of defense counsel; authority to try or settle; selection of expert witnesses; and determination of whether to cross-file against suppliers and dealers.

Companies stating that they employed a committee for product liability prevention reported the following corporate functions represented on these committees:

<table>
<thead>
<tr>
<th>Function</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineering</td>
<td>88%</td>
</tr>
<tr>
<td>Manufacturing (quality control)</td>
<td>80%</td>
</tr>
<tr>
<td>Risk management and insurance</td>
<td>73%</td>
</tr>
<tr>
<td>Design</td>
<td>70%</td>
</tr>
<tr>
<td>Law</td>
<td>65%</td>
</tr>
</tbody>
</table>

The leading product liability cases and several of the larger jury awards had involved industrial machinery. In 1967, the institute conducted a seminar on product liability issues and published the proceedings of this seminar in a book, *Products Liability and Reliability*. A second seminar, in 1972, also resulted in a book, *Company Programs to Reduce Products Liability Hazards*. The institute's president, Charles W. Stewart, served on the advisory committee to the Interagency Task Force on Products Liability, and the 1976 survey seems to have been conducted with a view toward its being used by the Interagency Task Force. It was published both as part of a section of Task Force Working Papers and separately by MAPI.
Research and development 62%
Safety 59%
Marketing 58%
Advertising 44%
Purchasing 30%
Industrial relations 18%

Although the chairmanship of such committees varied, by and large, they were held by a member of general management (about 1/3 of the respondents) or engineering (about 30 percent of the respondents).

The MAPI survey reveals that, by the mid-1970s, many firms in the industries covered by MAPI’s membership—primarily industrial machinery—considered the product liability problem serious enough to have taken specific organizational steps to deal with it. The organizational steps taken were diverse, but seemed to have been aimed in two general directions—control over the critical steps associated with product design and distribution and control over various aspects of the firm’s product liability litigation. Both technical and legal skills were heavily represented on committees involved in product liability prevention.

The Conference Board Survey

In 1978, the Conference Board published the results of a survey that provided information about the organization and operation of the product safety function in individual companies (McGuire, 1979). The report contains, for example, a detailed description of the ITT program (pp. 29–38); it also describes the positioning of the product safety function at Zenith, Ex-Cell-O, Bell and Howell, Colt Industries, Alcoa, and Eastman Kodak (p. 18).

The Conference Board survey was confined to large companies—all of the approximately 300 respondents were drawn from the nation’s 2000 largest firms. The Conference Board respondents also seemingly had broader product lines than the MAPI respondents. Whereas 95 percent of the latter had characterized their markets as primarily industrial, the Conference Board respondents reported their product line characteristics as shown in Table 4.

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2The survey asked the following questions: Does your company have a product liability “problem”? If so, how would your company describe it? Some 183 companies reported a problem; only 22 said that they had no problem. Of the 183 with a problem, 38 called the problem serious; 96 called it potentially serious; 36 called it costly, but not of great magnitude; and 13 called it minimal. In other words, while only 18 percent reported an actual serious problem, nearly half were afraid one would develop.
Table 4
PRODUCT CHARACTERISTICS OF CONFERENCE BOARD
SURVEY RESPONDENTS
(In percentages)

|                      | All | Divi- | Nondivi-
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
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<tbody>
<tr>
<td></td>
<td>n = 300</td>
<td>sion-</td>
<td>alized</td>
</tr>
<tr>
<td></td>
<td>n = 251</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solely consumer</td>
<td>10</td>
<td>7</td>
<td>23</td>
</tr>
<tr>
<td>Primarily consumer</td>
<td>22</td>
<td>22</td>
<td>23</td>
</tr>
<tr>
<td>Solely industrial</td>
<td>20</td>
<td>17</td>
<td>31</td>
</tr>
<tr>
<td>Primarily industrial</td>
<td>34</td>
<td>36</td>
<td>21</td>
</tr>
<tr>
<td>Consumer and industrial</td>
<td>15</td>
<td>17</td>
<td>2</td>
</tr>
</tbody>
</table>

The Conference Board survey revealed that in a majority of the firms surveyed the product safety function was quite new (Table 1, p. 5). Kenneth Randall, president of the Conference Board, wrote in the foreword to the volume reporting the survey results:

Until the early 1970s, relatively few firms maintained a separate, formal product-safety function. More often, safety responsibilities were assigned internally on an informal basis and were judged to be the implicit concern of those scattered units in the company who designed, produced, and sold its products.

By the late 1970s, the function was commonplace. Indeed, divisionalized companies typically had formal product safety activities at several levels of the firm (Table 3, p. 12). But, as the report also shows, the executive to whom the product safety unit reported typically did not devote full time to this activity, although he may have had a full-time staff (Table 6, p. 451).

Certain differences in organizing style were noted, some of which were related to the nature of the firm's product line. For example, although the underlying data were not reported, McGuire remarked that manufacturers of consumer goods were more likely to have full-time product safety executives based at corporate headquarters than were the producers of industrial goods. The greater likelihood of finding product safety executives in firms producing consumer goods may be explained by the fact that several of the Conference Board
respondents had initiated safety efforts (either formal or informal) in response to the passage of the Consumer Product Safety Act and, in particular, its reporting requirements (Section 15-B).

As to differences depending upon the level of placement within the firm, the report noted that "among those firms where product-safety responsibilities are primarily at a corporate level, the safety units are often relatively small and mainly perform a staff coordination and consulting function." Group-level product safety committees were found to be "an exception rather than the rule."

Firms with group-level organizations usually have other substantial staff resources at this level. A minority of the respondents were found to have completely decentralized the product safety function to the operating division. Where this had been done, one or more of the following characteristics were found to exist:

1. A company's product-liability risks, because of the nature of its products, may be concentrated in the one or two divisions deemed "closest to the problem" and thus believed by management best able to handle their own safety requirements.

2. A firm may have grown rapidly, primarily through acquisitions, and each of these acquisitions, which later became an operating division, may have had a product safety unit. The parent firm may have seen little need to disband such units and may not have established a coordinating function at a group or corporate level.

3. The products and services of each division may be so specialized and technical that the safety aspects of the products or services are best monitored and controlled at the division level.

4. As a matter of overall company policy, divisions may be fully responsible for almost every aspect of their operations, with little corporate- or group-level assistance.

5. The operating divisions in some firms are so large that a safety unit located at either the corporate or group level probably could not assist them. As noted earlier, however, by far the largest number of companies favored a combined approach which employed product safety functions at both the division (and/or group) level and the corporate level.

This diversity of organizational styles was attributed in part to the novelty of the function. In his foreword, Randall wrote:
The fact is that, even now, few companies have been entirely satisfied with the organization of their product-safety efforts or with the various procedures by which they attempt to monitor safety performance and respond to product-safety emergencies. This accounts for the flurry of experimentation still under way.

A few broad characteristics help to explain the pattern of organization adopted by the survey respondents: the need of consumer goods manufacturers to be able to respond to CPSC, as noted above; the nature of the product’s users; the degree of hazard of the product; and the size of the organization.

Given this diversity in organizational responses and the lack of any well-accepted principles concerning the organization and operation of product safety units, the wide range of duties assigned to them comes as no surprise. Table 5 shows this range of duties. A few patterns emerge: First, the corporate level and minor division level predominate in what we call the legalistic functions—those dealing with product liability claims and safety regulatory agencies. Only the minor division predominates in the operational functions. The reluctance to assign “operational” product safety duties to corporate-level product safety units (except for the role of educator) seems consistent with the desire of top corporate decisionmakers to delegate such responsibilities. Where they are thus delegated, the delegation is usually to the minor division level.

Finally, the report discusses the prevalence of product safety committees. The majority of firms do not have such committees at any level. Nondivisionalized companies seem to use the committee approach more than divisionalized companies. Technical skills (engineering, etc.) seem most heavily represented on committees in nondivisionalized companies and on committees at the major division level. In contrast, corporate-level committees are dominated (in terms of representation) by legal skills. The safety representative may be either an engineer or a lawyer. The extremely infrequent representation of the product design function on committees at all levels may indicate that engineering is a surrogate for product design.

The report mentions, without giving statistical detail, the following four primary duties of product safety committees:

1. Helping to establish safety policies and procedures for the company (or the operating unit represented by the members).

3Data on committee composition were presented in Table 10 (p. 83). No data were given for minor divisions.
Table 5
PRINCIPAL FUNCTIONS OF PRODUCT SAFETY UNITS
(In percentages)

<table>
<thead>
<tr>
<th>Function</th>
<th>Corporate</th>
<th>Group</th>
<th>Major Division</th>
<th>Minor Division</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Legalistic</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Processing product liability claims</td>
<td>72</td>
<td>33</td>
<td>19</td>
<td>85</td>
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<tr>
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2. Providing consultation to top management on safety matters (in particular, developing guidelines on the safety implications inherent in product design and testing; product emergencies—including recalls and major failures; product-use instructions and labeling information; advertising; and safety-related record keeping).
4. Coordinating company safety efforts with respect to product-recall campaigns; liaison with regulatory agencies; product-liability litigation defense; and so on.
The report notes that corporate-level product safety committees seldom attempt to exercise operational control over product safety decisions, since individual units are considered better able to perform these duties. However, because of their direct access to top management, such committees can exert substantial indirect leverage over an operating unit whose safety performance is considered below desirable levels.

The Conference Board survey provides valuable insights into how corporations across the economy are organizing to deal with their product safety problems. It confirms that these problems have been perceived by firms as having strong operational and legal (including regulatory) components. The wide diversity of organizational responses is dismaying to the student of organizational behavior, but it is not surprising in view of the variation in customers and technologies faced by the firms, as well as the lack of any clearly demonstrated superior organizational pattern, a matter we shall discuss in detail below.

EVIDENCE FROM DETAILED CASE STUDIES

For published in-depth critiques of the operation of product safety programs, we turn to two sources: a study of four companies by Alvin S. Weinstein, Henry R. Piel, William A. Donaher, and Aaron D. Twerski under National Science Foundation (NSF) sponsorship and a study of two product safety organizations conducted by Albert Flores.

Process Liability: The Study by Weinstein et al.

Weinstein and his colleagues examined the workings of the product safety activities in four companies—identified only as A, B, C, and D. The study focused on the techniques used by these firms to surface and resolve safety-related design issues. In particular, the authors explored the feasibility of instituting a process defense in product liability cases—a defense that would focus attention on the reasonableness of the design process, not on the safety of the design itself. The case studies are detailed in Appendix I of the authors' final report to the National Science Foundation.

Since the study concentrated on design processes and their monitoring, the case studies principally describe the processes that the authors found in place at the four firms, three of which were manufacturers

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Footnote: The proposal for a process defense was formally spelled out in Twerski et al. (1980). The article elicited a sharply critical response from Professor James A. Henderson, Jr. (1981), followed by an equally sharp reply in Twerski et al. (1981). The substance of this exchange will be discussed later.
and the fourth, a large retailer. Each firm had elaborate systems of committees and procedures to surface information concerning safety trade-offs and, at least in theory, to assure their proper resolution. But while the authors concluded that each firm demonstrated through its safety activities a substantial concern for product safety, they noted severe gaps in each program. Indeed, in another article, the authors concluded that “the documentation of the design safety review process in the companies studied under the NSF grant did not meet the standards suggested by the authors” (Twerski et al., 1980, p. 366, n. 54).

Weinstein and his colleagues expected much from the companies they surveyed: a strong corporate commitment to product safety; detailed design review procedures, introduced early in the design process, involving formal safety evaluation; and detailed monitoring, based on extensive and thorough documentation, to assure that the spirit as well as the letter of these procedures was followed. They did not find this at any of the companies whose safety programs they studied.

Company A. This large manufacturer had an elaborate, but informal and unstructured, design review process, which it applied to new products and to major product redesigns. The authors considered documentation highly inadequate and faulted the company for lacking a specific means of tracking product performance in the field and linking this performance to the original design effort. They were especially concerned that the company’s delegation of accident investigation to insurance claim adjustors resulted in the potential loss of valuable safety-related information.

The authors summarized Company A’s performance as follows:

Our evaluation of the standard-setting process of this company is of necessity a measured one. The company’s commitment to product safety is substantial. They have invested much talent and effort to structure a product safety program which brings safety into product development in the earliest stages. In addition, the involvement of such disparate groups as test engineers and marketing personnel in the product safety review indicates that the company seeks to inculcate sensitivity to safety at every level of management and decision-making. The most significant lesson to be learned from the company’s safety performance is that only by sensitizing the entire corporate community to safety can real strides be made in marketing a reasonably safe product.

Having said the above and being duly impressed by the commitment to product safety, it is also quite evident that significant and very real gaps exist which prevent even the most intelligent and well-intentioned product safety personnel from making reasoned and balanced decisions.
Company B. This company appears to have had a product liability problem. The authors note that "the equivalent of one plant's gross income is allocated to pay product liability claims," leading the company to pay considerable attention to product safety matters.

Company B's procedures were more formal than Company A's. For example, it routinely used checklists and failure modes and effects analysis (FMEA). It assigned major responsibility for design safety to a safety engineer who performed this analysis and filled out the safety checklist.

Other aspects of the safety review process, however, were "basically informal"; the safety engineer was left to familiarize himself with the types of safety issues that might be encountered in designing each product. The authors questioned whether assigning separate responsibility for safety review might not cause safety considerations to be ignored until the design was too far advanced.

Company B, like Company A, employed an outside insurance company to investigate its claims. The authors found this undesirable for the reason stated earlier. Indeed, since Company B (apparently in contrast to Company A) was totally self-insured, the authors characterized this practice as "counterproductive."

Company B apparently paid little attention to the review of advertising and instruction manuals. It delegated the former to the corporate legal department. Concerning this practice, the authors remarked: "There are no formal methods aside from employees' intuitive judgments for assessing how well the company, in fact, communicates with its consumer through the manuals and instructional material."

Although the company employed certain procedures for evaluating potential hazards and their consequences, the results of which could trigger a design change, the authors' overall assessment of Company B's safety effort was not favorable:

Although the company has undertaken a substantial commitment to safety, there appear to be serious gaps in their design review process. The most important is the failure to involve all personnel, who are responsible for the end product, at the concept stage in the evolution of the product. Indeed there appears to be no point in the product development where all the constituencies assess the interplay between their various roles in the scenario. It appears that this is all to come together in the mind of the safety engineer. Although the identification of responsibility has virtue, it does not militate against formally enlisting all of the important line personnel and involving them at an early stage in the product safety design review process.
Company C. This large retailer marketed a complete range of consumer goods manufactured by other companies. These companies ranged from small, independent facilities with limited engineering capability, to large, well-staffed corporations.

The company maintained an elaborate tracking network to spot and diagnose product failures in the field. It used this network to help trigger product recalls. The authors were clearly impressed by this process.

Safety review of new products that the company marketed was considerably less structured, relying principally on product engineers employed by the company's technical laboratory. The authors criticized the lack of a formal design review process. Indeed, the comparison between the elaborate apparatus for tracking product performance in the field and the apparently ad hoc nature of the company's design review process permeated the authors' critique of Company C's program.

The contrast between this company's comprehensive retrospective system for responding to a safety problem arising from actual product use and the limited, unstructured, prospective attention to analyses of safety during the design evaluation is unusual and is difficult to understand.

It should be obvious that, despite the fact that a prospective design safety review process is not an absolute guarantee for a reasonably safe product, modifications to the product made prior to production and marketing are less costly and generally more effective than responsive action to a problem that arises once the product has wide distribution. It would appear, therefore, that similar attention to the product during the design process could be justified at least equally, if not more, on a sound economic basis.

This apparent gap in corporate philosophy may arise, in part, because the research and development laboratory only provides technical assistance to the product buyer and the laboratory's role is perhaps secondary to that of the buyer whose objectives may not consciously be concerned with safety in the overall marketing and sales goals. Since the company markets its products under its own label, with no identification of the actual manufacturer to the consumer, it would seem even more imperative that a comprehensive prospective design review for safety be a significant objective of the corporate philosophy.

Company D. Company D manufactured a product line ranging from industrial equipment to consumer goods. It had a corporate product safety and integrity office charged with the responsibility of
developing, implementing, and monitoring compliance with the programs adopted for each product line.

Each operating unit devised its own formal procedures to identify and minimize potential product hazards during all phases of a product’s life. These procedures usually involved at least three formal design reviews, at different stages of the design process, conducted by a group not directly associated with the development of the specific product. The designers used elaborate checklists to indicate to this outside group that various design steps had been complied with. However, the questions on these checklists were designed to elicit yes or no answers as to whether certain things had been considered. They did not in any way reveal the process by which the safety decisions had been made. Company D had no systematic approach to reviewing existing products.

The authors’ critique of Company D’s design review process, despite its formalism, was harsh:

The company’s commitment to product safety is substantial, as measured by the talent and effort devoted to a program which brings safety considerations into the earliest stages of product development. The involvement of “experts” from outside of the division, or at least, not directly involved in the product under consideration, indicates that there is an honest attempt made to incorporate the necessary and broad range of skills into the design review process. This procedure can only sensitize each division to the corporate commitment to safety as a real concern during each stage of product design.

Despite this commitment, however, it is apparent that there are gaps in the process that can inhibit the process and frustrate the policy.

While the design review committee is activated at least three times during the design process, the entire review is formulated and focused from the product design engineer's perspective. The design engineer formulates the checklist questions to be considered by the review committee. While the individual members of the committee are to review the questions with the design team in advance of the meeting, it still remains as an after-the-fact review. It is difficult to see, even if extensive documentation is provided to the committee members, that the scenario-building process in which the committee does not participate, could be recreated by them.

The critical questions of user population, foreseeable product misuse and product use environment, for example, are essentially open-ended and the completeness of the process can only be judged as adequate if one is immersed in the process. A review of the results is likely to be insufficient in order to establish the thoroughness of the process. The checklist questions ... are not adequate to probe the design engineer’s methodology, let alone assess the scope of analysis.
While there appears to be reasonable documentation of each product's design formulation and design review, the process stops at the division level. It is true that the corporate product safety and integrity committee has corporate-wide responsibility for ensuring that the design and review directives exist and are implemented in each division. What is missing, however, is a corporate-level policy review and analysis group. While the stated methodology may be similar for all divisions, that alone is insufficient to ensure that the decision-making process, product-by-product is reasonably coherent.

The rather rigid implicit model employed by Weinstein and his colleagues suggests that there is a single "right" way for a firm to structure product safety efforts, regardless of the particular circumstances of the firm. In particular, it does not distinguish between firms producing high-hazard products and those with less acute problems. It ignores differences in firm internal organization. It stresses formal structure, largely neglecting the role played by informal elements of internal relationship. Thus, though the evaluations of the four firms seem to show some real weaknesses in product safety efforts, the firms were probably being judged against an unrealistic standard. Certainly, the importance of the deficiencies identified is conjectural.

The standard employed by Weinstein and his colleagues may appear more understandable when considered in conjunction with one of the underlying aims of their study. We noted above that their study was, in part, an attempt to explore the feasibility of establishing a process defense—a new way in which a firm could escape liability for injury caused by its products. The essence of their proposal is as follows:

The thesis of this Article is that there has been altogether too much emphasis placed on the quality of the final design at the expense of ignoring the process by which critical decisions are made. If the law is to serve a prophylactic function and promote the goal of product safety, it must abandon this singleminded focus which forces courts to second-guess product safety decisions. Instead, we must place under judicial and administrative scrutiny the process by which the decisions are made. Our contention is that a structured, well-articulated, and highly visible standard-setting process performed by private industry or private consensus standard-setting groups can provide greater assurance of product safety than does the present system, which reviews only the quality of a manufacturer's decision on a particular product feature.

Thus, we propose a new defense in design defect litigation—a process defense. If a manufacturer defends an action by revealing a well-documented safety review process, the court should presume that the product is not defective. If the process leading to a design decision has a high degree of integrity, the court should restrict its review of the design itself to instances in which the industry has clearly erred. In short, judicial review of a product's design should shift the
emphasis from the ultimate design to the process that brought the product into existence.5

In making this proposal, the authors create a dilemma for themselves. They must be able to define what constitutes good process clearly enough so that a jury can make an objective determination as to whether it was being employed. Furthermore, their definition must necessarily avoid the trap of substituting process for substance.6 They are therefore driven to describe an intensely formal process that embodies both substantive checks and a detailed paper trail. Little wonder, then, that few private business firms—even ones noted for the high quality and safety of their products—adopt such a rigorous design assurance process.

Organizational Influences on Professional Ethics:
The Flores Study

Whereas Weinstein and his colleagues underline the importance of organization and structure—i.e., process—in assuring appropriate safety decisions, Flores (1982b, 1982c) emphasizes professional ethics. Flores, a philosopher, studied in detail the safety programs at Monsanto and the National Aeronautics and Space Administration (NASA), both of which are reputed to stress safety.

NASA is a special case: The products with which NASA deals—such as the space shuttle—are few and the safety consequences of their performance readily apparent. According to NASA engineers, safety-cost trade-offs are seldom if ever resolved in the direction of permitting higher risk in order to save cost (they do, however, mention budget constraints). NASA's program is the paradigm of formalism with complete documentation, explicit exploration of safety consequences, etc. It inculcates concern for safety into its own and its contractors' engineers.

Not surprisingly, Flores concludes: “The National Aeronautics and Space Administration's Safety Program is a superior model of how to manage complex engineering projects where the potential for catastrophic consequences to human health and safety make even a single accident intolerable.” Presumably, NASA's procedures would satisfy even Weinstein and his colleagues. But NASA is so special that it is not very interesting except perhaps as a polar case.

5Twerski et al. (1980, p. 358). (Emphasis in the original.)
6One of their critics, Professor Henderson, notes the difficulty of this by referring to the experience with the National Environmental Policy Act (1981, pp. 597–598). Henderson also questions whether good design process is objectively certifiable (1981, pp. 590–594).
Monsanto is a major producer of industrial chemicals. Most of its products are used in intermediate industrial processes, rather than directly by consumers. However, the performance of its products, often in hostile environments, has important safety implications. Monsanto is also concerned with the safe design, construction, and operation of the facilities where its chemicals are produced.\footnote{Monsanto’s commitment to a rigorous safety program may be related to an extraordinary disaster in 1947, when a ship loaded with ammonium nitrate exploded in Texas City, killing 550 people and destroying major Monsanto facilities.}

The company has an elaborate formal safety program. Product development includes an extensive safety review.

Before any actual engineering design work is initiated, considerable testing must be conducted to determine the environmental and health related consequences of manufacturing a new product. At the earliest phases of product development, the new product undergoes a risk assessment during which a product safety testing program is developed. This program includes risk assessment of worker, consumer and environmental exposures plus the environmental fate of the product. In addition, before new product manufacturing begins, a second and more advanced risk assessment is performed for regulatory purposes. In addition, Monsanto spends considerable funds on toxicological testing during product development. Engineers are, then, responsible for integrating these results into a process design that meets internal safety policies and external standards and regulations, in a manner that makes commercialization both safe and profitable. (Flores, 1982c, p. 7)

According to questionnaires returned to Flores by individual Monsanto engineers, quantitative risk assessment techniques are used routinely. Indeed, if we interpret his figures correctly, these techniques are used in far more cases than formally required.\footnote{See Flores (1982c, p. 35).} This willingness to support the use of potentially expensive formal techniques lends force to Flores’s conclusion that the company backs up its commitment to safety with resources.

Flores was especially concerned with engineers’ views concerning the effectiveness of Monsanto’s design review process and asked those he interviewed: If you participated in a formal group design review process [95 percent of those interviewed had], how effective was it? Some 43.4 percent described the process as very effective and 22.4 percent as somewhat effective; 4.6 percent were not sure; 8.6 percent called it somewhat ineffective and 21 percent, very ineffective. From these data, Flores concludes:
The majority of Monsanto engineers have a favorable opinion of the overall effectiveness of this review process in promoting safe designs. Generally, engineers regard design reviews as a thoroughly reasonable and systematic way of identifying and resolving hazards, defining a level of acceptable risk, and insuring that applicable design safety standards and government regulations are properly satisfied. The lack of proper preparation of all participants for a review and the difficulty of coordinating the various groups represented in the design review process, together with the problems of properly interpreting ambiguous design standards and regulations, are identified as the major problems affecting the review process’s effectiveness.

But, the design review process, in his view, is even more important as a device for reinforcing individual attitudes:

When we inquired as to what engineers regard as the most significant organizational influence on their safety attitudes and design practices, the design review process was consistently pointed to. . . . This is understandable since engineers' design activities are directly structured by the need to meet the requirements involved in a detailed design review. Because of the emphasis placed on safety in the course of a design review, design engineers are constantly reminded of the need to identify, eliminate, and control hazards to life and property. And since design engineers are liable to their superiors for making sure safety problems are properly resolved, the incentive to design for safety is thereby increased.

We do not know how much weight to place on Flores's results. The fact that the company knew that it would be identified by name in his study may have encouraged it to put its best foot forward. One experienced observer (Manuele, 1978, p. 98) of corporate product safety programs noted that

- There is usually an important difference between issued policy and procedure on product safety and what is actually taking place.
- No activity is as effective as those responsible for it say it is.

Flores's results contrast sharply with those of Weinstein et al. We believe that in large part they reflect different prior views about the roles and capabilities of corporate safety organizations. Weinstein and his coauthors, who have written extensively on the proper role of organization in assuring product safety, were disappointed to find that the reality of the firms they studied fell so far short of the goals that they (the authors) had created for them. Flores clearly was pleasantly
surprised to find that a corporation actively contributed to the awareness and performance of its employees with respect to product safety. However, he made no attempt to compare the result with some well-defined goal.

As we noted earlier, the rather rigid Weinstein model stresses formal structure and apparently ignores the role played by informal elements of internal relationship. On the other hand, Flores does not imbed his findings in an articulated model of proper safety organization. He takes as his measure of effectiveness the perceptions of the participants in the firm. The fact that a high proportion of Monsanto engineers believe that the corporation functions effectively is a less impressive criterion when one also notes his other finding that engineers enter the firm with little knowledge of what is required for product safety programs. By Flores's own data, which show the extent to which engineers learn about product safety on the job, the capacity of these same engineers to evaluate its effectiveness is thrown into question.

Both studies are useful. However, they suggest the need for another research approach which, on the one hand, is more sensitive to the nature of the setting within which product safety activities operate and, on the other hand, keeps in mind the proper goal of those activities. The next section presents an effort to do this.
V. ORGANIZATIONAL RESPONSES TO
PRODUCT SAFETY PRESSURES:
INTERVIEW EVIDENCE

This section presents further evidence on organizational responses to product safety pressures and their effectiveness. The evidence comes from interviews conducted by Rand researchers (in all but one case, the authors of this study) with officials of nine large manufacturing firms, one large retailer, and several other organizations having an interest in product safety.

We decided early in the project to use interviews as a major source of information. The interviews, conducted over more than a year, were structured not only to test hypotheses formed from our reading of the general literature on product safety and the large-scale surveys described in the previous section but also to enrich our knowledge of safety-related corporate behavior and thereby to generate additional hypotheses.

Indeed, we created the model appearing at the end of Section III only after several of our interviews had suggested that previous attempts to characterize corporate product safety responses had focused far too narrowly. The various categories presented below for characterizing certain response factors emerged only after the interviews had been completed, as we attempted to make sense out of the varieties of behavior we had observed.

The interviews varied considerably in length. None took less than an hour, and some went on for several hours. In all but one firm, more than one official was interviewed. In two firms, multiple interviews were conducted with the same individual. In every case, follow-up questions were posed and answered by telephone or letter.

Our primary interest was in understanding better how product safety issues were dealt with at the corporate level in large manufacturing firms.1 Consequently, our interviews were all with individuals at this level. This is not to imply that other levels of the firm are

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1We considered selecting one or two companies (the maximum, given our resources) and conducting interviews at various levels within the company, from division to corporate, as Flores (1982) appears to have done at Monsanto and NASA. We rejected this strategy because it would have narrowed our sample unacceptably. We were also concerned about access. These concerns were confirmed in the one case in which we tried but failed to obtain access below the corporate level.
unimportant in assuring adequate attention to safety in product design. Just the opposite is true. Most of the key safety-related decisions are (and, indeed, must be) made at the division or group level.

Observers agree that the corporate-level product safety function sets the tone for the entire organization’s product safety efforts. It can reinforce incentives at the divisional or group level to pay increased attention to safety in product design. Alternatively, it can undercut whatever tendencies exist to do this. It can either reinforce the efforts of individual engineers and designers to identify and fix safety hazards or transmit the message that it does not consider safety important.

We sought to understand how the corporate level performed this function. Should the corporate-level activity serve (as Weinstein and his colleagues seem to suggest in their Company D case study) as a hands-on policy analysis and review group? Should it passively monitor safety performance, serving perhaps as a “court of appeals”? Should it educate, imparting knowledge of safety techniques and their use? Is there indeed a single “best” function? This section represents a distillation of the answers that we found to these questions, conditioned by our own later analysis.

We had hoped to conduct perhaps twice as many interviews as we were able to. We settled on a smaller number for two primary reasons. First, several companies that we wanted to see refused to permit interviews. The reasons varied, but generally did not seem to center on concerns about data disclosure. We appreciate the fact that interviews of the type we sought require considerable time and understood the reluctance of some firms to commit this time. This makes us all the more grateful to those who consented, and especially to those who took the task as seriously as some of our respondents clearly did.2

The second reason for limiting the number of interviews was that as our work progressed, we increasingly seemed to be traversing worn ground. We began to have greater confidence in the validity of the generalizations presented in this section and, since we were not seeking to test our ideas formally using statistical methods, felt that we were encountering sharply diminishing returns to our interviewing efforts.

This raises another point concerning the selection of our sample firms. Although, as the preceding section indicates, the majority of

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2As our project wore on and word about it spread, we realized that some who consented to interviews did so for the chance it gave to compare their firm’s efforts with what we had found elsewhere. In such cases, we were happy to answer questions, while being careful to preserve the anonymity of previous respondents. We were encouraged to discover that several firms were rethinking the scope and direction of their product safety programs with a view to reorienting them toward serving broader corporate product quality objectives.
large manufacturing firms now seem to have established a formal, corporate-level product safety function, a relatively small number seem to be recognized for the seriousness of their efforts. By the time we decided to end our interviewing, we had contacted and either interviewed at or been rebuffed by the majority of these pacesetting firms. To have moved beyond this group would have required a substantial increase in the time and resources directed to interviewing.

CHARACTERISTICS OF OUR SAMPLE

The people whom we interviewed in the nine large manufacturing and one major retailing firms were designated the "corporate product safety officer" or some similar title. However, not all of the firms that we visited had such an official (although, with one exception, they had formal product safety efforts). In a number of instances, we also talked with an individual specializing in product liability issues in the firm's law department.

In all cases, the firms and the respondents were promised confidentiality. This prevents our being too specific about the characteristics of the firms in our sample. We can say, however, that the smallest firm had sales of approximately $500 million per year, that the bulk had annual sales in the $3 billion to $10 billion range, and that a few had annual sales of $15 billion. In short, all were of a size that would have placed them on the Fortune 500 list in 1981, and several were in the top 100 firms on that list.

All but one firm in our sample were organized into divisions. Several of the larger ones grouped divisions producing for similar customer classes or employing similar technologies. However, the degree of decision-making power at the group level varied enormously. In several cases, the groups seemed to exist mainly for accounting convenience.

The firms varied widely in the management philosophy employed by their chief executive officers. Some exhibited a strong hands-on approach, with corporate-level staff having a substantial say in product decisions. Others were highly decentralized, with the corporate staff deliberately kept small.

Our sample of firms represented the entire range of product types and customer classes: consumer durables and nondurables, industrial capital goods, and processed materials. The degree of firm diversification also varied widely. Several firms had clung to a core technology from which they had gradually branched out: one was so diversified as to defy characterization.
We first learned about the product safety programs of some firms from descriptions (often in considerable detail) in published sources. We learned about others by word of mouth. Our sample contained no firms considered weak with respect to product safety by either outsiders or insiders.

Indeed, considering the legal risks involved, we would have been surprised if any firms with poor records had consented to be interviewed, our promises of confidentiality notwithstanding. Yet we were surprised at how candid many people we talked to were about the strengths and weaknesses of their firm's product safety efforts and about the general problems of assuring appropriate attention to product safety in the modern multidivisional multiproduct manufacturing firm.

This last point deserves amplification, for it is important in interpreting our results. We do not pass judgment on the product safety programs in the firms we visited and would urge our readers not to judge them. Some of the statements below may appear (and, indeed, are) judgmental, but we want to describe problems faced by large organizations, not to critique individual product safety programs.

Finally, to the extent that we describe and characterize special product safety problems faced by certain industries, the reader should not necessarily infer that we have interviewed individuals from these industries. The special problems and how various firms have chosen to deal with them are known throughout the product safety community, and our interviewees shared this knowledge with us.

**FACTORS CONDITIONING FIRMS' RESPONSES**

Our ideas on how to organize our interview results emerged as we conducted the interviews and learned about the behavioral complexities of the responding firms. Based on the product safety literature and survey results, a schema emphasizing corporate size as a determinant of organizational complexity and size of corporate safety effort might have seemed plausible. In the end, however, we concluded that factors other than firm size conditioned our firms' organizational responses to product safety pressures. These factors were (1) the inherent seriousness of the safety problems faced by these firms; (2) constraints imposed by the underlying organization of the firm; and (3) constraints imposed by the management philosophy and style of the chief executive officer (CEO).
Potential Seriousness of the Product Safety Problem
Faced by the Firm

All products are hazardous in some situations, yet some products are more hazardous, or are hazardous in a wider range of circumstances, than others. By this we mean that the failure of such a product to perform as intended imposes a risk of serious harm (or death) and possibly does so to an extremely large number of people. Examples of such products are pharmaceuticals, automobiles, and aircraft.

A second category of products can seriously harm the user and does so numerous times each year. But the danger appears less serious, or appears controllable to a large degree by the actions of the user. The number of people at risk may also be substantially smaller. Industrial machinery and some classes of consumer durables (e.g., lawn mowers) fall into this category.

A third class of products is one that people do not normally associate with serious hazards. If these products are improperly designed, manufactured, or used, the consequences for the victim can be just as severe as in the other two classes of product. Such occurrences are rare, however. Certain types of home appliances (refrigerators and freezers, for example) fall into this category.

We propose such a division of product types (and it is, like all such divisions, somewhat artificial) to suggest that product safety is more likely to be a salient issue in firms that produce products in the first category, less so in the second, and even less so in the third. This is true even without the increased social pressures over the past 20 or so years to improve product safety. These pressures may affect the consequences to the firm of producing and marketing a product that is eventually deemed unsafe, but they are not likely to influence the recognition of the product's inherent safety. We found the role played by the corporate-level product safety effort different in each of these cases.

Inherently Hazardous Products. Paradoxically, the corporate-level product safety presence was hardest to pin down in these cases precisely because the product was considered inherently hazardous. Recognition of this fact permeated the organization. No single official was assigned the responsibility for product safety matters in the two firms we visited whose products fall most clearly in this class.

In these firms, many officials were concerned with various aspects of safety. For example, the strong regulatory presence felt in both firms led to considerable safety-related documentation and record keeping. In one of the firms, a pharmaceutical manufacturer, FDA requirements drove the safety effort. The product development process, manufacturing techniques, marketing, and labeling all were closely supervised by
the FDA. The FDA’s efforts dominated, notwithstanding the fact that compliance with these standards does not shield drug manufacturers from liability under current law. Failure to comply with FDA standards, however, is prima facie evidence of negligence.3

In the other firm, regulatory pressures were only slightly less ubiquitous. The scope of federal standards applicable to the firm’s principal product was smaller, but the firm had to certify, prior to new product introduction, that all applicable federal standards had been met and, if challenged, to show how that determination had been made. This meant that the firm had to develop internal standards that were, in effect, stricter than the federal standards in order to account for normal manufacturing variability.

Both firms also had experienced a substantial volume of product liability litigation. They considered this an inevitable cost of producing the particular products they specialized in—not a sign of design or manufacturing failure. Both made substantial efforts to keep their product liability problems separate from their ongoing operating decisions.

One of the firms deliberately treated product liability settlements as an overhead expense, though it charged other product quality-related costs to the relevant product line. The other charged product liability costs to the product, but only for pricing purposes (i.e., it recovered the expected cost of judgments by increasing the cost of the product) and for deciding whether particular product lines should be continued. The fact that suits arose and judgments were paid out was not considered to impugn the product or anyone connected with its development or manufacturer. In short, both firms treated the information generated by specific product liability suits as random noise, though long-term changes in the cost of product liability claims might affect pricing and production decisions.

We did not press either firm to determine how a genuine failure would be treated. At one firm, a respondent suggested that competitors had encountered major safety-related product failures and had paid a substantial price in terms of product liability judgments and increased regulatory surveillance. The clear implication (one that we were unable to verify with the competitors) was that insufficient attention to safety issues had possibly contributed to the failures and, at the very least, had compounded the difficulties they caused for the companies.

The firm being interviewed used this example to justify its elaborate safety procedures, arguing that such failures would have been picked up long before any substantial volume of suits developed, and certainly

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3See above, Section II.
long before any final judgments were entered. It and the other firm producing high-hazard products had elaborate procedures precisely to achieve this.

In particular, the firm producing a technologically complex mechanical product from many subsystems had a process for identifying critical parts and subjecting them to special hazard analysis and testing. However, the firm lacked good methods for identifying and dealing with synergistic hazards. The firm producing chemical entities used procedures specified by the registering agency overseeing it as the basis for its process and upgraded these procedures where it felt additional attention was necessary.

If the nature of the product produced causes substantial attention to be paid to safety throughout the development and manufacturing process, is there still a role for a corporate-level product safety effort? Our research suggests two possibilities.

First, a corporate-level effort may help surface especially subtle hazards caused by the interaction of subsystems in a technologically complex product. In an organization that produces a product known to be potentially hazardous and assembles this product from numerous subsystems, many of which themselves may embody potential hazards, there is a temptation to believe that the product as a whole is safe if each subsystem is safe. In some sense, such assumptions are necessary, since the number of possible interactions among subsystems in a complex product like an automobile or an airplane is extremely large.

The emergence of the crashworthiness issue in both aircraft and automobiles has lent new urgency to this interaction problem. We visited one firm that produced such a technologically complex product; there, the responsibility for spotting and dealing with these interactions seemed to rest primarily on high-level engineers who, owing to this company's history, occupied important positions in the management hierarchy. But safety was not their sole, or even prime concern. The firm recognized this as a weak point and freely acknowledged that some sort of formal safety effort might have aided these engineers in their task.

Such an effort could also have been counterproductive, and perhaps this is the reason the firm had not tried it. Assigning formal responsibility for safety at some high level in the organization might have been interpreted as relieving lower-level individuals of their responsibility and thus might have reduced overall safety.

This trade-off is one that appears not to have been widely recognized in the product safety literature. This literature, and researchers advocating a strong, corporate-level safety presence, generally assumes
that formal risk-analysis techniques are reliable enough, and a high-
level corporate commitment to safety effective enough, to unambigu-
ously improve the safety of technologically complex products.4 Based
on our understanding of these tools and our (admittedly limited) obser-
vation of their use in firms generally considered to have good safety
records, we consider this assumption debatable.

A second possible task for a corporate-level product safety activity
in high-hazard product firms is the management of the inevitable flow
of product-related litigation and regulatory contacts. This role can
serve two purposes. First, it can minimize the costs to the company
from these activities by preventing virtually everyone from having to
become involved at one time or another. In other words, litigation or
regulatory "specialists" can be developed and utilized.

Second, and perhaps more important, handling litigation and regula-
tory liaison in this way can help insulate designers and engineers from
what some firms perceive as the potentially counterproductive influ-
ces of these activities. It has been argued5 that an inevitable sizable
flow of product-related litigation may demoralize engineers, especially
if they were convinced that they were performing their jobs properly.
Similarly, having to respond to often uninformed, if well-meaning,
government regulators might be frustrating to engineers, leading them
to consider all regulatory efforts worthless.

The two firms we visited both had found ways of dealing with this
second class of perceived problems; some of these ways we have already
mentioned. They had done so without creating a separate product
safety organization. Considerations of safety were integrated into the
mainstream of their product development decisions in a way they con-
idered to be generally adequate.

Low-Hazard Products. We visited two companies whose products
seemed to present relatively low hazards. Both had extremely active
product safety programs at the corporate level (this was why we chose
to visit them). In one instance, while the program had high visibility,
we doubted its effectiveness; attempts to resolve these doubts by
follow-up visits were rebuffed by the company. In the other, the

4See, for example, Weinstein et al. (1980); Manuele (1978, pp. 97–104); R. Chandran
and R. Linneman (1978, pp. 33–45); and G. Corley (1978, pp. 1–17). In contrast, Kolb
and Ross (1980, p. 77) state: "The form that the product safety organization can or
should take in one company varies dramatically from that best suited in another—based
on the company’s size and industry size, the technological sophistication of the product,
the production volumes and processes, and the complexities of a product’s man-machine
relationships."

5Hoenig (1981) argues this in the context of automobile design and crashworthiness
considerations.
program seemed to be an extension of the company’s long-standing reputation for producing products of high quality.

Why did companies for which product hazards were seemingly not a severe problem have such active corporate-level programs? Because a major portion of both firms’ product lines came under the jurisdiction of the Consumer Product Safety Commission, some form of corporate-level safety organization would have been necessary in any event. But, the product safety efforts of at least one of the firms predated the founding of the CPSC, so that could not be the entire reason. Moreover, both corporate product safety programs seemed to go well beyond the formal requirements of the CPSC.

Another possible explanation is also essentially defensive. Both firms are highly exposed to public scrutiny; their names are household words. One goes so far as to closely associate its corporate identity with the products of its many divisions. By doing this, the firm makes itself a more attractive target for product liability suits.

Given this strategy, the existence of a corporate-level product safety activity that attempts to impose uniform safety processes and procedures throughout the company may be seen as a variant of the process defense suggested by Weinstein et al., and may thus help to limit the firm’s liability exposure. At the least, it may demonstrate the “good faith” and “social responsibility” on the part of the company in dealing with product safety and thus help to reduce the probability of punitive damages.

A third characteristic of both programs may be even more important in explaining their existence. Both were founded by (and one is still headed by) strong “missionary” personalities—individuals whose careers appear to have been directed to “preaching the gospel” of product safety. In firms not routinely faced with obvious product safety problems, the presence of such a personality may be necessary to explain a highly visible corporate-level product safety effort and to keep designers, engineers, and others in the company sensitive to a problem whose consequences they rarely if ever see.

The danger in this sort of situation is that the corporate-level effort will not outlast the tenure of the missionary. Furthermore, without a corporate-level commitment to safety as an important corporate objective—one that management will back up with resources when necessary—the most fervent missionary will be unable to establish, let alone sustain, an effective product safety program.

**Moderately Hazardous Products.** Firms producing what we refer to as moderately hazardous products may present the most interesting and most complex case. For these firms, in contrast to those producing
inherently hazardous products, safety and the consequences of producing a product that is inadequately safe cannot automatically be assumed to be on virtually everyone's mind at all times. Moderately hazardous products may look safe or, conversely, their dangers may be sufficiently apparent to cause the designer to believe that the hazards are so obvious that they need not be considered in design. The failure of one of these products, however, may produce severe consequences.

The firm producing this type of product may not be subject to continuous regulatory surveillance with respect to safety. Often regulators appear only when a failure occurs—or is alleged to have occurred. Such a firm also may not be subject to the frequent product liability suits typical of the firm producing the inherently hazardous product. Yet, almost certainly, suits will have been filed and large judgments may have been entered against the company. In such cases, it might be reasonable to expect the firm to view product safety problems in one of two sharply contrasting ways: either as situations in which it finds itself unjustly caught, through no fault of its own, or as something to be controlled through appropriate attention to design, manufacturing, litigation, and regulatory liaison.

Two firms we visited represented close to extreme cases. One produced a considerable volume of consumer goods as well as a broad line of industrial goods. It therefore had occasion to deal with the Consumer Product Safety Commission on a relatively regular basis. The product line of the other was confined almost exclusively to industrial products; its primary point of contact with product safety pressures was through product liability suits.

Both firms had experienced product safety problems—one, through a greater than average incidence of product recalls; the other, through one very expensive (and, in its view, unjust) product liability judgment. The contrast between the corporate-level responses of these two companies was striking.

The firm producing industrial goods almost exclusively had originally hired a missionary type of product safety officer from the aerospace industry who had tried to apply aerospace design-assurance techniques to the firm's products. Given the broad range of hazard potential inherent in this firm's varied product line, this effort was seen as overkill, and abandoned. The experience had left the firm suspicious about the value of formal product safety techniques, and as a result, the locus of corporate-level product safety concerns had drifted to the legal department. Here, an assistant general counsel was struggling to develop a more appropriate corporate response in the face of a relatively hostile corporate attitude.
The other firm had decided that it needed to control its product safety problem, but in a way consistent with its overall management philosophy (see below for more details on this point). The chairman of the company supported the establishment of a small corporate product safety presence, but backed this presence up with his personal prestige and attention. Top corporate officers and the board of directors were kept aware of the firm’s safety performance. Divisions with poor product safety records were told to improve, and the resources of the corporate-level office were made available to them. In short, this firm’s corporate-level product safety office established and maintained an atmosphere that nurtured the corporation’s overall safety efforts (efforts that were primarily the responsibility of the operating units).

Although broad generalizations are always hazardous, our limited interview evidence, plus our consideration of the nature of product safety problems and possible corporate responses to it, suggest that the corporate-level product safety effort potentially can play the most important role—either for good or for ill—in firms producing moderately hazardous products. The placement of the product safety effort in the corporate hierarchy, the resources it commands, and its ability to demonstrate that the firm’s CEO backs its actions are all signals that can be read and understood throughout the company.

If the corporate-level response is seen as essentially legalistic and defensive, then it is likely to send the message that product safety is primarily a problem for the lawyers and that no response from the operational side of the corporation is required. If the corporate-level response emphasizes hazard reduction, then the problem may be seen as being as much operational as legal. Thus it may be that moderate hazard companies should give the most serious consideration to how they structure their product safety efforts and the signals these efforts send, both inside and outside the company.

The Structure of the Firm and the Management Philosophy and Style of the CEO

In addition to the inherent hazardousness of its products, the structure of the firm and the management philosophy and style of its chief executive officer determine the need for and potential scale of a firm’s formal product safety efforts. We group the firm’s formal structure and management strategy together because they are often inseparable. Indeed, formal corporate structure may be largely determined by the management style practiced in a company.
Except perhaps in the case of firms producing inherently dangerous products, safety issues are not important enough alone to drive important structural decisions. Thus, a firm's product safety effort must somehow fit into and be seen as consistent with a preexisting structure. Furthermore, as a firm's structure changes in response to changing strategic needs, the product safety effort must be capable of changing without substantial loss of effectiveness.

The importance of an appropriate match between the placement of the product safety activity and the firm's overall structure was especially evident in one large manufacturing firm we visited. Some years earlier, for reasons unknown to us, the firm permitted its product safety effort to be publicized. Descriptions of its programs and policies, and even copies of the forms it uses in product safety audits, have been widely disseminated outside the company. This gives the impression of a substantial corporate-level product safety presence.

Our visit suggested otherwise. It appeared to us that whatever product safety program the firm now has is concentrated primarily at the division or group level. Given the highly diverse nature of the firm's principal product safety problem, this may be appropriate.

However, the launching of this conspicuous, corporate-level effort, followed by its implicit downgrading owing to inadequate follow-up, may well have undercut the potential usefulness of a corporate-level product safety effort in alerting divisions producing low- and moderate-hazard products to available design assurance techniques. Certainly a comparison, especially by the firm's own personnel, of the mismatch between the external impression created and the actual corporate-level interest in product safety could not help but undermine the credibility of any future effort to demonstrate a corporate commitment to product safety.

If a firm's product safety program must be consistent with its structure, so must it also be consistent with the management philosophy and style of the CEO. Indeed, this may be even more critical to its success. In many companies, the personality and style of the CEO permeates the organization. People throughout the firm are quick to judge whether a new function—such as a corporate-level product safety office—fits or does not fit the CEO's style. If it does not fit, then the office will be seen by everyone as a useless appendage created solely for purposes of external relations. If the activity fits, it will have real influence, even if it has few actual resources.

Two examples illustrate this point. We mentioned earlier one firm, producing what appeared to be low-hazard products, which had developed an extremely elaborate and formalistic system of product
safety goals and norms. The corporate product safety office published (for internal company use) procedures for determining appropriate levels of risk and undertook major programs to teach personnel in operating units risk assessment techniques, etc. This was clearly the most elaborate corporate-level effort we encountered in any of the organizations that we visited.

The role played by this corporate-level product safety office seemed to contrast sharply with the normal style of this corporation, which was to delegate authority to operating units and to apply only financial performance norms to their operation. Furthermore, we found no evidence that this uncharacteristic style of corporate operation was based on a decision by the CEO. We were therefore suspicious of the effect of this effort on decisionmaking at the divisional level. Our request to talk to divisional personnel was refused.

The effort at another, somewhat smaller, highly diversified firm that we visited contrasted markedly with the one just described. Here the strong delegation style of the CEO was understood, seemingly throughout the company. Certainly it was transmitted to us. His distaste for overhead costs was also apparent. The corporate-level product safety office was a lean organization. It seemed, however, that the office had managed to accommodate itself to its lack of budgetary resources.

The head of the product safety office—in contrast to the head of the corporate-level product safety office discussed immediately above—did not attempt to develop corporation-wide directives for appropriately safe products. Instead, he viewed his job as mediation. He also made a point of going out into the field to talk to divisions. He provided little formal education to operating officials.

However, this official believed—and, more important, he thought that operating people believed—that he was running the type of corporate-level product safety office that the CEO wanted. Furthermore, in this corporation, where additions to corporate-level staff were closely watched, the fact that the corporate legal department had added a small number of lawyers versed in the legal and operational aspects of product safety must have been seen as a signal that the effort was to be expanded.

PRODUCT SAFETY TASKS

Our interviews, as well as our reading of the product safety literature, suggest that there are a few broad categories of tasks which any
corporate-level product safety activity must undertake and against which its effectiveness will be judged. Some of these have already been hinted at, but let us now make them explicit.

**Internally Oriented Activities**

One group of tasks is essentially internally oriented; that is, the activities are aimed at the company itself and not at those, such as customers, regulators, and suppliers, with whom the firm deals. Of course, the product safety unit’s success in external relations may enhance or undercut its internal effectiveness; the two go together.

**Setting the Tone for the Firm’s Product Safety Effort.** Considering the inherent inability (and undesirability) of corporate-level officials involving themselves in the details of day-to-day operations (including design decisions), the task of setting the tone may be the most important function of the corporate-level product safety unit.

To set the proper tone, any formal, corporate-level product safety unit must first of all represent both the underlying organization of the firm and the management style or philosophy of the CEO. While failing to do this may not prove fatal to the effort, it certainly will substantially complicate an already difficult task.

Second, the corporate-level product safety activity must match its attempted actions to the resources at its disposal. Setting goals or tasks that clearly are unachievable, or that require more resources than the unit can expect to command, is a signal to the rest of the company that the unit is not to be taken seriously. The head of the product safety unit therefore must exercise considerable restraint.

For example, the head of the lean product safety unit referred to earlier informed us that his firm used outside claim adjustors to investigate accidents even though the firm was largely self-insured. Remembering the admonitions of Weinstein et al., and our experiences at another company that had, in our view, an extremely effective arrangement for linking data generated in the field to design efforts, we inquired whether this arrangement resulted in the loss of potentially valuable information.

The head of the unit agreed that he lost data that he very much would like to have. He probably could show, he added, that bringing the accident investigation in house would be cost-effective. But, he said, the chances of securing permission to enlarge corporate staff (and overhead) by an amount sufficient to internalize accident investigation procedures were so slight that it seemed not worth his effort to try. In
short, he was avoiding a fight that he knew he almost certainly would lose and whose loss would be perceived within the firm as seriously damaging the effectiveness of his unit. He saw this as more than offsetting the information loss that the use of outside accident investigators occasioned.

Contrast this with the corporate-level effort at the firm that previously had publicized its superficially elaborate product safety effort. The minuscule resources available to the head of that corporate-level product safety office, his apparent low level of activity, and his being housed away from the corporate headquarters all seemed to us to signal that the firm did not take the effort seriously. Indeed, he indicated his belief that if a serious product safety issue arose, he stood little chance of being supported by higher-level officials.

This same firm had earlier been involved in a major legal proceeding in which large fines and even jail sentences were imposed. In this instance, top corporate officials had disclaimed any responsibility and had let lower-level officials take the blame (and consequences). This experience, it seemed to him, might well signal what would happen if a major safety problem emerged—a perception that he seemed to feel was shared throughout much of the company.

Structuring and Helping to Enforce Financial and Nonfinancial Rewards and Penalties. At each company, we asked how the consequences of product safety performance were transmitted back to operating units. Companies had different means of doing this, but each official we talked to recognized the importance of feedback.

Only one company developed explicit safety performance goals against which operating unit managers were said to be measured. However, we were unable to learn how much weight safety issues were actually given in assessing an operating unit's performance.

One company reported that it regularly briefed top corporate officials and the board about the company's product safety performance. The CEO, in turn, raised these problems in a general way at meetings of division heads. If a unit was considered to have a special safety problem, this was discussed at a private meeting between the CEO and the division head. At this meeting, commitments were made concerning how and when the problem would be eliminated.

Most companies appeared to recognize the importance of linking safety performance to financial performance and tried in various ways to charge safety-related costs to the division that generated them. Indeed, one or two self-insured companies had developed actuarial estimates based on expected product safety costs for the coming
year—the likely volume of claims, rework and warranty costs generated by safety-related hazards, etc. These costs were then charged directly against the product.

The only exceptions to this general policy were the two high-hazard product firms noted earlier in this section, firms that deliberately treated product liability costs as overhead. In both cases, the companies had explicitly examined the situation leading to the rash of claims and had determined to its satisfaction that their designers and other responsible officials had acted appropriately. They therefore refused to charge the substantial cost of these settlements against the divisions or products, except for purposes of determining whether the product should remain in production.

**Developing Links to Other Safety- and Quality-Related Activities in the Firm.** In several firms that we visited, the product safety function (especially at the corporate level) was undergoing metamorphosis. Most such units had been set up in the late 1960s or early 1970s and had gained initial strength out of the product liability crisis of the mid-1970s and the controversies surrounding the founding and early operation of the Consumer Product Safety Commission.

The crisis atmosphere in product liability has now faded, except in a few areas such as asbestos and formaldehyde, and the CPSC has become quiescent. Furthermore, the officials who originally established the corporate-level product safety functions, often the missionary types that we referred to above, have retired or are on the verge of retiring. Their successors and others who are in a position to reorient their earlier efforts are looking for a new touchstone.

In certain cases, the new touchstone is quality. This criterion reflects the growing realization that quality costs—the costs of such things as the reworking of products that failed quality control inspections, unsuitable parts received from shippers, warranty costs, and safety-related costs—are in many instances much greater than previously realized.  

One corporate product safety officer to whom we talked is redesigning his firm’s product safety effort to integrate it into the firm’s developing cost-of-quality program. He believes that this will allow him to induce the firm’s engineers to focus more effectively on the design phase where, by spending a little more time and money, safety problems can be detected before they develop. Historically, this firm has emphasized quality control and quick attention to problems as they

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6This point is made forcefully by Wheelwright (1981).
develop in the field. Its overall safety record appears excellent, but this program's director believes that this excellence can be enhanced (or, at least, maintained) at significantly lower cost by changing the company's design philosophy. He sees the cost-of-quality approach as a way to do this.

The extent of this corporation's reorientation is unique among the firms we visited; its corporate emphasis on product quality is also unique. It exemplifies the importance of linking the firm's product safety efforts to other firm goals in a mutually supportive way, thereby increasing the program's leverage.

**Externally Oriented Activities**

In view of the strongly legalistic nature of the duties of corporate-level product safety activities as revealed in the two large-scale surveys mentioned earlier, we expected that a large portion of the product safety tasks facing product safety officials in the firms that we visited would be externally oriented. To a degree this turned out to be true. But the nature of the involvement was not quite what we expected.

**Role in Litigation.** Several of the firms had experienced substantial product liability problems, i.e., a large number of suits, and had paid out large (sometimes multimillion dollar) judgments and settlements. For this reason, we had expected that the corporate-level product safety officers might have played an important role in developing litigation or settlement strategy, appeared as witnesses to describe the firm's product safety efforts, or helped to identify witnesses inside the firm and to organize testimony.

This was not the case. Product liability defense is a legal problem, handled by the law departments of firms. In some cases, these law departments develop the equivalent of small law firms specializing in product liability. They tap specific skills throughout the corporation, especially in operating units. But, as far as ongoing litigation is concerned, they seem to interact little with corporate-level product safety officials. These officials may be involved in settlement decisions, but this was by no means common in the companies we visited.

More to the point, we were not made aware of any instance in which corporate-level product safety officials were called to the witness stand to describe their firm's product safety activities. The firms we contacted do not seem to have tried actively to invoke a process defense, even though their product safety processes were probably more complete and more thorough than is typical of manufacturing firms. Even more surprisingly, these officials seem not to have been called to the
stand by plaintiffs' attorneys to testify as to whether their firm's established design review processes were indeed being followed, though in one case it seemed clear that they were being largely ignored. In short, plaintiffs' attorneys do not seem to believe that they can use failure to comply with established process as evidence on which to win judgments against the companies.  

**Regulatory Liaison.** The role that corporate-level product safety officials played in regulatory liaison differed substantially among firms, depending on the nature of the company's products. We have already mentioned the two cases of firms producing inherently hazardous products, where the level of regulatory interaction was so high that both firms had senior officials designated as regulatory compliance officers.

In firms producing products under CPSC jurisdiction, the corporate-level product safety officers seemed to be the principal points of contact between the commission and the firm. And although the Conference Board survey suggests that an extremely low percentage of corporate-level product safety officers "manage recall campaigns," several of the ones we interviewed play major roles in determining whether and when recalls should be initiated, how and when the CPSC should be informed, and how the recall was to be conducted. They also were heavily involved in various negotiations between the companies and the CPSC.

### THE EFFECT OF EXTERNAL PRESSURES ON PRODUCT SAFETY ACTIVITIES

In this section, we discuss what our interviews revealed about the effect of the various social pressures described in Section II on the operation of the individual firm's product safety programs.

**Product Liability Litigation**

Growing corporate awareness of product liability issues, spurred in several instances by suits that resulted in substantial individual judgments against firms, increased the willingness of these organizations to establish formal corporate product safety activities. Nevertheless, we encountered only one case in which the loss of a major suit might have been the proximate cause for the firm's establishing its product safety effort. This firm, more than any other we visited, had continued to view product safety as essentially a legal issue.

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1 In his sharp critique of the Weinstein proposal, Professor Henderson (1981, pp. 608–611) argues that plaintiffs' lawyers would use such evidence.
All the firms viewed product liability litigation as essentially a random influence, generating no clear signals as to how to adjust design behavior. The extreme version of this has already been mentioned: the two firms with the largest volume of litigation took steps to insulate design decisions from the influence of litigation. Although corporate-level product safety officials, in concert with representatives of their firm’s corporate legal departments, saw as one part of their jobs the need to inform operating-level officials of developments in product liability law, none cited any instance in which a particular case caused a safety-enhancing change in design behavior.

One firm, exposed to liability due to failure to provide adequate warnings, had adopted the practice of adding to the list of warnings it supplied with its product a reference to any new study that suggested a potential danger, regardless of how poorly (in its view) the study had been conducted. This led, in the firm’s opinion, to less effective warnings, since the warnings supplied tended to look like a laundry list. Indeed, the Food and Drug Administration, which monitored the firm’s products, had objected to the firm’s adding further warnings on precisely this ground. However, the firm felt that the only way to reduce its liability exposure to acceptable levels was to overwarn.

We encountered instances of firms withdrawing products because they feared unacceptably high liability risk. These did not appear to be products with a poor safety record, however. For example, a large materials supplier had declared (and had made this view known to fabricators who purchased and resold its products) that it would not knowingly supply its product for certain uses. Another firm had barred shipment of its product for a certain aerospace application.

A third firm adopted a more novel approach. It removed its name from a component that it manufactured since, in the event of an accident involving a product containing this component, the presence of the firm’s name on the component raised the probability that the firm would be sued.\(^8\)

Of course, in removing its name from the component, the firm might expose itself to liability under variations of the *Sindell* doctrine, whereby liability might be incurred if a firm was unable to definitely prove that it did not produce the relevant item. This has to be balanced against the exposure when it explicitly identified itself as the manufacturer.

\(^8\)The manufacturers of other components used in this product did not put their names on their components. In event of product failure, the primary target of a suit would be the one firm that identified itself, hence the motivation for the change.
We were interested to learn whether major changes like *Sindell* were causing concern among the firms we interviewed. The place where we most expected to encounter this problem was at the large materials supplier we visited. The firm reported that a number of plaintiffs’ lawyers had approached it exploring possible application of *Sindell* theories. However, in every case the firm’s product tracking network, installed years before and with no apparent thought to its value as a tool in product liability defense, had demonstrated its ability (at least to these lawyers’ satisfaction) to exonerate the company.

A major weakness of product liability litigation as an incentive for design change—one that emerged again and again in our interviews—originates in the long time lag between a design decision and the date that sufficient evidence accumulates during the course of a suit to suggest that the design decision might have been in error. This lag has two parts. The first is the lag between the time of the design decisions and the time when products begin to fail. The second is the lag between failure and the bringing out of evidence in a suit.

Once failures begin to occur and come to a firm’s notice, it begins to investigate possible design and/or manufacturing failures. To the extent that the filing of suits brings product failures to a firm’s attention, the fact of suits—but not necessarily their outcomes—may produce valuable information for firms. The firms that we interviewed had other techniques—such as service reports—to generate such information. The actual outcomes of suits, however, seem not to generate design-relevant information from the point of view of the firms we interviewed.

The time lag between design and suits is typically measured in years, and may in some cases approach decades. By the time the suit is settled, the product may no longer be in production, perhaps because a new model has been introduced. Even if it continues to be produced, the individuals responsible for the earlier decisions may have left the company or moved elsewhere within it.

We asked firms whether they had considered tracking individuals responsible for design decisions later found faulty, not for retribution, but to establish the principle that poor decisions made at one time will be held against an individual even if several years had elapsed and he had moved within the company. Only one firm said that this had seriously been considered and that it had been rejected because of fear that it would be perceived as unfair.

Firms typically took the position that serious (or even minor) design errors were far more likely to be detected in some way other than as a result of a product liability suit. They pointed to information gen-
erated by customer complaints, warranty work, etc., which was accumulated by product tracking networks and analyzed to detect product failures, often long before any injuries had occurred. In short, the firms felt that the entire design process might be colored by the recognition that slipups (or alleged slipups) in design might eventually result in large judgments being levied against the firm.

The connection between design decisionmaking and lawsuits, however, was not perceived as direct or immediate enough that product liability could be said to exert a clear influence on day-to-day design decisionmaking. Furthermore, the apparent irrationality of many jury verdicts (as seen by firm personnel) helps to undercut the force of whatever positive incentives the liability system might create.

The threat of product liability suits gives evidence of producing defensive documentation. The case of overwarning has already been noted.

In another firm, we were told of an instance in which an engineer had suggested a product modification that was taken up by the appropriate committee, considered, and rejected. The proposed change, the story went, would have made the alleged problem worse. However, the committee did not document the reasons for its rejection. Later, in the course of litigation, the engineer's original memorandum was found and the company was forced to explain why the engineer's advice had not been followed.

In response to this episode, all design review groups were instructed to document how suggestions of this sort were dealt with. This ran counter to the instincts of the engineers in the group, who saw no reason to spend time writing down reasons why something did not work. The lawyers, however, insisted. This was a rare case of lawyers' intervening in the operational aspects of safety decisions.

The company viewed this requirement for increased documentation, primarily as a defensive measure, as at best marginally useful, and at worst, a waste of resources that fed engineers' cynicism about the rationality of the product liability process. Perhaps this sort of struggle between the lawyers and engineers at this company is why one respondent to the MAPI survey, in answering the question concerning whether it had a corporate policy on documentation, referred to the documentation issue as "a never-ending struggle."

We noted in many companies that we interviewed that their reaction to product liability issues had gone through several stages. Their initial response to being hit with (and possibly losing) one or more

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9Interestingly though, only one firm had a systematized analysis of all these potential data sources.
large suits, generally in the late 1960s or early 1970s, had often been one of shock and outrage. They usually decided to fight for what they thought was right, even if this meant spending more money than a judiciously timed settlement would have cost.

As time went on, the firms' sense of outrage lessened (though it never disappeared), and they began to see even large suits as routine affairs, to be treated like any other business decision. Questions of legal strategy and settlement, matters that once might have occupied the time of the CEO, were delegated to lower-level corporate officers.

Settlement decisions were made on the basis of expected value calculations, with thought given to their strategic implications. That is, claims were settled if settlement costs seemed less than litigation costs, but this was tempered with concern that the company might become seen as an easy target or that the settlement of one claim might, if publicized, generate a rash of similar claims. Losses were not treated as corporate tragedies, but as problems to be controlled.

Some companies had entered a third stage. Companies that had been hit with a large and continuing volume of suits in one particular area of their product line had developed enough class knowledge—or expertise—in the handling of such suits to dispense, in some cases, with the time-honored policy of employing local defense counsel and instead using their own team of lawyers and experts. In the course of this, they had developed specialist law firms inside their legal departments. Even the firm that prided itself on its lean overhead had recently substantially upgraded its legal staff devoted to product liability with a view toward taking more control over the management of its suits.

**Insurance**

We described in Section II how insurance rates are set for product liability and noted that most are determined judgmentally, not on the basis of actuarial experience. During the early 1970s, rates rose sharply as insurance carriers reassessed their actual and potential risks in the light of changes that were then occurring in product liability claims experience.

For the firms in our sample, this same period led to reassessment of insurance coverage practices. Prior to the 1970s, most purchased product liability insurance and some even had "first dollar" coverage. Claims were handed over to insurance companies to process, with insurance companies making the decisions concerning whether to fight or settle.
Once rates began to rise sharply, however, these firms altered this practice. Today, several self-insure, placing catastrophic insurance privately with Lloyds. Others retain some purchased coverage, but have arranged for very large deductibles. Companies generally hire insurance companies (on a fee basis) to process claims and, in several cases, to investigate accidents. Insurance companies are more experienced than the firms in this kind of work and probably have better access to local counsel in the event of suits. However, the firms have largely moved away from purchasing product liability insurance.

Some have recreated an internal insurance market so as to allocate the cost of liability coverage. Based on past experience and known outstanding claims, judgments are made as to the cost of a division’s (or product’s) likely product liability claims during the coming year. However, no attempt has been made to estimate claims “incurred but not yet reported,” the so-called IBNR category that has caused so much controversy. The firms that do this employ outside actuaries to verify the soundness of their procedures. Discovering that they were being charged “judgment made” rates, firms evidently decided that they were as well (if not better) equipped than insurance companies to make these judgments and began to do so.

Companies are also exercising more influence, even where they retain outside insurance coverage, over settlement decisions. A classic complaint heard against insurance companies is that the strategic effect of settlement decisions is not adequately taken into account. Whether true or not, firms are demanding, and generally receiving, a larger say in settlement decisions.

We were especially interested in knowing whether the firms in our sample received help from insurance companies in spotting and diagnosing product safety problems. The universal response was that they did not. One firm reported that lectures by insurance carriers advising management to pay more attention to product safety problems helped to reinforce the warnings conveyed internally. But beyond these general lectures, firms obtained no concrete help. As one firm put it,

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10 To be sure, if a firm could estimate IBNR reserves with accuracy, it would be to its advantage to include them in the current charge it makes against a product line. But, as we have seen, estimating IBNR reserves is an extremely problematical process. The insurance firm, in contrast, has no choice, since its insurance contract traditionally has required its current premium to cover all future claims.

11 It might be argued that by proceeding in this fashion, these firms give up the cost savings that result from risk pooling. Apparently the firms felt either that these savings are not that large or that they presently were accruing principally to the insurance companies.
product safety practices in insurance companies were years behind those in effect in this company.

This should not have surprised us. If corporate-level product safety officers have a difficult time overseeing design decisions, those outside the firm are bound to have even greater difficulty. If there were general acceptance of what constituted good safety design practices, and if the existence of the procedures to institute and comply with this practice were readily verifiable, then an outside expert might be able to judge the quality of the firm's overall product safety effort.

Or, if the output of the process were measurable—such and such a level of defects, etc.—then the quality of the process might be ascertainable from an examination of output measures. This would also be true if class knowledge accumulated by a person who had seen many design operations would quickly reveal which operation was likely to perform well and which poorly, as far as safety is concerned. If any of these conditions obtained, then we might expect outside advice and counsel from experts employed by insurance companies to play a role in helping to improve firm product safety efforts.

As we hope has become clear by now, what constitutes an appropriate and effective product safety effort is an individual firm characteristic. It depends on such things as the nature of the firm's products, the characteristics of its customers (and, if they are not the customers, the ultimate users of the product), the organization of the firm, the management style of the CEO, etc.

Certain patterns may repeat across firms, but that fact does not necessarily mean that a practice observed to be effective in one firm will prove effective in another firm. In this respect, the product safety function may resemble the planning function in firms. Each firm must (perhaps with the help of outside experts) decide what it wants its planning unit to do and how it wants the unit to fit into the rest of the company's activities. Only then can elements be pieced together to produce an effective planning operation. We doubt that insurance companies will ever come to play the catalytic role ascribed to them in the workplace safety area.

**Regulation**

Regulation plays a mixed and extremely complex role in the activities of the firms we visited. In one case—that of the pharmaceutical firm—it totally drives the product development process. At the opposite extreme, the diversified producer of industrial products has little product safety-related regulatory contact.
The most interesting case of regulation involves consumer products that fall only in the bailiwick of the CPSC. The creators of the CPSC envisioned a major role for it in establishing product standards, as discussed in Section I. Yet, in practice, CPSC standard-setting activity has proved relatively unimportant, at least for the firms we visited.

The development of a standard is such a long and complex process that it has little impact on design behavior. Often, however, a CPSC notice that it is considering developing a certain kind of standard has considerable effect. Whether the commission intends this or not, such a notice creates the perception that existing designs may be unsafe and, in so doing, generates potential liability.

We encountered one example where the announcement by a government agency (not the CPSC) that it might consider a particular standard led the company to immediately establish the hypothesized standard as an internal corporate standard. The company fought certain aspects of the government's proposal, and the standard itself was not formally promulgated for years. In the meanwhile, however, all the applicable products that the company produced were meeting (indeed, were exceeding) the standard.

The more important CPSC authority is its right to order recalls. Corporate product safety officers consider this authority a powerful weapon reinforcing their influence. They can use the threat of CPSC recall action to spur their company into action before the CPSC acts. For this authority to be helpful, however, the CPSC must exercise its powers responsibly. It must also show itself willing to move rapidly when a firm has decided that a recall is necessary and needs commission help to carry it out.

In one instance, a firm with an excellent product safety record discovered that a design error in one of its products might have produced an electrical hazard. No injuries had yet been reported in connection with this product; the defect had been diagnosed through careful analysis of warranty claims. The company decided to recall the product and sought CPSC help. The company's product safety officer was unable to get the CPSC to react. Finally, the company recalled the product on its own, after informing the CPSC of its intention to do so.\footnote{The safety official involved was relatively new to his position. A more experienced safety officer argued that the CPSC remained reasonably responsive to specific corporate requests for action.}

The CPSC operates an accident information system based on two types of data: that collected from a sample of hospital emergency rooms and expanded to a supposedly valid national statistical sample
(the National Electronic Injury Surveillance System [NEISS]) and that gathered from in-depth investigations of a far smaller sample of serious accidents.

We found no firm that considered these data in any way useful—for example, in spotting accident trends and their possible causes. Our respondents' references to the system suggested, rather, that the data were either useless or, in a couple of cases, positively misleading.\(^{13}\) The clearest example of the latter occurred in a situation in which the CPSC, based on its information but without documenting its claim, declared that the product in question had been associated with scores of deaths; the industry, after searching its records, claimed to be unable to find a single one.\(^{14}\)

Attitudes toward the CPSC's NEISS and in-depth accident investigations contrasted sharply with attitudes toward the information generated by the National Highway Traffic Safety Administration. The NHTSA's analysis of major traffic accidents and deaths (FARS), we were told, constituted valuable raw data on which the auto industry relied heavily.

The differences in the value attributed to two data sets having the same ostensible objective—to signal the need to recall for safety improvements—may stem, at least in part, from their sources of information. The NHTSA data are gathered from police accident reports. Policemen are trained accident observers who know that their reports may be used as a basis for establishing accident liability and that they themselves may be called to the witness stand to do this. In contrast, CPSC data—in particular, the NEISS data—are generated as the by-product of emergency room treatment, when the establishment of causality is at best a nuisance and at worst a hindrance to solving the problem at hand.\(^ {15}\)

Regulation often interacts in complex ways with product liability litigation. As noted earlier, compliance with regulatory standards is not a defense in product liability actions, but failure to comply may be

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\(^{13}\)A detailed critique of NEISS is presented in Heiden, Pittaway, and O'Connor (1982).

\(^{14}\)In discussion, the industry did not deny the propinquity of the product to many fatal incidents. However, the causal issue was in doubt and no plaintiffs had successfully alleged this product as the cause.

\(^{15}\)Another factor may be the different characteristics of the accidents observed by the two systems. The FARS deals only with accidents from one class of products and appears to provide information that can be usefully and meaningfully aggregated. It is tailored to that particular product. NEISS, on the other hand, is designed to apply to a broad range of products. The particular categories in it must be broad enough to apply to this broad range and, in so doing, may lose their effectiveness as useful categories for aggregation.
prima facie evidence of negligence. This sometimes generates a situation in which regulatory agencies tell firms to do one thing and the firms' own counsels, based on readings of recent product liability cases, advise them to do another.

The interaction between litigation and regulatory attitudes toward excessive warnings has already been mentioned. Even more serious, perhaps, are the situations documented by Hoenig of crashworthiness cases in which companies have been held liable for failing to use designs the adoption of which would have put them in direct violation of a federal standard.

We have also noted cases in which the mention by regulatory agencies that they were considering proposing a certain standard has caused firms to adopt the standard to prevent liability. Finally, we encountered one instance in which a firm got into legal trouble for adopting internally a tougher standard than the applicable federal standard (to assure that all its units, even with some manufacturing variability, would meet the federal standard). Having discovered that, for production purposes, it could relax its internal standard somewhat and still exceed the federal standard, it was charged with failure to meet its own original corporate standard. Given such cases, one can see why several companies that we interviewed wanted to ensure that any federal product liability statutes include a defense based on compliance with government standards.

THE IMPORTANCE OF THE CORPORATE PRODUCT SAFETY FUNCTION TO PRODUCT SAFETY

As corporate profits shrink in the current recession and the pressures to slash overhead grow, some firms must be tempted to eliminate their corporate-level product safety activities. This temptation is enhanced by the recent eclipse of the Consumer Product Safety Commission and the general reining in of regulatory agencies. Would this be wise? What difference does the activity seem to make in the firm's overall safety performance?

The first thing we would note is the low level of resources used at the corporate level for formal product safety activities. Even in the largest companies that we visited, staff resources amounted to no more than three or four full-time professionals plus secretarial support. Most corporate product safety officers had some funds to be used for training purposes, and several did mention that they occasionally employed outside consultants. But the total level of resources devoted to product safety at the corporate level seemed surprisingly small.
We did not observe a strong relationship between resources available and effectiveness. We would be the first to admit the subjective nature of our impressions concerning effectiveness of various programs. No reliable published statistics on hazard rates exist, and those companies that have internal records would not let us see them.

Judged by external reputation, the plausibility of the information that we obtained during our interviews, and tantalizing but extremely fragmentary internal corporate measures, what appeared to us to be the most effective operations were those headed by individuals who had managed to develop the best match between the types of activities engaged in by the corporate-level product safety office and the commitment of the CEO to effective control of the firm’s product safety problems, whether operational, legal, regulatory, or all three.

In short, if the head of a firm’s product safety office had developed such a match-up, a relatively small volume of resources, strategically employed, seemed to be sufficient to effectively convey the CEO’s commitment throughout the corporation. The ability quickly to shift attention and limited resources to trouble spots, and to back this up with signals from the CEO that this was indeed company policy, also seemed important.

If, however, the corporate-level product safety office did not develop this match and did not display the ability to spot and deal effectively with problems, the level of resources at its disposal seemed relatively unimportant. The problems posed by an inactive corporate-level office are self-evident. But, paradoxically, an office that appears to be too active relative to the firm’s underlying safety commitments can also be a problem. An office that is too visible and too public relative to its demonstrated ability to perform within the firm would seem to pose a threat to a company, both legally and operationally. Such an office is likely to be seen as serving as nothing more than an external relations function. This could undercut any favorable effect that its activities might have in altering behavior inside the firm.

We know that our impressions may have been generated by hasty and incomplete observations, and we hesitate to judge. Nevertheless, we observed three product safety activities that we would classify (or at one time would have classified) as overly active.

The product safety activity that piqued our interest most was probably the most ambitious and formal one that we saw. As part of a large, highly diversified company, it attempted to establish appropriate safety design criteria for a bewildering array of operating units. The attempted reach of this program was impressive, but the program itself seemed at odds with the operating philosophy of the firm. We
wondered how this program, so impressive and complete on paper, was applied in practice. Our efforts to probe this point were rebuffed.

The other firm where we suspected such a mismatch had sometime earlier taken steps to downgrade its corporate product safety office. Originally, the office had been staffed by an experienced safety expert from the aerospace industry who attempted, upon his arrival at the company, to transplant aerospace industry techniques. Clearly, he had failed—the mismatch between the ambitiousness of the program that the expert wanted to establish and the nature of the problem as perceived by the company was too great, and the effort was abandoned. At the time of our visit, the company had a corporate product safety officer with vaguely specified activities and an office remote from corporate headquarters.

The third company also had at one time established an ambitious product safety effort with policy statements, audit checklists, etc. The program still existed, but it had shrunk. The individual currently responsible for the program was attempting to reorient it and align it with current corporate goals, but as yet appeared not to have succeeded.

The activities of two other companies contrasted sharply with the three just noted. In both companies, the corporate-level product safety office consisted of one or two professionals, but in each case, the head of the office appeared to be fitting his program to the company’s safety problem, and doing so in a way that was consistent with both resources and commitment.

One of these programs, in a company with a hands-on corporate-level management style, was evolving toward a total definition of quality in which safety was one element. This company had long been recognized in its industry as a producer of extremely high-quality products. Its long-time missionary type product safety officer had recently retired, and the new officer in charge of the program clearly would have to reorient it if it was to remain a vital part of the company. This new man’s ability to sense how the program could be better integrated into the firm’s long-established concern with product quality reflected a sensitivity to the importance of matching resources and commitment to the problem as perceived within the organization.

In the second instance, a company with a decentralized management style, the product safety officer had deliberately kept his objectives and activities modest, consistent with the CEO’s lean corporate staff policy. Yet he appeared able to command the resources and clout necessary, should a problem arise.
To sum up, resources are not the key to effectiveness for corporate-level product safety activities. An appropriate matching of activities, resources, and commitment are the key. Corporations that have established corporate-level product safety offices primarily for external reasons might well consider cutting back on them—the effect on safety is likely to be slight if even positive.

Corporations that have developed programs that combine the elements we consider necessary for success would do well to keep them. Indeed, they probably will, for in each such case, the head of the program was able to make a convincing case that these activities were more than paying their way. In any event, the resource requirements for maintaining an effective corporate-level product safety activity are slight.

Before closing this section, it is probably useful to recall briefly the three companies that we interviewed that had no formal corporate-level product safety office. Two of these produced inherently hazardous products, and for that reason, and because of strong ongoing regulatory surveillance, devoted substantial resources to product safety. In each case, a corporate-level product safety office might have made a minor difference, but fitting such an office into an already complex set of safety-related activities might have proved difficult. The danger would have been that, given the already substantial commitment of resources devoted to safety, the establishment of such an office might have been viewed as an external relations gimmick.

The third case is one where the lack of a formal product safety function reflected the distaste on the part of corporate-level officers for such activities. This company expressed the traditional view that safety was the responsibility of individual designers and engineers and that committees and other such organizations were either superfluous or positively harmful. This company produced a large variety of products, all based on a single core technology. Design changes seemed to be quite evolutionary, and a private standard-setting and monitoring function was active in this firm's industry. For this reason, its attitude toward formal product safety efforts may have been correct. In any case, the lack of a product safety effort does not appear to have hurt the company.

This study started with the observation that formal product safety activities have become commonplace over the last decade, especially at the corporate level, in large U.S. manufacturing firms. This trend had been remarked on approvingly by business leaders, academics, congressional committees, and representatives of the executive branch.
Survey evidence, cited in Section IV, confirmed this trend, but suggested that the reasons for the establishment of formal product safety activities may have had as much to do with their ability to defuse external pressures as with any positive influence that they might have on other activities inside the firm, especially design. We then reviewed case studies that suggested that product safety activities might play an important role in establishing and overseeing the operation of design review processes that would enhance safety, and that they could serve the important purpose of transmitting to individual design engineers top management’s commitment to produce safe products.

Our interview data suggest that the original idea that the establishment of corporate-level product safety activities would necessarily have a positive impact on product safety may have been a considerable oversimplification. In some instances, a corporate-level product safety activity may be irrelevant; in others, it may play a positive role, and in yet others, it may be either useless or even harmful. Distinguishing between these situations requires, in our view, examination of the sorts of factors mentioned in this section—factors such as the inherent safety characteristics of the firm’s products, its internal organization and management philosophy, and the degree to which any program is consistent with each of these.
VI. ENHANCING INCENTIVES TO DESIGN SAFER PRODUCTS: IMPLICATIONS FOR PUBLIC POLICY AND CORPORATE MANAGEMENT

This section explores the implications of our analysis and evidence for public policy and for corporate executives concerned with product safety. A bill currently before the Congress will, if passed, create the first national product liability statute. What impact on firms’ product safety activities—and on the safety of firms’ products—would the passage of this bill likely have? There also is interest in relying less on formal regulatory techniques and more on private sector incentive systems, such as insurance. What do our results suggest concerning the role that each of these plays in product design decisions and about how changes in each might alter these decisions?

Given the relative recency of the corporate product safety function, we believe that our work also has some utility for corporate executives involved in product safety matters. The final section of the chapter addresses the proper role of the corporate product safety function, particularly in light of the increasing concern with product quality.

Before addressing these points, we would again caution the reader concerning the strength of our conclusions. Although we believe that our work—both our analysis of the published literature and our field interviews—represents the most comprehensive look yet taken at the pressures on product design and how these pressures are mediated for good or ill by formal organizational units within the firm, we realize how little we still know.

The firms that we interviewed were hardly typical. Yet, even within this limited sample of firms with good safety records, we encountered sufficient behavioral variety to convince us that generalization is extremely risky. The most important result of our work may be the picture it presents of the complexity of influences and of their potential for conflict, given the complex and diverse paths by which they are transmitted to the product design process.
THE POSSIBLE CONSEQUENCES OF PRODUCT LIABILITY REFORM

As noted earlier, the sharp increase in product liability insurance premiums in the 1970s generated an upsurge of concern about product liability among manufacturers (especially small manufacturers). The increase itself resulted from a rise in the number of product liability claims and suits, increases in the average settlement value of these claims and suits, and fears on the part of insurers that their liability exposure might grow uncontrollably. Lack of adequate data hampers attempts to apportion these causes, but it is generally acknowledged that the fear of future liability exposure was the principal element in producing the rapid insurance rate rises in the mid-1970s.1

The Significance of Product Liability as an Influence on Design

Since the late 1970s, the growth in product liability insurance premiums has slowed.2 Some rates are even reported to have fallen.3 Much of the crisis atmosphere that pervaded the earlier debates on product liability has faded.

Product liability costs as a share of total production costs serves as one indicator of the importance to firms of the product liability issue. The data on this issue are both incomplete and extremely difficult to interpret. Nevertheless, it appears safe to conclude that for most large manufacturing firms, product liability costs (including the cost of defending litigation and certain product liability prevention activities) probably amount to much less than 1 percent of total sales revenue.4

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1Examples of the problem are cited in U.S. House of Representatives (1978, p. 4).
3The Insurance Services Office collects data for manual rates only, rates covering perhaps less than one quarter of the premium income. In their Chief Executive Circular, the ISO reported declines in average product liability rates, in manual categories, for 1979, 1980, and 1981; rates increased in the first three quarters of 1982. One component of the fluctuation was variation in the rate of return on reserves. Further declines in the available nominal rate of return are likely to occur, possibly inducing rate increases.
4We base this statement on two sources of information. A survey conducted for the Risk and Insurance Management Society (1979) found that in 1978, total risk costs (including premiums for all forms of liability insurance, unreimbursed liability costs, and risk and insurance management expenses) exceeded 1 percent of sales revenues in only four industry groups, none of which was involved in manufacturing (see Table 2, above). Furthermore, 86 percent of the respondents to the 1976 MAPI survey reported that their product liability insurance premium amounted to less than 1 percent of sales revenue (U.S. Department of Commerce, 1977a). Most reported that unreimbursed costs and other "internal costs not covered by insurance" did not amount to a large share of their insurance premium. Industrial machinery is especially affected by product liability, so these figures may be higher than for industry in aggregate.
This figure on product liability costs conceals an extremely wide variance. In some cases, entire industries—asbestos is the most prominent—face potential liability judgments large enough to threaten their continued existence. For certain individual products (drugs, for example) product liability costs may routinely reach 10 percent of total sales revenues. Even in industries in which liability costs are on average relatively low, the threat of a multimillion dollar verdict is a recurring nightmare for small firms.

These exceptional cases notwithstanding, for the typical medium to large manufacturer, the direct cost of product liability is a small, but potentially significant, element in its total cost of doing business. Nevertheless, of all the various external social pressures influencing product design decisions, product liability seems to be the most fundamental. The other influences largely work through product liability activity.

In industries producing potentially high-hazard products but not receiving significant product-related regulation (e.g., industrial machinery), product liability probably exerts the overwhelming pressure. In industries subject to moderate regulatory pressures (industries subject only to CPSC regulation, for example), its influence likely overshadows that exercised by the regulators. Indeed, regulatory actions in such industries may be perceived as important or unimportant depending primarily on their effect on a firm's liability exposure.

The liability consequences of failure to meet a federal standard have already been pointed out. Although meeting federal standards does not provide an absolute defense against liability, the firms that we interviewed believed that it was important to be able to show a jury that a product meets relevant federal safety standards. Even recalls may have their major effect through the generation of more product liability suits and a weakening of the firm's defense in such suits.

Only in a few industries where product-related regulation is pervasive (drugs and aircraft, for example) does regulation likely exceed product liability as a design influence. Even here, however, the liability consequences of design decisions are seldom far in the background.

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5For example, the RIMS survey provides data on the lowest value, first quartile, median, third quartile, and highest value by industry. For metals (average 0.36 percent of sales), these figures are 0.04 percent, 0.34 percent, 0.46 percent, 0.70 percent, and 1.28 percent of sales, respectively. Thus, within machinery, the total cost of risk (as defined in the preceding footnote) for the highest firm responding to the survey was 32 times the cost for the lowest firm; the cost for the third quartile of respondents was 2.0 times the cost for the first quartile.

6Some examples of such problems for small manufacturers are provided in Hearings of the Subcommittee for Consumers of the Senate Commerce Committee, 1982.
Unfortunately, though product liability appears to powerfully influence product design decisions, it sends an extremely general signal. The linkage between what constitutes good design practice and the degree of a firm’s liability exposure is extremely fuzzy. The signal threatens: Be careful, or you will be sued. But, it does not give precise guidance on how to be careful, or, more important, how careful to be.

To a degree, the lack of precise guidance is inevitable. Product liability law has two objectives: to compensate injured victims and to signal manufacturers the level of safety their products should attain. Over time, the compensation motive has been gaining in importance. To be sure, the two motives are not entirely antithetical.

As the dollar volume of product liability awards has grown, the message that product failure can be expensive to a firm has been transmitted ever more clearly. However, in the effort to broaden the circumstances under which injured product users can obtain compensation and to enlarge the pool of resources that can be tapped to provide this compensation, courts have inevitably muffled the signals concerning what constitutes good, as opposed to bad, design practice.

Some of the most important decisions involving compensation—the Sindell case, for example—were handed down by courts faced with the impossibility of providing compensation to an injured victim if existing law had been applied; these courts, feeling the need somehow to provide compensation anyway, explicitly wrote new law. Judicial decisions that weaken the direct linkage between firm performance and the degree of liability exposure complicate achievement of the signaling objective.

The fact that product liability law still is largely made by judges further complicates matters. In recent years, a number of states have passed legislation dealing with some aspect of product liability, but the law differs substantially from state to state.  

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7The California Supreme Court found inapplicable all of the various theories under which Sindell might be able to collect damages even though she could not identify the maker of the DES that her mother took. However, rather than dismiss the action the court stated: “In our contemporary complex industrialized society, advances in science and technology create tangible goods which may harm consumers and which cannot be traced to any specific producer. The response of the courts can be either to adhere rigidly to prior doctrine, denying recovery to those injured by such products, or to fashion remedies to meet these changing needs” (Sindell v. Abbott Laboratories, 1980). The court then did just that.

8A compilation made by the Farm and Industrial Equipment Institute shows that between 1977 and September 1981, 32 states enacted legislation dealing in some way with product liability. However, the comprehensiveness and content of this legislation varies widely, and in one important instance, California, the legislation merely established an interim committee to conduct a study.
The importance of these two complicating factors should not be overstressed, however. Concerning the matter of strict liability as applied to design decisions, a number of commentators have stressed that, regardless of what courts say, negligence remains the operative standard.9

Our respondents (especially lawyers familiar with the current state of product liability law) differed sharply on the importance of negligence. Some disputed the proposition that negligence was an appropriate concept to use when talking about liability with respect to design decisions. They did not want to go so far as to assume that the firm would be held to the extreme standard of absolute liability, but they clearly believed that judges were moving close to that position.

Others believed that most courts held to a negligence concept. But, even they acknowledged, as does Birnbaum, that individual decisions occasionally interject new uncertainties as to what the design test really is, although courts generally gravitate toward something that looks like a negligence standard. The important thing about this debate is not so much who is correct—there probably is no correct position—but that lawyers communicate divergent impressions to their respective firms.

The effect of state-by-state variance in product liability law is also not clear. Having to follow developments in multiple jurisdictions certainly imposes some expense on firms, but recent developments in electronic retrieval of court decisions lowers this cost.10 Furthermore, confusion sometimes follows when a court in one state appears to break new ground. Will the precedent be upheld even in that state? Will it spread?

In our experience, the general counsel’s office in most firms has usually been conservative in its advice concerning the state of the law.11 That is, it determines roughly what the law is in the toughest state and advises that this be used as the guideline.

This behavior is probably appropriate, at least for the firms we interviewed. All sell in national markets, so all can expect some suits in the most adverse jurisdiction. For these firms, perhaps the major problem is simply uncertainty about the future path of the law.

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9See, for example, Birnbaum (1980).
10These electronic retrieval systems are not available for courts of original jurisdiction. Decisions at this level have small precedential value until they are upheld at the appellate level, but they create some uncertainty.
11One product liability counsel cited the case of a state, not normally a leader in these matters, in which a court had ruled adversely on a particular product. He advised his firm to hold the product off the market in that state only, believing that the ruling was an aberration not likely to be followed in other jurisdictions.
The Movement for a Federal Product Liability Statute

We have already described the pressure that led to the creation of the Interagency Task Force on Product Liability and the drafting of a model state product liability statute. By 1981, hope for achieving state-by-state uniformity, at least in the near future, had faded. According to some, the state laws that were adopted helped little.

In a recent speech, Dean John W. Wade, a respected authority on tort law and the reporter for the Restatement of the Law of Torts (2d), commented: "Much of this [state legislation] is inadequately drafted and prepared without any attempt to maintain a fair balance between the conflicting interests involved. The process of bringing the states into a reasonable agreement has been sadly set back by many of these statutes."12 Finally, many manufacturers were concerned that, although the product liability crisis of the mid-1970s had subsided, product liability law was continuing to change in ways adverse to their interests.

Senator Robert Kasten, Jr., of Wisconsin, who had spearheaded the passage of the Risk Retention Act of 1981, the first piece of federal legislation relating to product liability, had his staff draft a federal uniform product liability statute. After two rounds of public comment and subsequent revision, he introduced a bill on June 16, 1982. We describe below the portions of the bill especially relevant to design decisionmaking by firms.

The Kasten bill13 states that a product shall be considered unreasonably dangerous in design

if, at the time of manufacture of the product, a reasonably prudent manufacturer in the same or similar circumstances would not have used the design that the manufacturer used. A product is not unreasonably dangerous in design unless—

1. The manufacturer knew or, based upon knowledge which had sound support in the scientific, technical, or medical community for the existence of the danger which caused the claimant’s harm, should have known about the danger which allegedly caused the claimant’s harm; and

2. A means to eliminate the danger that caused the harm was within practical technological feasibility.14

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13Unless otherwise specified, all references are to S.44, as proposed to the Senate, January 26, 1983. This bill differs in significant ways from the bill Senator Kasten introduced in 1982.
14Sec. 6(b)(1) and (2).
The bill defines *practical technological feasibility* as:

the technical and scientific knowledge relating to the safety of a product which, at the time of manufacture of a product, was developed, available, and capable of use or implementation in the manufacture of a product, and economically feasible for use by a manufacturer.\textsuperscript{15}

Concerning the claim often made in product liability cases that alternate designs existed that, if adopted, would have prevented the complainant's injury, the bill states:

An alternative design or formulation is evidence that a product was unreasonably dangerous in design only if the claimant establishes that, at the time of the manufacture of the product—

(1) The manufacturer knew or, based on sound support in the scientific, technical, or medical community for the existence of the alternative design, should have known about the alternative design; and

(2) The alternative design would have—

(A) Utilized only science and technology for which there was sound scientific, technological, or medical support and which was within practical and technological feasibility;
(B) Provided better safety with regard to the particular hazard which caused the complainant's harm and equivalent or better overall safety than the chosen design. The overall safety of the alternative design is better than the chosen design if the hazards it eliminates are greater than any new hazards it creates for any users and for any uses; and
(C) Been desirable functionally, economically, and otherwise, to the person who uses or consumes it.\textsuperscript{16}

The objective of (2)(B) is to deal with the problem created by *Larsen* and related cases in which juries have ruled in favor of plaintiffs whose claims were based on alternative designs that would have mitigated the plaintiff's injuries but perhaps have reduced the overall safety of the product. Paragraph (2)(C) assures that a risk-utility test must also be invoked. Parallel language is provided concerning manufacturer's responsibility to provide warnings.

The bill also deals with two other issues that have concerned manufacturers: product misuse or alteration and introduction by plaintiff of evidence of subsequent remedial measures. Regarding the first, the bill allows the manufacturer to demonstrate, by a preponderance of

\textsuperscript{15}Sec. 2(8).
\textsuperscript{16}Sec. 5(e).
the evidence, that misuse or alteration of the product was in part or in
whole responsible for the complainant’s injury. If successful in doing
so, any damages will be reduced or apportioned accordingly.17

The bill states that alteration will not be grounds for apportionment
if

the alteration or modification was in accordance with instructions or
specifications of the manufacturer or product seller; or the alteration
or modification was made with the express consent of the manufac-
turer or product seller; or the alteration or modification was reason-
ably anticipated conduct, and the manufacturer or product seller failed
to provide adequate warning or instructions with respect to that
modification.

Alteration will be considered to have occurred “when a person other
than the manufacturer or product seller changes the design, construc-
tion, or formula of the product” (Sec. 14(a)). However, the bill pro-
vides that “notwithstanding the provisions of Section 14, a manufac-
turer or product seller may introduce relevant evidence of post-
manufacturing improvements in defense of punitive damages” (Sec.
13(a)).

The bill also significantly changes the mode of setting punitive dam-
ages. Juries will determine only whether punitive damages should be
awarded; the court will determine the amount of the damages. Many
commentators believe that this will substantially reduce the size of
damage awards.

In short, the bill addresses many areas in which manufacturers have
expressed concern about the liberalization of the standards for liability
and, specifically, makes it significantly more difficult for plaintiffs to
prove that a design was defective. Furthermore, it clearly establishes
negligence as the relevant standard in design defect and warning cases.

The Kasten bill does not directly address two significant areas. The
first concerns the weight to be given to compliance with federally
established standards; the second involves the issue raised by the Sin-
dell case.

With regard to the first matter, both the first and second staff work-
ing drafts specifically provided that the existence of a federal standard,
pertaining to that aspect of the product causing the claimant’s harm,
created a rebuttable presumption that the product was not

17Misuse is defined to have occurred “when a product is used for a purpose or in a
manner not consistent with the warning or instructions available to the user, or which is
not consistent with reasonable practice of users of the product, or when a product user
fails adequately to train its employees in the safe use of the product, or otherwise provide
for the safe use of the product” (Sec. 10(a)(2)).
unreasonably unsafe in design. This presumption could be overcome only if the claimant were to prove, by clear and convincing evidence, that the product was unsafe in design, using the definition of unsafe provided by the bill, that a safer design was available and within practical technological feasibility, and that the alternative design "would also have complied with all mandatory Federal, State, and local government standards."\(^{18}\)

In the bill that Senator Kasten introduced, this section was dropped. The closest thing to it is the language in Sec. 5(d)(2)(B) requiring that a proposed alternative design provide "better overall safety" than the design in question and defining this term in a way that invites a balancing of harms. If one views the regulatory process as providing such a balancing, then it might be argued that no proposed alternative design which resulted in a violation of a federal standard would provide "equivalent or better overall safety than the chosen design." Certainly, the examples cited by Hoenig (1981) of conflicts between standards implicit in product liability decisions involving automobile crashworthiness and NHTSA standards are susceptible to this interpretation.\(^{19}\)

The bill also avoids the issue raised by the Sindell case. In Sindell, the plaintiff was unable to identify the manufacturer that produced the DES that allegedly resulted in her cancer. Ordinarily this would have barred recovery. However, the California Supreme Court declared that each manufacturer of DES would be held liable in proportion to its share of the market "unless it demonstrates that it could not have made the product which caused the plaintiff's injuries."

Both staff working drafts contained language requiring a plaintiff to establish "by a preponderance of the evidence that the product unit which allegedly caused the harm complained of was manufactured by the defendant."\(^{20}\) The bill, as introduced, made no mention of the issue. The reason for this modification, which parallels the findings of the California Supreme Court in the Sindell case, is easily understood.

\(^{18}\)This is the language contained in Staff Working Draft No. 2, Sec. 6(a)(1)(A).

\(^{19}\)In the Dawson case cited by Hoenig (p. 648), this requirement would not have been met had the evidence provided by the defense experts proved persuasive. This also appears true of the Gray case (p. 711) and possibly Sence (p. 711). However, neither the current bill (nor, for that matter, the earlier Kasten staff drafts) would deal with the "inconsistent intent" issue raised by Hoenig (p. 712). Using the Dresba case, Hoenig notes that the thrust of crashworthiness decisions might be inconsistent with the intent clearly stated by Congress in providing for the establishment of federal motor vehicle safety standards that all vehicles not be equally safe (in this case, that a Volkswagen microbus not be as safe as a large, front-engine sedan), provided the differences in safety were intrinsic in the design and clearly apparent to the purchaser.

\(^{20}\)Staff Working Draft No. 2, Sec. 4(a)(1)(B). This represents a strengthening of Staff Working Draft No. 1, which required only that the "product," and not the "product unit," in question be "manufactured by the defendant." Staff Working Draft No. 1, Sec. 4(a)(1)(B).
In his first statement of position on the possible need for a federal product liability statute, Congressman Henry Waxman, Chairman of the Subcommittee on Health and the Environment of the House of Representatives Energy and Commerce Committee (the House subcommittee to which any such bill would be referred), declared his general sympathy with federal product liability legislation but also his unalterable opposition to a negation of the Sindell doctrine.\textsuperscript{21} Moreover, the doctrine has not been adopted in other states, so that it seems less important than at the time of the decision to treat the matter directly in federal legislation.

**The Likely Effects of a Federal Product Liability Statute**

The fact that a federal product liability bill has been introduced does not guarantee that such a bill will ever emerge from the Congress or, if it does, that it will look like the proposed bill. Nevertheless, a bill has been introduced and has received broad support. Therefore, it is not an academic exercise to consider the consequences should a bill something like S.44 be enacted.

We noted earlier that current product liability law creates two quite different sources of uncertainty for business. First, being judge-made and differing state by state, the law varies. This presents a problem that business attempts to solve by monitoring the development of the law in many jurisdictions and by assuming that the operative standard is that (or close to that) adopted by the strictest state. Second, as society’s attitude toward the burden that should be placed on the manufacturer or product seller for assuring safer products and toward sharing the burden of product accidents has changed over the years, the center of gravity of the law has shifted.

The Kasten bill alters both the variance and the mean of current product liability law, especially as concerns what constitutes unsafe

\textsuperscript{21}Waxman said: “I do not believe that this legislation should require the claimant to identify the manufacturer of a product. While most states do require identification of the manufacturer by the claimant, there are several notable exceptions to this requirement which have been recognized by the Restatement [of Torts] and other authorities. Imposing an identification requirement in a federal bill would not only overturn Sindell v. Abbott Laboratories, but also [other] generally acknowledged exceptions to the rule. Further, I believe any attempt to overturn Sindell which is not coupled with some compensation mechanism for victims of chronic hazards like DES threatens the political viability of the entire bill.”

On the issue of the proper test for design defects, Waxman declared in the same address: “With respect to design and failure to warn defects, there is much controversy over whether the correct standard should be strict liability or negligence. The strict liability formulae utilized by many states bear striking resemblance to negligence principles.” Address by Congressman Henry A. Waxman to the National Conference on Product Liability and Tort Law Reform, Arlington, Virginia, April 20, 1982.
design.\textsuperscript{22} It reduces the variance by its sweeping preemption of state product liability law. It shifts the mean by making it substantially more difficult for plaintiffs to prove that a design is defective.\textsuperscript{23}

In actual practice, however, the proposed statute may not greatly reduce variance of product liability law, at least for a number of years. To avoid overburdening the federal courts, the bill provides that the federal product liability statute would be administered in the first instance by state courts. To be sure, these state courts would be administering a federal law.

In its current form, however, the bill contains numerous phrases possibly subject to a wide range of interpretation. For example, what are the criteria for "economically feasible" when applied to a new technology in Sec. 2(8)? In interpreting these phrases, some of which likely have no close counterpart in current federal law, state courts would probably look to their own experience. Only when federal appellate courts had sorted out these various interpretations—a matter of some years—would a body of consistent law begin to be developed.

The proposed statute would, however, immediately end the process of leapfrogging. It would anchor the current law in such areas as introduction by plaintiffs of evidence of postmanufacture improvements or novel theories expanding the concept of liability (such as \textit{Beshada}).\textsuperscript{24}

The shift in the center of gravity of the law is probably more important than any reduction in variance. While, as we have noted, some form of negligence has generally been the operative test in design defect cases, certain courts have continued to oppose law that includes negligence concepts in what is supposed to be strict liability. Thus, without a federal statute, the concept of negligence will likely continue to be eroded. Further, as new instances of product-related harm come to light under the current system, the courts in some states will be pressed to find ways of stretching the concept of strict liability to permit the award of compensation. A federal product liability statute would severely check this practice.

The proposed tests for alternative design provide firms with considerably clearer guidance for determining whether they have met their responsibility to the consumer. A plaintiff would no longer be able to

\textsuperscript{22}The bill makes no change in the current strict liability standard as applied to manufacturing defects or failure to comply with an express warranty.

\textsuperscript{23}Another important change is aimed at eliminating the battle of experts that often is part of design defect cases. In addition to all the other requirements already stated concerning the plaintiff, the bill states that "expert opinion is not considered sufficient evidence to support a proposition of fact unless it is supported or corroborated by sound objective evidence" (Sec. 4(6)). The term \textit{sound objective evidence} is not defined.

\textsuperscript{24}\textit{Beshada v. Johns-Manville Products Corp.}, 90 N.J. 191, 447 A. 2d 539 (1982). This decision imposed liability on the defendant, an asbestos producer, even though it could not have known at the time, given its research expenditures, of the dangers inherent in its product.
conjure up a possible design tailored precisely (and solely) to the circumstance that caused the alleged harm. Any such proposed design would have to meet the "practical technological feasibility" test, as well as demonstrate an increase in the overall safety of the product.

Indeed, in a sense, the statute establishes a form of "process defense." It enables a manufacturer to show that, through its design process, it has considered all "practical technologically feasible" alternative designs and has reasonably rejected all except the chosen one. This would put pressure on firms to formalize their design process so that they could make such a showing. The enactment of the Kasten bill would undoubtedly ease the designer's work.

How would such changes affect the role of the corporate product safety office? Inasmuch as the latter has the function of conveying to the designer the strictures contained in the current interpretations of the law, the function is simplified. The body of law will be both more consistent and more stable. However, in the companies that we visited we were struck by how few changes in law were transmitted to those involved in design decisions. The product safety officers could identify no more than a few relatively minor legal decisions that had directly impinged on design and production criteria for the firm.

Uncertainty in the law is costly, if only in psychic terms. In reality, however, the connection between the law and product design is sufficiently weak that even major changes in the law will have little effect on the behavior of firms with respect to consumer product safety, except inasmuch as they lead to significant changes in the overall cost of product claims.

INSURANCE

Much of the public policy debate about product liability from 1975 to 1980 centered around claims that insurance was often unavailable and that prices had risen at extraordinary rates. Congress held numerous hearings on the insurance issue, and the executive branch established the Interagency Task Force on Product Liability to study product safety, largely in response to concerns about the price and availability of insurance.

The debate led to the conclusion that the problem was overstated initially and that little could be gained by major public policy interventions. Consider, for example, the 1980 report of the U.S. Department of Commerce Task Force on Product Liability and Accident Insurance dealing with the insurance issue. This task force, established in the aftermath of the Interagency Task Force on Product Liability,
recommended against federal regulation of the insurance industry. It
made a number of highly technical recommendations with respect to
techniques for determining rates, recommendations aimed at the insur-
ers and the Insurance Services Office, the industry's information or-
ganization. For the state regulatory agencies, the task force had little to
suggest except that they encourage the insurers to adopt the technical
recommendations.

A More Limited Role for Insurance

We argue in this section that insurance may be of declining impor-
tance in product liability for large manufacturers and that policy
should focus primarily on the availability of insurance for small and
medium businesses in a few high-exposure product lines. Our argu-
ment is based on the assumption that increasing incentives for self-
insurance will reduce the capacity of the insurance industry either to
set valid rates or to develop the kind of product liability prevention
expertise that was expected of it earlier.

The large manufacturers whom we interviewed had all, during the
1970s, greatly decreased the proportion of their insurance coverage
obtained from outside companies. However, they were not all formally
self-insured. In some cases, they had very large deductibles ($250,000
per incident, $10 million total per annum was fairly typical); in others,
they had "excess" insurance only, covering only payments in excess of
some limit, with the limit well above any likely level of payments. But
even with these policies, they had greatly changed the role of the
insurance company.

Insurers still provided basic claim investigations and payments ser-
dices, simply because few manufacturers are equipped with the dense
national network of offices that would make it efficient to do these
same tasks internally. But major decisions about settlement and litiga-
tion were now handled by the firm. Contrast this with the situation
reported in the late 1960s. "In some instances, the manufacturers
apparently do not even inform themselves of the final resolution of
these claims, and for these manufacturers it is obvious that a court
decision will have no direct effect on product design or warning deci-
sions" (Whitford, 1968, p. 228).

We suggest that there are at least three reasons for this change in
relationship between insured and insurer. All involve differences in the
settlement criteria of the two parties.
First, the manufacturer may want to avoid acquiring the reputation of being a "deep-pocket" company, i.e., one that is likely to settle easily. This reputation would encourage many small claims suits that otherwise might be settled early in the claims process. In this respect, the firm will necessarily be concerned with the long-run consequences of settlements on its reputation; the insurer may have a shorter horizon, since the contract with the firm is typically an annual one. A shift in the long-run litigation costs can be passed on by the insurer to the firm in future contract periods.

Another element of reputation creates a second division between insured and insurer. The insurer does not—and, in fact, could not—cover losses resulting from a decline in the firm's reputation as the result of publicized product defects. Yet, one of the major costs of product defects may be just such reputational losses.

The lack of insurance coverage of reputation loss has two important consequences. The firm may be more willing to litigate and risk the loss of a major product defect suit because if it wins the suit not only does it avoid paying damages but its reputation is maintained. The insurance company would not give the same weight to the reputation factor in making settlement decisions. The other consequence of the lack of insurance coverage is to raise the optimal level of product liability prevention expenditures. If the firm is purchasing these services in bundled form from the insurer, it will seek to change the mix of services from that offered by the insurer. It may be cheaper for the firm to provide the correct bundle of services itself.

Third, several organizational aspects of litigation and settlement may lead manufacturers to prefer to retain control. Firms may choose to litigate for reasons of internal morale—for example, because the firm's design group is convinced that it acted responsibly. Settlement would be interpreted as disapproval and would lower morale. While this is unlikely to be the sole criterion in determining whether to settle a case, it may move some cases across the margin from settlement to litigation in terms of the manufacturer's preferences. Similarly, the manufacturer may be able to tap economies of learning through

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25One insurer asserted that there had been very little turnover in insured-insurer relationships even during the 1970s. This insurer's own experience was that turnover barely ever reached 10 percent annually. The insurer also asserted that settlement decisions were made jointly with the insured. Our interviews with manufacturers suggested that large manufacturers had had more turnover than this. The interviewees also indicated that insurers had not always sought their views about settlement decisions.

26The same differential incentives may lead to the opposite outcome. If a trial provokes further adverse publicity for the firm, then it may be more willing than the insurer to reach an out-of-court agreement that includes a nondisclosure agreement with the plaintiff. In either situation, the insured and insurer have different criteria.
specialization of its own attorneys, if it controls litigation. The firm's attorneys will have an easier relationship as well with the production and design officials who contribute to the development of a case.27

Indeed, internal litigation expertise is a particularly valued quality in some settings. High-hazard product manufacturers are likely to have a stream of cases around a small set of issues. Drug companies, for example, may find a cluster of suits around particular side effects for a given drug. In defending these cases, the firm's lawyers will develop a highly specialized knowledge. With an insurer responsible for litigation, the firm can be less sure that it will retain the expertise developed in early trials.

In this connection, internal litigation may also provide a valuable organizational capital. For example, in one company that controlled all its own litigation and had a continuing stream of cases, we noted that engineers were assigned to work with the litigators as one of the standard rotations in their careers. This assignment made engineering staffs more aware of product liability matters and improved the technological understanding of the lawyers.

Firms in high-hazard, tightly regulated industries have an additional motivation to control litigation. Much of the litigation centers around matters that are subject to regulatory control; the drug warning-label cases are again prominent examples. The expertise developed in dealing with the regulatory agency also provides the basis for litigation expertise. Stands in litigation and regulatory proceedings are more easily harmonized.

**Increased Self-Insurance**

These observations concern large corporations; yet another factor may lead small manufacturers to reduce their use of insurance companies. The Risk Retention Act of 1981 substantially increased the incentives for self-insurance for smaller firms, which can form pools for insurance purposes. The act is still too new to permit evaluation of its

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27 Yet another factor may be the noninsurability of punitive damages, referred to in Section II. Law on this matter is unclear and some insurers apparently do make payments to cover punitive damages. If punitive damages increase in importance and courts rule against coverage of such awards, then this would create different settlement criteria for the insured and insurer, though in this case the effect is to make the insured more willing to settle. The insurer will have to cover the entire cost of settlement, assuming it falls within the policy limits. That settlement may include some element of the expected punitive damages. If the case goes to trial and the jury finds against the defendant, with punitive damages as a substantial portion of the total award, the insurer covers only the compensation component of that cost.
effects. Surprisingly, by the end of the first year only one pool had been created, and it was not yet functioning.\textsuperscript{28}

One potential advantage of these pools is that they may be able to develop better expertise concerning product liability prevention and to set rates that more accurately discriminate between high- and low-risk firms within the pool.\textsuperscript{29} However, in an environment in which poor-risk firms can obtain insurance at better rates from insurers, such pools may attract only a small number of the better risks.

This shift to self-insurance by large- and (possibly) medium-sized firms may adversely affect the capacity of the insurance industry to develop better hazard rating systems. With fewer firms providing data for the development of rates, manual rates will likely form a decreasing portion of the total number of rates. Insurers may increasingly rely on judgmental rates simply because of a smaller pool of risk experiences to draw upon in setting rates.

The shift to self-insurance will also reduce the ability of the insurance industry to develop product liability prevention expertise. At present such expertise seems to be sold mostly in a bundled form, i.e., together with pure insurance services. The services could, of course, be unbundled, with insurers selling many firms prevention services only; indeed, some insurers do so currently. But, the insurance industry becomes the low-cost provider of such services on the basis of the knowledge that it acquires through serving firms as insurers; if it sells less insurance, it will develop less expertise in the prevention area.

Of course, the most important observation about product liability prevention services is that the insurance industry provides little in the way of such services. Even now, as the experience of our case study firms suggests, many insurers show scant knowledge of measures in the design area that manufacturers might adopt to reduce the flow of defective products and related injuries.

The problems of product liability insurance rates reflect this lack of knowledge. The great variations reported in the extent of reserves for the Incurred but Not Reported (IBNR) category suggest the level of uncertainty that surrounds rate-making. The rate decline reported since 1978 by ISO appears to have occurred not because of declines in

\textsuperscript{28} Telephone interview with insurance industry association official.

\textsuperscript{29} The Grinding Wheel Institute provides an interesting historic example of the possibilities of industry-wide cooperation. "After World War II, the Grinding Wheel Institute became concerned about the increasing frequency of costly product liability losses. . . . Led by several major manufacturers that dominated the industry and joined by one insurance carrier and a research organization—Cornell Aeronautical Laboratory—the group developed a two-phase program to hold down insurance costs. The initial phase was aimed at reducing the number of grinding wheel accidents through strict loss control standards" (U.S. Department of Commerce, 1977c).
actual costs of awards and settlements but because of decreased uncertainty on the part of insurers about the future rates of change, as well as increased investment income from reserves.

The problems of product liability insurance rates stem from the nature of this type of insurance. Despite the increases in suits and award levels during the 1970s, product liability is still a minor line of insurance activity. ISO member companies, representing perhaps 95 percent of the insurance industry, reported product liability premium income of only $1.3 billion in 1980, in contrast, for example, to workers’ compensation premium income of $23 billion. The incentive for developing expertise is limited. Furthermore, because product liability insurance is provided by many large insurers, no single firm has the basis for developing a unique expertise.

One of the consistent themes of the congressional hearings on product liability insurance was the lack of data that would permit evaluation of the performance of the industry with respect to this line of insurance. Product liability was lumped together with a number of other lines of insurance because it was not sufficiently important to insurers to merit separate listing.30

Since 1978, a number of states have sought to define a separate line of insurance that would permit assessment of the profitability of product liability policies. Although more data are now available, the task force pointed out that the “long tail” of loss experiences (i.e., the many years that frequently elapse from the time of sale to the time of claim settlement) associated with this line of insurance means that even more detailed data about the timing of payments and investment income are needed for effective regulation.

The continued uncertainty about awards and settlements for product liability is also changing the nature of the insurance contract being offered by insurers. Instead of a fixed premium with unlimited tail coverage, insurers are now moving toward more risk sharing with the insured and limited tail coverage; i.e., the contract specifies higher coinsurance payments by the insured firm and a specified coverage termination date relative to the given year. Coverage for remaining claims arising from that year will then be offered in a separate contract written at the termination of the initial contract.

Finally, the shift to self-insurance, by reducing the extent of data available to the industry for rate-setting purposes, may effectively raise

30 According to the 1980 task force report, “the bulk of product liability experience was shown in line 17 (of the standard reporting form)—‘other liability.’ However, it has been estimated that 40 percent of the experience shown on this line is product liability experience” (U.S. Department of Commerce, 1980, p. 15).
costs to the remaining insured, in particular, small companies. The result may be perceived as a crisis in the cost of insurance for small businesses.

**Insurance as a Form of Private Regulation**

Some have suggested that the private insurance mechanism might be a superior substitute for existing public regulation in certain areas. For example, the 1982 *Annual Report* of the President’s Council of Economic Advisers contained a section entitled “Increased Reliance on the Market” in which the council wrote:

The advantage of market-like devices is that they can create incentives to behave in the desired way. That is, if we can simulate an effective market, we can rely on self-interest to achieve the desired goals. This will reduce the cost of achieving the regulatory goal and also increase the extent to which the goal will be achieved.

A good example is provided by comparing government safety regulation of firms with private market insurance against risk. In the case of government regulations, violators are punished, commonly with a fine, which may create incentives for the regulated firms to conceal possible violations and to avoid cooperation with safety inspectors. If, on the other hand, a firm which is insured can make its operations safer, it will usually benefit by having its insurance premiums reduced. Thus, such firms have an incentive to cooperate with insurance company inspectors and adopt any recommendations which are made. This is but one example of how a market device, by elicit-ing cooperation, is more efficient in achieving desired goals than is regulation, which elicits conflict.

While we would not wish to deny the council’s general premise that market-like incentives systems can, in certain cases, be superior to regulation in achieving important social goals, and while, as will become clear below, we do not consider product safety regulation to be problem-free or perfectly effective, our results caution against oversimplifying the advantages of the private insurance mechanism, at least in the product safety area.

As we have pointed out, the relationship between the insurer and the insured is hardly conflict-free; important asymmetries in incentives may exist between insurer and insured. Moreover, the rate-setting mechanism is hardly as experience-related as the council’s statement would suggest. Finally, unlike in an area such as workplace safety, an insurance inspector is unlikely to gather the kind of “class” knowledge appropriate to design practices in individual circumstances.
Insurers can—and do—serve a useful educational function, informing companies about the existence of design assurance techniques and institutional arrangements for their effective implementation. But, the same difficulties that prevent the unambiguous definition of good design process, plus the lack of a clearly best organizational form for assuring proper attention to product safety issues, would seem to severely limit the usefulness of insurance inspectors—as they would equally limit the usefulness of government inspectors—in monitoring firm design practices.

Indeed, in contrast to the Council of Economic Advisers, which optimistically evaluated the private insurance mechanism, we believe that insurance is likely to lag quite far behind product liability and (well-designed) regulation as a constructive force for assuring that firms pay appropriate attention to safety in product design.

REGULATION

Clearly, the term regulation covers a wide range of instruments and policies of government. It should also be clear that there can be no single correct regulatory policy for the government to pursue with respect to product safety. Different industries present different regulatory opportunities and different regulatory problems.

In discussing the implications of our analysis for federal product safety regulatory activities, we will divide these activities into three general categories: standard-setting, mandating the recall of products deemed defective, and other activities such as information generation and dissemination. While standard-setting has received the most public attention, it will turn out, except with respect to a few products, to be probably the least important.

Standard-Setting

When people talk about the federal regulation of product safety, they usually have standard-setting in mind. The idea of the government establishing either design or performance standards for important consumer products was at the heart of the legislation that established the Consumer Product Safety Commission and the National Highway Traffic Safety Administration.

The standard-setting model applies accurately in two instances. We begin our examination of the implications of our work for federal standard-setting with a brief review of these instances—the activities of the Federal Aviation Agency and the Food and Drug Administration.

These two agencies intervene in the earliest stages of product development and monitor safety procedures and decisions of firms
throughout the development, marketing, and manufacturing process. We have already stated our view that in industries subject to these highly intensive, safety-related regulatory interventions, regulation rather than product liability appears to drive the corporate product safety effort.

The FDA represents perhaps the polar case here. Product liability expenses constitute a major element of drug firms' costs. But, if the firm we visited is typical, these expenses are seen as an unfortunate but inevitable cost of doing business and do not appear to independently influence the industry equivalent of the product design process. Indeed, even product liability law appears to recognize that drugs occupy a special place, and product liability cases in this area appear to be directed more toward securing compensation for victims than toward creating incentives for manufacturers (the latter supposedly being the job of the FDA). There has been a great deal of complaint about the costs of such regulation, particularly in terms of the delays imposed on drug innovation decisions. Procedures for review are claimed to be overly cumbersome and unnecessarily risk-averse.31

Strikingly little attention is given to the possibility of deregulation with respect to product safety in either drug or aircraft manufacture. Two recent contributors to a volume on alternatives to regulation (Poole, 1982b; Weimer, 1982), in analyzing FAA and FDA product safety regulation, commented that the possibility of deregulation had scarcely been discussed.

Both Poole and Weimer then outlined ways in which the deregulated system might function to assure a reasonable level of safety. Of course, lacking data based on experience, they were forced to speculate on the responses of the various actors—i.e., manufacturers, hospitals, airlines, etc. Poole pointed to the effective response of the insurance industry to the lack of fire-safety regulation in the latter part of the nineteenth century as a model suggesting that aircraft insurers might reconstruct some private, and more efficient, market equivalent of the FAA for certifying new aircraft. Weimer emphasized the role of secondary providers for private market control of drug safety, but with less optimism than Poole. The sheer diversity and number of new drug entities makes safety regulation far more difficult for drug manufacturers than for aircraft producers.

Except for the relatively academic Poole and Weimer proposals, however, the argument about safety performance in these two industries has centered on relatively marginal changes in the policy of

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31 An excellent case study reviewing the evidence on this point and putting the issue into perspective is Grabowski and Vernon (1983).
regulatory agencies, rather than on a massive shifting of responsibility to private firms. The liability system would undoubtedly provide producers with incentives to avoid unsafe products, but the consequences of any failure here apparently have been deemed by society as being too massive to permit risks. 32

Our observations about the strikingly different role that regulation appears to play in firms producing high-hazard products as opposed to firms producing low- or moderate-hazard products suggest a generalization about the use of regulation to influence product design and manufacturing decisions in general: either standard-setting regulation should attempt to exercise a full partnership role with management in product decisionmaking (as it does in the case of drugs and aircraft) or it should play a largely complementary role to the product liability system (such as we suggest that CPSC does in practice). Considering the resources involved, this sort of highly intrusive regulation would appear to be desirable only in cases where the consequences to the public of a massive product failure, combined with the realistic probability of its occurring without such regulation, are substantial.

Noting that “billions of decisions concerning health and safety are made each day in the United States,” only a “minute portion” of which are subject to a specific regulatory standard, Lave (1981, pp. 2–3) remarks:

The health and safety attributes ascribed to purchased goods and services result from engineering judgments, semi-informed guesses, and chance, as conditioned by regulation. Few of these processes are even conceptually subject to regulation by federal government agencies.

Far from being able to do the whole job, regulatory agencies can do so little that they must be used carefully if they are to have any effect. Their first task must be to curtail the worst abuses, not wasting time on unimportant issues, and their second task must be to influence but make no pretense of controlling the decisions of manufacturers and consumers. The latter depends on presenting these nongovernmental decisionmakers with facts, analyses, and a framework for making decisions and changing the perception of the importance of health and safety.

Unfortunately, efforts have been made to apply FDA- and FAA-type regulation in areas where its need (as well as the prospects for its success) seems questionable. These efforts have generated considerable controversy, in part perhaps because the scheme of regulation being

32On the issue of dealing with such low probability, high consequence events, see Page (1978).
applied may be inconsistent with the nature of the underlying problem and most certainly is inconsistent with the level of resources that the responsible agencies have been able to expend on its implementation.

Consider the case of the National Highway Traffic Safety Administration (NHTSA). This agency may well have made major contributions to the improvement of automobile safety. Its accident information system (FARS) appears to have led to better focused safety engineering innovations. It has mandated a number of safety devices that appear to have substantially increased the safety of automobiles.33

However, NHTSA has failed to find an effective method for intervening in the product development process. Efforts to set standards for various components have occasionally failed because of the agency’s insensitivity to the length of the product development process in this industry; it takes about five years from the initial conception to actual production of a substantially new model. Any requirement for changes in the next model year, or even the year after that, is likely to be bitterly contested.

The failure to intervene effectively does not necessarily lead to the conclusion that more intrusive regulation on the part of NHTSA is appropriate. It suggests, however, that NHTSA must either regulate less ambitiously or intervene more directly in the development process. Given the relatively large number of genuinely new products (from the point of view of hazard generation) that the automobile industry produces, we suspect that it is likely to be more feasible (and also more effective) for the agency to restrict itself primarily to postproduction certification, the collection of safety-relevant information, and the operation of an aggressive recall system.

NHTSA might also institute a major R&D program to generate (and publicize) information about new safety techniques and about the safety performance of current automobiles. It already has some such programs. In Fiscal Year 1981, the latest year for which complete data are available, research and analysis activities accounted for $40.3 million of NHTSA’s $89.2 million in total funded program costs (FY 1984 Budget, Appendix, pp. I-Q13).

NHTSA’s efforts to generate new automobile safety technology through the commissioning of prototype safety vehicles has been a mixed success. Its crash-testing activities, in which production models of currently available cars are slammed into barriers and the results measured and widely publicized, appear to have attracted widespread public support and interest, but have been intensely controversial with manufacturers. However, we suggest that the NHTSA consider largely abandoning its standard-setting activities. Its current position is

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33Peltzman (1975) attacked this view with a statistical analysis of the determinants of traffic accidents. His results have been challenged in a number of articles (e.g., Robertson, 1977; Crandall, 1983).
singularly uncomfortable; it has stated ambitions which it lacks the
dowers and resources to achieve, and the result appears to be high ten-
sion with minimal effectiveness, given the resources expended.

Consider another product area, one that we have not dealt with in
detail in this report—toxic chemicals. Conditions here may be
appropriate for an FDA-like level of intrusiveness into product design,
manufacturing, and distribution issues. Indeed, the Toxic Substances
Control Act of 1976 (TSCA) appears to contemplate just such interven-
tion. Borrowing heavily from the FDA model, it calls for premarketing
approval, recall activity, etc.

The massiveness of the toxic chemical problem complicates regula-
tion. According to a report issued in 1980 by the Toxic Substances
Strategy Committee, an interagency group made up of agencies with
responsibility for the regulation of toxic substances, over 43,000 chemi-
cal substances were listed by the EPA in its initial inventory of sub-
stances that are produced commercially in significant amounts and
considered subject to regulation under TSCA. Vast numbers of poten-
tially toxic chemicals are being marketed.

The issue has been to narrow the list of candidates for regulation to
a manageable number and then to apply appropriately stringent surveil-
ance to those deemed truly dangerous. Lave et al. (1983a and
1983b) recently suggested how such testing might be done at reason-
able cost. Whether the EPA will succeed in this is still to be deter-
dined; however, toxic chemicals seem to involve a much more
appropriate match between intrusive regulatory activity and underlying
need than do automobiles.

We have generally stressed the important role that regulation plays
in the product liability system. Indeed, one effort was made to involve
regulation much more directly in the litigation process: Early drafts of
the Kasten bill contained a clause proposing that the defendant’s com-
pliance with federal regulatory standards should provide a rebuttable
presumption that the defendant had exercised due care. The form of
the bill finally introduced no longer contained that clause, but there
continues to be some pressure for it.

The desire on the part of manufacturers for such a clause is under-
standable. When the government sets standards, it in effect assumes a
portion of the design decisionmaking responsibility. Its decisions,
which have the force of law, constrain and condition the decisions of
product designers in private firms, sometimes with unexpected (and
possibly unfortunate) consequences (recall the examples in Hoenig).

In cases such as the FAA and the FDA, it would seem reasonable for
society formally to recognize that the government’s pervasive regula-
tory surveillance creates some assurance of a quality control process for
design. Furthermore, adherence to this process should create a strong defense—a process defense, so to speak—for the manufacturer. This assumes that the regulatory process is, in fact, working as intended.

The question of whether to apply the same presumption to the less pervasive regulatory standard-setting, however, raises doubts. For the same reason that we questioned the ability of such agencies as NHTSA to exercise a meaningful standard-setting role, we would also question their ability to certify the design processes of the firms they regulate. Moreover, there is the question of what the granting of such a presumption might do to the process of regulatory standard-setting. The process would either have to be massively expanded to provide the requisite assurance that it was indeed serving the function claimed for it, or it might collapse of its own weight as the limited role it now plays became better appreciated.

Some notion of the burden involved in attempting to regulate a large number of products is conveyed by a recent congressional report on the implementation of the Medical Devices Amendments of 1976. The report, published in 1983, seven years after the act, found that of the 41,000 medical devices to be classified for regulatory purposes, the FDA had managed to give final classification to 800. The agency estimated that 44,000 man-years were needed to carry out regulatory classification for the 1100 devices that were deemed to need regulation but not prior approval. Even allowing for some degree of protective exaggeration, the data suggested that the task was likely to be beyond the resources of the agency.

In fact, outside a few areas, the regulatory standard-setting function is (and is likely to remain) too weak to provide a major prop for product liability litigation. If the above-mentioned clause dropped from the Kasten bill were adopted, each regulation considered by an agency would have to be further scrutinized with regard to the adequacy of the substantive and procedural aspects of its formulation. Did the agency use a reasonable figure for the value of a human life in carrying out a cost-benefit analysis, if that was used in the procedure? Where an agency adopted a standard developed within the voluntary standards system, was that standard, when initially developed, given adequate review by affected parties other than producers?

The creation of a process defense in product liability litigation would surely lead the courts to reject many existing standards and the regulators to behave even more cautiously. If Congress is convinced that regulations can be used to clarify the responsibilities of producers, then it might greatly increase the funding of the standard-setting agencies to

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assure that they are able to promulgate regulations that will meet judicial scrutiny. Industry might also demand a substantial expansion of the scope of the regulatory system, since that would now more clearly define its liability. Given the cost of regulatory development, this expansion would be possible only with extraordinary and unprecedented increases in the budgets of the relevant agencies. Even then (as Lave noted), the limits of our ability to refine estimates of some of the major parameters involved in safety decisions may reduce the authority of standards below the level acceptable in the litigating process.

We believe that legislation creating a defense based on meeting government standards should be limited to the few cases that meet the conditions that we describe for an effective government partnership in the design process. In the other, more numerous cases, we do not consider such a defense appropriate. Indeed, the primary lesson of our research (as well as the research of others) is that government standard-setting in these instances ought to be substantially cut back and regulatory resources focused on such activities as recalls, to which we now turn.

Recall Activities

Recall powers have become an increasingly important tool for the less intrusive regulatory agencies. Both CPSC and NHTSA routinely issue recall notices for the products of major manufacturers, sometimes with the cooperation of the firms, but sometimes only after the firm has failed to act. The CPSC has clearly shifted its emphasis from standard-setting to recall and information activities.\textsuperscript{35} We believe that this shift stems less from a changed ideology on the part of commission members than from a growing realization of the costliness, cumber-someness, lengthiness, and ultimate futility of standard-setting efforts.\textsuperscript{36}

When appropriately handled, recalls appear to offer an efficient tool for influencing firm behavior, given the growing importance of corporate reputations. A recall identifies a particular manufacturer as failing to exercise adequate care. Not only does this possibly increase

\textsuperscript{35}The decrease in the CPSC budget has led to a decline even in the number of recalls. From 588 recalls in 1980, the last year of the Carter Administration, the number declined to 350 in 1981 and 163 in 1982 (\textit{Washington Post}, May 16, 1983, p. A11).

\textsuperscript{36}Viscusi (1983) argues that recalls are favored by the CPSC in part because the commission does not have to go through public hearings, regulatory review, etc. when it uses its recall powers.
his exposure in any lawsuit involving the product but it also lowers customer expectations about his performance with respect to other products. Consequently, it may adversely affect the firm's position in all its product markets.

We are unable to provide much more than conjecture on this matter. It is not possible to identify the size of the reputational effect arising from a product recall, i.e., the effect on market share of the firm in all its product lines resulting from the recall of a single product. Such a piece of research would be extremely complicated to conduct. However, we can offer some anecdotal evidence concerning manufacturers' sensitivity to the reputational consequences of a mandated recall.

Automotive News (August 17, 1982, p. 2) listed nine recalls carried out by Ford and Chrysler without public announcement; they simply sent notices to the initial purchasers of the affected cars. Although the newness of the cars meant that the manufacturers probably had relatively good lists of current owners, thus reducing the necessity for public announcement, clearly they were seeking to reduce the number of persons aware of the problem.

In a case involving the CPSC, the manufacturer negotiated an agreement with the agency to minimize the amount of information available concerning the defect, in return for which the firm agreed to pay a fine close to the maximum that the CPSC could impose. The firm agreed to conduct an expensive effort to notify all owners of the item (a thermostat used in a liquid propane gas water heater). However, the notification campaign, centering around the distribution chain, involved narrowly restricted publicity and did not require that the firm disclose any information to newspapers or other mass media. The firm also got the CPSC to agree not to make a formal finding of a safety hazard, a finding that might have adversely affected the firm's position in product liability suits.

Mandatory recalls may also be relied on increasingly because they do not unite an industry against the regulatory agency. Whereas in standard-setting procedures the agency may be pitted against a group of firms seeking to prevent a particular agency action, in the recall

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37 While we can produce no evidence on the impact of recalls on the number of suits, anecdote suggests that the publicizing of a product defect in connection with a recall is likely to substantially increase the number of product liability claims alleging the same defect as the cause of injury.

38 This may account for the fact that certain manufacturers, noticeably Ford (with respect to automatic transmissions) and General Motors (with respect to the rear axle on its X-cars), have begun to demand full-blown regulatory proceedings in connection with recalls.

39 Case Study No. 40 in Coffin et al. (1981).
setting it deals only with the affected individual firm. For agencies
with limited resources for dealing with the political consequences of an
aroused industry, this is a nontrivial consideration.

Further, a recall is targeted to a reasonably clearly identified prob-
lem, whereas standard-setting has virtually no limits. A major criti-
cism of the CPSC has been precisely the way in which it has decided
on the priority of items for standard-setting proceedings. While the
critics' points are well taken, it is not clear what is the correct method
for setting priorities.

In contrast, the recall process is triggered by a relatively well-defined
event. In improving its performance in this area, the agency may raise
the efficiency with which it collects information relevant to deciding
that a recall is necessary. Alternatively, it may be able to pass those
costs on to the firm by rules that extend the firm's responsibilities for
collecting recall-relevant information.

Recalls nonetheless involve some major problems. First, they are
often triggered quite late in the lifetime of a product defect. For ex-
ample, the thermostat recall in 1980, mentioned above, involved products
the distribution of which began in 1961. The first accident had hap-
pened in 1968, and at least 23 explosions occurred before the problem
was identified. 40

The speed with which a firm becomes aware of a problem depends
on such factors as the severity of the injury caused, the extent to which
the firm is involved in the marketing and maintenance of the product,
and the care that it exercises in collecting and analyzing information
about complaints, warranty work, etc.

The CPSC, by assigning responsibility to a designated individual in
the corporation and placing an affirmative obligation on the firm to
notify the commission when a potential hazard is identified, motivates
firms to seek the relevant information more aggressively. Even though
we have identified this as an important motivation for firms to raise
the extent of their product safety efforts, it is still likely that most
firms will be fairly slow to identify any but the most serious problems.

The second difficulty with recall programs stems from their limited
success in reaching their targets, the owners of the defective products.
Success rates, which vary greatly, are determined by such factors as the
value of the item and the recency of its purchase. Problems identified
in late model cars are likely to lead to highly successful recall cam-
paigns, as the manufacturer will have an accurate list of current own-
ers. Efforts to reach the owners of electric fans manufactured at least
four years before the recall began are predictably less successful.

The third difficulty with recalls lies in establishing appropriate standards for their initiation. Indeed, the central question in the recent, highly publicized controversies concerning the automatic transmissions in Ford automobiles and the rear axles in General Motors X-body cars is not whether failures have occurred—that point is indisputable—but whether the past and prospective incidence of failure justifies the expense of the recall.

Decisions to recall need to involve an appreciation on the part of the regulatory body of the likely effectiveness of the recall in locating potentially defective units (although this is by no means a predetermined variable) and the scope of the hazard that will exist if the recall is not ordered. Perhaps agencies like NHTSA and CPSC might make better use of the power of the product liability law by creating a class of cases in which they identify a pattern of product failures that may be insufficient to justify a mandatory recall but in which the mere fact of publicity, plus the attendant fear of suit, might be adequate to cause the manufacturer to take steps to identify and fix those units that might be especially prone to safety problems.

However, the fact that a regulatory agency might decide—using some grounds such as cost-benefit analysis—that a mandatory recall is unwarranted should not be considered by courts as equivalent to that agency's having determined that no problem exists. In other words, the decision not to initiate a recall should never be considered as equivalent to the issuance of a standard certifying the existing product.

The CPSC and, to a lesser extent, NHTSA might be able to improve their performance in the specification of programs that manufacturers must undertake to assure early identification of postmarketing problems. The approach should not be to set out rigid requirements for all firms but to provide guidelines which could be adapted to the different structures and product lines of various corporations. By identifying information systems that improve performance with respect to recalls, the regulators can provide models that the product liability system will further motivate firms to adopt.

Other Activities of Regulatory Agencies

Throughout the conduct of our research, we have been struck by the continued absence of reliable baseline information. One can understand why such information might have been unavailable to the National Commission on Product Safety, working in the late 1960s, or to the early National Highway Traffic Safety Administration. But to find such information still lacking, even after more than a decade of detailed regulation by CPSC and, to a lesser degree, NHTSA, is surprising.
If we recommend that regulatory agencies (other than those that are willing and able to assume more or less a full partnership in design decisions with the industries that they regulate) largely abandon standard-setting as a regulatory tool, we also recommend that agencies which heed this advice devote considerably more time and resources to developing such baseline data, testing consumer products, and publicizing the results of such testing.

The use by regulatory agencies of the government’s clear advantage in collecting and aggregating information would provide these agencies with better information as to when they might appropriately exercise their recall and standard-setting powers. Finally, such information would help citizens who believed themselves injured by poorly designed or manufactured products to utilize the product liability system to prove their claims.

**IMPLICATIONS FOR CORPORATE MANAGERS**

Thus far in this section, we have focused principally on what our results seem to imply for the various instruments that either represent or reflect public policies influencing product design decisionmaking. These results should be of interest not only to government officials but to those in firms who must deal with such officials and who try, in one way or another, to influence government policy. However, we want to close this report with a few observations directed specifically to those who oversee and operate the product safety activities in firms such as those we interviewed.

In many firms, the formal product safety unit was created during a period of external stress in an attempt to deal with that stress. Either the actual or expected costs of product liability litigation caused firms to see that formalization of responsibility for product safety activities made good business sense, or the growth of federal product-related regulation created the need for a unit to deal with the government; in some cases both elements clearly must have played a role.

This is not to deny that, in some instances, creation of the product safety unit was stimulated, at least in part, by a recognition that such a unit could improve product design practices within the firm and that this was a desirable outcome, even independent of regulatory and legal pressures. Evidence strongly indicates, however, that external motivations figured prominently in many cases.

The public continues to be concerned about consumer product safety, even while being aware of the costs that safety may entail. According to a 1980 survey,
Focusing specifically on the government's regulations to insure the safety and dependability of consumer products or services, two-thirds of the public think that such regulations add at least a fair amount to the costs of the goods people buy. . . . Although more people now think that product safety and dependability requirements add significantly to costs, the majority of most segments of society will still believe that these expenditures are worth it. Fewer than one-third of the people in any population subgroup feel that the costs are not merited.41

The general pressure on firms for assuring the safety of consumer products will not likely recede much in the near future.

The prospects for a uniform federal product liability statute are growing. At the same time, pressure is increasing for federal regulators to take a more informed, less adversarial posture in dealing with the firms they regulate. There is also increasing recognition, reflected in this report, of the extremely limited role that federally promulgated product standards can play. But, as should be obvious from our discussion earlier in this section, even if these trends continue, external social pressures to design safer products will not disappear. However, some of the arbitrariness and unpredictability of both product liability litigation and regulation may be ameliorated.

We have also noted that product liability insurance rates seem to have declined and that companies are both cutting their insurance costs and obtaining better control over the disposition of claims through an increased use of self-insurance. These factors, plus the intense cost pressures that businesses now face, cannot help but provide managers with the incentive and opportunity to cut back on the resources that they devote to such things as product safety units.

Our conclusions on whether businesses should cut back on product safety are ambiguous. Some of the product safety activities that we are aware of seem to have been created as much for external show as for generating genuine and constructive changes in the firm's design practices. In some cases, these units are so at variance with their firm's general operating philosophy that their elimination would pose little danger. Indeed, to the extent that such units are generally recognized within the firm as being primarily for external show, their elimination might even enhance product safety activities.

We believe, however, that a role exists for a well-designed, properly placed, and appropriately funded product safety function in virtually any manufacturing firm. The products being manufactured by American businesses today have become so complex; the process by which

they are designed, so spread out through the various units of the firm; and the hazards that these products can generate in the hands of users, so subtle and difficult to anticipate that firms cannot afford not to devote formal attention to ensuring safe product design.

Product safety may be viewed as part of the larger problem of the low reputation of American manufactured goods for product quality. The American consumer rates U.S. product quality lower than that of either European or Japanese goods. For example, Magaziner and Reich (1982, p. 176) provide striking data on the relative reliability of Japanese and U.S. color television sets (measured by the proportion requiring service within the first year). Similar data on the comparative quality of U.S. and Japanese automobiles are provided by Abernathy, Clark, and Kantrow (1981, p. 74).

Much of the quality problem is a function of factors apart from product design; quality control seems to have deteriorated badly in many U.S. industries. Nevertheless, part of the problem arises from poor design, in particular from lack of concern about the production problems presented by particular design decisions. A recent interview with an automotive executive expressed the problem well: "We used to throw the design over the wall to manufacturing. If it didn't come back in a week with a brick attached to it, we assumed that it was producible." Now, manufacturers are increasingly aware that design decisions must take account of the problems that alternatives might present to the manufacturing department of the firm. This obviously has important implications for product safety, since one source of safety problems arises from the difficulty that particular designs present in permitting production of uniform quality and safety.

Greater attention to design decisions need not require the expenditure by the firm of huge sums of money. Unlike Weinstein and his colleagues, we do not see why every large firm should adopt elaborate design assurance processes with complex checklists and multiple-level audits. A degree of design assurance complexity such as Flores observed at NASA may be appropriate for firms producing small numbers of extremely hazardous, highly complex products. It is absurd to suggest, however, that all firms should employ such elaborate organizations in order to ensure that they produce adequately safe products.

Indeed, what appeared to us to be the most effective product safety organizations were those that were sized, located, and financed at a level consistent with the safety problems inherent in the firm's products, the need for higher-level supervision or monitoring of safety-

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related design decisions, and the interest of the chief executive officer in the firm’s safety performance. Mismatches in any of these areas led to a waste of resources. A lean product safety organization that clearly has the ear of the CEO and good working relations at various levels of the firm is likely to be much more effective than a highly visible unit that establishes procedures but clearly lacks either the resources to impose them or, even more disastrous, the support of the firm’s top officers when such support is necessary.

In short, there is no single best or correct way to structure a firm’s product safety effort. Virtually every firm can use such an effort, however, even if certain of the social pressures that stimulated the establishment of such units during the 1970s recede somewhat.

As the source of a firm’s concerns changes, the firm’s product safety activities can (and should) change also. If product liability and regulatory pressures decrease in importance, firms should change the focus of their product safety organizations. However, the rise of other concerns—improved product quality, for example—provides other avenues into which the activities of such units can expand. Some of the firms that we interviewed have sensed this and have embedded their product safety activities in their overall programs to ensure quality.

We consider the combining of product safety and quality control appropriate, provided it is carefully done. The sources of information that both activities use are likely to be highly complementary. The nature of the intrafirm failures that lead to a suboptimization in the area of product safety appear quite similar to those that lead to similar problems in product quality. But, the change in focus should not be merely a change in title.

Society has come to ask a great deal of the modern manufacturing firm, and the firm has had to adjust to these demands—both the reasonable and the occasionally unreasonable ones—in ways that have altered its structure and behavior. But as Chandler (1962) has stressed, change has also been required by alterations in the firm’s mission and in the difficulties of managing it effectively. The formal product safety organization responds to both internal and external pressures on the firm; the response is no less appropriate today than it was a decade ago.
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