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## Social Desirability of Safety-Related Research Joint Ventures: Effect of Tort Liability on the Social Welfare Calculation

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# SOCIAL DESIRABILITY OF SAFETY-RELATED RESEARCH JOINT VENTURES: EFFECT OF TORT LIABILITY ON THE SOCIAL WELFARE CALCULATION

by Debbie L. Moeckler\*

## I. Introduction

Consumers are increasingly concerned about the environmental costs that they and society will have to pay for hazardous side-effects from the production or disposal of consumer products. Therefore, the safe, proper disposal of hazardous waste has become an issue of ever-increasing concern. In addressing this concern, a wide variety of state, local, and federal legislation has been enacted. However, this legislation has been largely ineffective because the present legislation focuses on implementing legal remedies after the waste has already been disposed.<sup>1</sup>

The current legal framework should be reformed by changing the focus of the legislation from post-disposal remedies to pre-production and pre-disposal remedies.<sup>2</sup> Accordingly, new methods for addressing the production and disposal of hazardous waste need to be developed. In particular, there are a number of ways to create incentives that would achieve the desired level of research safety innovations involving the production and disposal of hazardous waste. One potential method for realizing the socially optimal level of research safety innovations is to encourage research joint ventures ("RJVs") between industry members that would result in the necessary safety research.

This Article analyzes the social desirability of using RJVs in high technology fields, such as hazardous waste management, to stimulate the socially optimal level of safety innovation. This analysis will help consumers understand some of the necessary incentives that might ultimately cause companies to develop safe processes that minimize the production of hazardous waste. Section II will set forth an overview of basic concepts of social welfare economics. Sec-

tion III will describe the expected effects on social welfare that result from a research joint venture, examining both the efficiency gains and competitive losses associated with RJVs. The traditional methods of analyzing the costs and benefits of joint ventures are explained. In addition, this section will discuss the factors that determine the expected weight of each element in the social welfare calculation. Section IV will discuss why the tort system must be accounted for in the social welfare calculation given its effect on the level of safety innovation. Finally, this Article

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The tort system must be accounted for in the social welfare calculation.

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advocates that traditional methods of analyzing research joint ventures need to be reexamined in light of the effects of the legal system's tort liability rules on the social welfare calculation.

## II. Social Welfare Economics

Because all resources in society are limited, including those devoted to research, society must determine how to allocate its resources. In particular, society must decide what goods and services to produce, how much to produce of each good and service, and how to distribute the goods and services to consumers.

Social welfare economics provides society with a method to determine how best to allocate its resources in the production of goods and services for consumers. Specifically, social welfare economics provides society with a way to distribute its resources efficiently. Measurable units of allocation and production include land, labor, raw materials and capital. Efficiency occurs by maximizing the benefits to society while mini-

mizing the costs to society. This efficient level of allocation and production is referred to as the socially optimal or socially desirable level. Social welfare is maximized when the benefit of one additional unit, the marginal social benefit, equals the cost of one additional unit, the marginal social cost. Determining the socially desirable level is often accomplished by using a social welfare calculation that is based on a formula that weighs costs and benefits.

Individual firms, in seeking to maximize profit, undertake the same decision making process as society. A firm will produce a particular product at the most efficient level when the firm's marginal cost equals the firm's marginal benefit, and therefore maximizes the firm's profit. In a perfectly functioning market, society will reach its optimal level through the choices of individual firms. In other words, in a perfect market, social marginal benefit equals the firm's marginal benefit and social marginal cost equals the firm's marginal cost. Therefore, as firms maximize their individual profit, social benefit will also be maximized.

However, there are often impediments that prevent the market from functioning perfectly. These impediments include transaction costs, i.e., the human time costs that are exclusive of the price of the item exchanged. Another impediment occurs when some of the costs of consumption or production are borne by others. These third party effects are called externalities. Additionally, there are some goods and services, called public goods, that society must

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provide to its citizens, even if the citizens do not pay for these goods and services. A firm may not have the proper incentive to provide public goods because the firm is unable to recoup its costs of production from consumers.

In an imperfect market, social marginal cost does not necessarily equal a firm's marginal cost and social marginal benefit may not equal a firm's marginal benefit. As a result, even if a firm were to produce at its individually efficient level, social benefit may not be maximized. This phenomenon appears to occur in the production of safety related research, as discussed in detail in Section III. Because society is not producing its efficient level of safety related research solely through the working of the free market, the government may need to cure these market defects.

The use of joint ventures for safety research innovation may provide a potential cure for the inefficiencies and defects in the market without the need for government regulation. A joint venture is a cooperative effort where firms pool their resources together to develop a particular end prod-

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uct. For example, in a research joint venture, firms pool their research-related resources to conduct research on a particular subject of interest to the firms.

### III. Potential Welfare Effects That Influence the Social Desirability of Joint Ventures

Several scholars have reviewed the potential effects on social welfare that result from RJVs.<sup>3</sup> The traditional methods<sup>4</sup> for evaluating RJV's focus on the economic effects absent a RJV. In certain instances, gains to efficiency may be realized by using a joint venture to conduct research and development ("R & D"). In other instances, a RJV may cause decreases in

competition. This Section will examine the gains in efficiency and the decreases in competition that may result from RJVs. Each factor that creates efficiency gains or creates competitive losses will be analyzed and applied to the social welfare calculation.

#### A. Efficiency Gains

There are at least three broad areas where social benefits may be increased by the cooperative R & D effort of a RJV as compared to non-cooperative research effort: (1) *ex ante* (pre-research) incentives to encourage the proper level of research, (2) economies of joint research that lower the costs of the project, resulting in gains from combining individual assets that cannot be achieved individually; and (3) *ex post* (post-research) dissemination of results, ensuring that after the research has been completed the results are distributed efficiently.<sup>5</sup>

##### 1. Pre-research incentives that may result in too little research: the spillover effect

A spillover occurs when a firm's research results are used by other firms who either pay nothing to the firm who conducted the research or at a minimum do not pay the researching firm an amount equal to the benefit received from the use of the research. Therefore, the benefits of the firm's research spill over to other firms.

When a firm conducting research is unable to charge the other firms proportionately for their use of the R & D either before or after completing the research, the other firms can unfairly benefit from the researching firm's investment. Because the researching firm is not able to recoup the full benefit of its investment, the firm has incentive to invest in a socially sub-optimal level of research. The firm's incentive to invest in R & D will be further diminished because not only does the firm receive less than the full return on its investment but its competitors are receiving the benefits of the research at a bargain price.

In theory, under a perfect system of property rights, the owner of the research would be able to charge

the users for the full cost of the completed research. Because the researching firm would receive the full return on its investment, the firm would invest in the socially optimal level of research. However, the current system of property rights is not perfect. For example, under the patent system, not all research results are patentable.<sup>6</sup> Although intangible assets, such as a process, are patentable, the more intangible a property is, the more unlikely that the owner will be able to show its novelty and utility, which are requirements for a patent.<sup>7</sup> Furthermore, even if the results were patentable, undetected infringement of the patent may still occur. Given these imperfections of the property system, a firm will be unable to recover the full cost of the completed research from the firm's competitors that use the research.

Even if the current property system was perfect and allowed each research firm to charge firms using the research an amount equal to the benefit received, the current property system may still not afford the optimal solution. Although the property system, through patents or other mechanisms, may effectively decrease the effects of spillovers by forcing firms to pay for the research, the system may also cause a decrease in the dissemination of information gained by the research. This decrease would occur as firms realized that the dissemination of their own patented research efforts would help their competitors improve. As a result, the gains to efficiency resulting from the dissemination of research are reduced because firms will not desire to help their competitors improve.<sup>8</sup>

The spillover or free rider problem may be eliminated through the use of RJVs. Under a joint venture scheme, the participating firms are forced to pay the full price of research because the firms agree ahead of time to split the costs of the research. As a result, the participating firms will be encouraged to invest at the socially desirable level of research because each firm would reap the appropriate return on its investment.

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However, if all of the potential participants do not join the venture, the spillover effect may not be completely eliminated. Some firms may decline to participate in the venture because they intend to utilize the benefits of the joint venture later without having to pay for the initial cost of the venture. If

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these non-participating firms are indeed able to benefit from the efforts of the joint venture, then the research costs are not completely shared by all of the beneficiaries of the research. Accordingly, firms have less incentive to participate in the joint venture.

The single largest factor that influences how great the spillover effect will be — and hence how much benefit can be derived from a cooperative effort — is the product of the joint venture. The magnitude of the spillover effect is tied to the end product of the investment because the property system affords differing degrees of protection to different types of products. Accordingly, if the firm is conducting research into innovations of end products, the firm will be able to protect most, if not all, of its investment through the patent system by patenting the processes or products developed. The firm will be able to charge other firms an amount equal to the benefit received from using its patented processes or products. To the extent that the investing firm can charge the other firms for use of the results from its investment, the firm is forcing the other firms to pay the cost of the investment. As a result, the current property system provides the most protection when the product is a tangible good.

On the other hand, if the result of the research is an intangible

good, such as information, the firm will receive little, if any, protection from the patent system. Accordingly, because of the difficulty in establishing any sort of property right over information, the free rider problem will be the greatest when the firm is conducting research where the end product is information.<sup>9</sup> Therefore, a joint research venture should result in the greatest gains to social welfare — by eliminating or reducing the free rider problem — when the joint venture is conducting basic research where the end product of the research is information.<sup>10</sup>

### 2. Economies of joint research

Cooperative research allows firms to achieve the same results at lower costs because the participating firms are able to: (1) reduce duplication of research effort; (2) achieve economies of scale; (3) realize synergies by combining complementary assets; and (4) pool the risks associated with research.

#### a. Reducing the duplication of research effort

A joint venture reduces the duplication of the research effort. Absent a joint venture, each firm would have to conduct all the preliminary or fundamental experiments independently. However, with the joint venture these parallel experiments only have to be conducted once. As a result, the joint venture conducts this research more efficiently because the same results are achieved at a lower price. These savings are especially important when the resources, such as scientists, are scarce.

The degree of competition in the industry will affect the magnitude of the efficiency gains that result from reducing duplicative research. In particular, “in highly competitive industries where each firm’s capital is needed merely to compete and cannot be invested in extended R & D projects, duplication of research efforts must be avoided.”<sup>11</sup> Accordingly, the greatest efficiency gains from reducing the duplication of research are expected when dealing with highly competitive industries.

However, the magnitude of effi-

ciency gains that result from reducing duplicative research may not be as great as generally expected because the saving of resources is only one of the consequences of combining preliminary research. Eliminating independent experiments may have negative effects as well. First, the results from each firm conducting parallel experiments may not be identical. Even if the results are identical, scientists may react differently to the results and follow different paths based on the results. This creativity may lead to greater research gains. Thus, when the number of independent experiments is reduced, the potential for creativity gains is also reduced. The loss of creativity that results from reducing the number of individual participants is a potential downside of synergistic<sup>12</sup> gains that may result from RJVs.

While the loss of creativity may reduce the extent of the benefit realized from decreasing the duplication of research efforts, on balance the benefits realized should outweigh the losses. However, if the effect of the loss of creativity is great enough, the overall effect of the joint venture on social welfare may be negligible.

#### b. Economies of scale

A joint venture may enable the participants to achieve economies of scale that any one of the firms acting independently would be unable to realize. In some instances, the minimal investment for a particular type of research may be too large relative to the size of the firm. For example, some very sophisticated research may require elaborate laboratory facilities or expensive pieces of research equipment. A joint venture may enable smaller firms to take advantage of investment opportunities that otherwise would be unprofitable. Therefore, a RJV may remove some of the financial disincentives that prevent small firms from conducting expensive research projects. The greatest gains from generating economies of scale are likely to occur in high technology industries, such as hazardous waste management, where sophisticated labs and equipment are essential

elements for productive research.

### c. Synergies

During a joint venture, the participants may experience efficiency gains that result from synergy. Synergy occurs when the output from assets that are used in combination is greater than the aggregate output of the same assets used individually. As part of the joint venture, individual firms combine assets and resources with other firms. If the individual firms have assets that are unique or complementary to the other participant firms' assets, then the combination of assets may produce synergistic gains. Because the combination of assets produces greater results from the same amount of investment, the joint venture is more efficient than the sum of the individual acts of the venture participants.

Synergistic gains are most likely to occur when the venture participants are from different industries or different niches of the same industry.<sup>13</sup> As the similarity among joint venture participants decreases, the probability of having unique or complimentary assets increases. Furthermore, participants from different areas may have adopted different approaches to deal with the same or similar problems.

### d. Risk pooling

When firms are involved in risky investments, with little or no actual return, a joint venture may allow the participants to create a portfolio of investments to help diversify away some of the risks. Diversification is extremely desirable when investments consist of research projects because research projects tend to be highly risky ventures for several reasons. First, the completion of the project remains uncertain because many projects result in dead ends. Second, even when a project is completed, the firm may be unable to recoup any or all of its investment. The same or similar results may have already been discovered by a competitor who has appropriated all the value of that discovery through a variety of mechanisms, such as the patent system.<sup>14</sup> If the firm is prevented from recovering

its investment, the value of the research results may be negligible. All of these uncertainties make research investments highly risky.

Given the high level of risk that is associated with research related investments, a firm would like to diversify away some of this risk. A RJV will enable a firm to spread risk among the venture participants and thus lower the average risk that a firm will face. As a result, the joint venture should provide more efficient investments because a participant will be able to make additional investments that now have a net present value given the firm's lower average risk.

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However, the magnitude of the gains from diversification that would result from a RJV is uncertain. Unlike some of the other efficiency gains, firms can generally diversify their investments individually in the market or through their shareholders. In other words, an individual firm should be able to achieve this benefit without having to participate in a joint venture. However, if a market failure prevents the firms from diversifying independently, then firms would be able to realize a gain to efficiency from diversification through participating in a joint venture.

### 3. Dissemination of the research results

Because research results are likely to be considered public goods or quasi-public goods, social welfare is increased by the dissemination of the results. A public good is a good or service whose benefits are not reduced by an additional user and for which it is generally difficult to exclude people from its benefit, even if they are unwilling to pay for it. The paradigm public good is information.

The product of a RJV, especially one set up to perform basic research, is most likely information.

Information tends to have the attributes of a public good, in that, "the use of information by one party does not exclude simultaneous use by others at no further cost."<sup>15</sup> Because others can benefit by using the information without increasing the cost of obtaining the information "economic efficiency calls for widespread use of R & D results."<sup>16</sup> As a result, broadly disseminated information will increase society's benefit, even if the information is given to the researching firm's competitors.

However, a firm will have no incentive to disseminate the information from research because of free rider problems. The patent system, which aims at encouraging a firm to share its information with other firms, fails to achieve this goal because the firm does not receive appropriate compensation. Difficulties in both monitoring and price discrimination prevent a patent owner from receiving adequate compensation.<sup>17</sup> As a result, the information will not receive the wide dispersal that society desires.

A RJV increases the incentive to disseminate information by at least guaranteeing that venture participants, who have all paid for the research costs, will share the information. In addition, downstream competition is increased when the firms share these innovations. As a result, the consumer receives the benefit of increased competition in the form of lower prices.

The existence of increased efficiency is directly tied to the goal of the joint venture enterprise. A joint venture that seeks to produce information about the safe pre-production disposal of hazardous waste would create a product with the characteristics of a public good.<sup>18</sup> The gains from this type of venture will not be present in a conventional joint venture where the end product is a tangible good; tangible goods do not usually possess the characteristics of a public good.

### B. Competitive Losses

Despite the potential gains to efficiency, a research joint venture may also reduce competition.

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There are two types of competitive losses associated with RJVs: (1) anti-competitive effects in the research market; and (2) anti-competitive effects in the product market.

### 1. Anti-competitive effects in the research market

A RJV may cause two different types of anti-competitive effects in the research market. First, the total amount of innovation produced by the RJV may be lower than non-cooperative conditions would produce. Second, the level of competition in the research market may be less in a joint venture than in a non-joint venture scheme.

#### a. Incentive to reduce total research performed

A RJV may create an incentive for the venture participants to reduce the total amount of research undertaken by the venture. Ironically, a RJV not only provides the firms with the opportunity to collude to slow the pace of R & D, but the very dynamics of a joint venture may create additional incentives to reduce the amount of R & D. Because a firm may realize lower costs because of its participation in a RJV, these lower costs will create lost profits for the firm's competitors. As a result, each of the participant firms may end up in a better economic position if the total amount of research in the RJV is decreased. Because the firms are collectively setting their research policy in the joint venture, the firms may choose a level of investment that maximizes profits for the participating firms. However, this level of investment may be socially sub-optimal given the decreasing costs that result from greater efficiency.

There are several factors that affect the strength of the incentive to slow the pace of innovation, including the scope and the duration of the joint venture. A RJV with narrowly defined goals and with a limited project duration will provide less opportunity for the type of collusion that would slow the pace of innovation.<sup>19</sup> Con-

versely, a RJV with broader and less-well defined goals and with a longer project duration will provide greater opportunities for collusion.<sup>20</sup>

In addition, the incentive created by the joint venture to slow the pace of technology is strongly influenced by the ability of the venture participants to conduct independent research. If the venture agreement does not prohibit the participants from conducting independent research and the participants have resources available to conduct independent research, the potential for this anti-competitive effect becomes negligible. As in any cartel scenario, each participant would have "both the incentive and the means to 'cheat' on any collusive scheme, and any restrictions on R & D competition introduced as part of a RJV agreement would be difficult for the participants to enforce."<sup>21</sup> Therefore, it is expected that firms will only collude to slow the pace of innovation in cases where there are restraints in the agreement that prohibit independent research. Absent such restraints, the incentive for the participants to cheat on one another should outweigh any potential anti-competitive effects.

#### b. Decreased competition in the research market

A RJV may decrease competition in the research market. While the RJV increases the dissemination of information among the venture participants, the overall competition between all firms in an industry may decrease because the venture participants may be less likely to grant licenses to non-venture firms. This result is referred to as "static inefficiency in the R & D market," that is, "for any given level of know-how, the fewer the independent entities competing to sell this knowledge, the higher the price is likely to be."<sup>22</sup> If the venture firms are able to restrict the dissemination of information to only venture members, the result may be higher downstream prices than would have been present absent the RJV. This result is analogous to the effect of monopoly pricing in the product market.

The size of the joint venture is pivotal in determining the net effect on competition. Large joint ventures have less incentive to sell the knowledge gained through the joint venture than do smaller joint ventures.<sup>23</sup> On the other hand, large ventures will be granting more licenses to use the information because there are more participants within the venture. While the net effect may be that the RJV results in less dissemination of information than non-cooperative research, it is difficult to predict the actual effect without looking at a specific RJV. It appears, however, that a very small or very large RJV should result in the greatest dissemination of information.

## IV. Determining Whether a Joint Venture Is Socially Beneficial

### A. The Role Of The Tort System On A Firm's Decision To Invest In Safety Innovations

The tort system is a set of legal rules that allocate the costs of accidents and injuries among various participants. In the area of product-related accidents, these participants include the producer of the product, the distributor of the product and the user of the product, the consumer. The tort system determines which participants will be held liable and the costs that each participant will have to pay for a particular accident. Because the tort system imposes costs on participants for their actions, the tort system will affect the participants' behavior. In particular, the imposition of liability on the firm producing the product involved in the accident will affect how much of the product the firm produces.

Many scholars have described in great length how a liability scheme will influence the behavior of a firm, including the firm's decision to invest in safety innovation.<sup>24</sup> A firm will invest in safety innovations to the point where the costs of the investment are equal to the savings to the firm from reduced accident costs. The savings to the firm from reducing the costs of accidents are determined by the particular liability rule — strict liability or negligence — that will

be applied in assessing costs for the firm's actions.

Under a strict liability scheme, "injurers must pay for all accident losses that they cause. Hence injurers' total costs will be the social goal of minimizing total accident costs. Consequently, injurers will be induced to choose the socially optimal level of due care."<sup>25</sup> No other inducements are necessary to equate the private benefit with the social benefit. Therefore, under a strict liability scheme, a firm should be engaged in the socially optimal level of safety innovation.

However, under a negligence scheme "an injurer will be held liable for accident losses he causes

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**Under a strict liability scheme, a firm should be engaged in the socially optimal level of safety innovation.**

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only if he was negligent, that is, only if his level of care was less than a level specified by the courts, called due care."<sup>26</sup> Under a negligence scheme, the firm's investment in safety innovation would equal the socially desirable level only if the court<sup>27</sup> has defined due care to be the same as the optimal level of care. If the court defines due care to be something less than the optimal level of care, additional incentives will be necessary to induce the firm to invest at the socially optimal level.

Under both the strict liability and negligence schemes, the amount of investment in safety innovation is directly tied to the existence and operation of the liability system. The firm will invest in safety innovation to the point where the benefit of investing, including the reduction in accident costs, equals the cost of investing. However, the level of investment in safety innovation is not necessarily the same under both schemes. Instead, the level of investment in safety innovations will be the same under the two schemes only if the courts accurately define due care to be the socially optimal level of care.

### **B. Effect Of Liability Rules On The Variables Used In A Social Welfare Calculation**

Several models have been developed to assess the social desirability of RJVs.<sup>28</sup> These models place much emphasis on what the venture participants would do absent the joint venture. However, in making this determination none of the models require the analyst to look at the effect of the liability rules on the venture participants' actions. Yet, as the previous section illustrated, a firm's decision on the level of safety innovation is directly tied to the particular liability rule in place. The existence of the tort system will affect the models that scholars have developed to analyze the social desirability of RJVs.

The key element in all the models is the investment decision of the venture participants absent the RJV. This element incorporates

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**The existence of the tort system will affect the models that scholars have developed to analyze the social desirability of RJVs.**

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two factors: (1) whether the firms will even invest in safety innovation absent the joint venture; and (2) at what speed will the joint venture innovate. These factors reflect the efficiency and anti-competitive concerns discussed in Section III of this Article. Both of these factors are affected directly by the particular tort scheme in place.

The decision of whether to invest in safety innovations will be determined by a cost-benefit analysis. The costs and benefits of a given safety innovation investment, however, will change depending on the tort scheme in effect. If the venture participants believe they will be subject to a strict liability scheme, each firm will choose to invest in the level of safety innovation that is optimal for the firm absent the RJV, given its particular cost structures. However, it should be noted that this level of research may not be the

socially optimal level of research, but instead is the least inefficient level without a RJV. Yet, when a RJV is involved, the same level of research may occur at even lower costs or a higher level of research may occur at the same cost. Accordingly, the level of research that results from being subjected to the strict liability scheme may not ultimately result in the socially optimal level of research if conducted in a non-cooperative setting.

Under a negligence scheme, in which a firm could be found not liable even though it failed to invest in a sufficient amount of safety innovation, a firm would have little or no incentive to engage in any safety innovation absent a RJV. Moreover, there is no reason to believe that firms would engage in the same level of research absent the RJV unless the firms believe that courts accurately set the level of due care at the socially optimal level. Even if courts attempt to set the level of due care at the socially optimal level, there is no reason to believe that the courts would consider the benefits of joint research in setting that level of due care. Therefore, firms operating under a negligence scheme would not have the incentive to invest at the level of research that would be socially optimal given a RJV.

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**Even if courts attempt to set the level of due care at the socially optimal level, there is no reason to believe that the courts would consider the benefits of joint research in setting that level of due care.**

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Furthermore, it may be possible that in a given RJV the participants will have different beliefs about which particular liability rule will apply to them. This scenario is possible because: (1) different types of firms are treated differently under current law; and (2) a RJV in the hazardous waste area could easily consist of different types of firms, including manufacturers, disposers, and intermediaries. If the firms have different

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beliefs about which liability scheme is applicable, then their individual decisions concerning the appropriate level of research will differ. This difference will affect the overall models that analyze social desirability absent a RJV by providing varying inputs due to the tort system.

The existence of a tort system also affects the degree to which a joint venture will result in a slowing of the pace of innovation<sup>29</sup> because the incentives that would lead joint venture participants to collude and slow the pace of innovation are directly tied to the liability rule in place. The analysis of the degree of collusion that will occur because of decreased profits to other firms from a RJV is inaccurate if the effect of the tort system is not taken into account. While firms may have an incentive to slow the pace of innovation to recoup some of the lost profit, there is a counterbalancing incentive, at least under a strict liability scheme.

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**The existence of a tort system affects the degree to which a joint venture will result in a slowing of the pace of innovation.**

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Under a strict liability scheme, a firm is given the incentive to invest in all safety innovations where the benefits outweigh the costs. The decreased profits can be seen as one element of the cost variable in this cost-benefit analysis. This decrease in profits will need to be balanced against the benefits which include the reduced accident costs that a firm will realize from investing in a particular safety innovation. Thus, the incentive to slow the pace of research is reduced, if not eliminated, when firms face a strict liability scheme.

The effects under a negligence scheme are not as clear. A firm will only realize a benefit from the safety innovation, that is, reducing the costs of accidents, if courts

incorporate that investment as part of the definition of due care. If courts do include that safety investment as a necessary condition for non-negligence, then the same counterbalancing incentive discussed for strict liability will result. If courts do not include that safety investment as a necessary condition for non-negligence, then firms will have no incentive to engage in the investment and moreover, may be placed at a disadvantage by investing.

Under a negligence scheme, firms may be more reluctant to enter into a RJV because of a potential increase in liability. The RJV and its results may suggest to courts that a company did have opportunities to improve safety. If courts incorporate this possibility into the negligence calculation,

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**Under a negligence scheme, firms may be more reluctant to enter into a RJV because of a potential increase in liability.**

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firms may be exposed to a liability risk that would not have been present absent the RJV. The additional exposure to liability may induce firms to limit the research of the joint venture or to avoid entering into a RJV altogether.

Overall, there appears to be little or no reason to be concerned about the incentive to slow the pace of innovation that results from a RJV under a strict liability regime. However, under a negligence scheme, the firm may find it desirable to slow the pace of innovation because of exposure to increased liability.

### V. Conclusion

Encouragement of research for the proper and safe disposal of hazardous waste will benefit consumers. The present social welfare models that calculate whether a research joint venture would result in the socially optimal level of research innovation fail to incorporate the tort liability system. A given liability scheme affects the social welfare calculation of a RJV devoted to safety innovations. Further research would help ascertain how the tort system directly affects

social welfare economic analysis. Only further study will determine whether the current models can be adjusted to reflect the role of the liability rules. Perhaps the traditional models will need to be replaced with a different type of analysis that incorporates the effects of the tort system on the decision to invest in safety innovations. Either way, the effect of the tort system must be included in the future analysis of RJVs.

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### ENDNOTES

- 1 See Roberta G. Gordon, *Note, Legal Incentives For Reduction, Reuse, and Recycling: A New Approach to Hazardous Waste Management*, 95 *YALE L.J.* 810, 811-17 (1986) (a discussion of recent legislative efforts to deal with the problems of hazardous waste management).
- 2 *Id.* at 818.
- 3 *E.g.*, Gene M. Grossman & Carl Shapiro, "Research Joint Ventures: An Antitrust Analysis," 2 *J.L. ECON. & ORG.* 315 (1986); Michael C. Katz, "An Analysis of Cooperative Research and Development," 17 *RAND J. ECON.* 527 (1986); Janusz A. Ordover & Robert D. Willig, "Antitrust for High-Technology Industries: Assessing Research Joint Ventures and Merges", 28 *J.L. & ECON.* 311 (1985); J. Fred Weston & Stanley I. Ornstein, "Efficiency Considerations in Joint Ventures," 53 *ANTITRUST L.J.* 85 (1984). Grossman & Shapiro, Ordover & Willig, and Katz, each develop their own models and methods to analyze the social desirability of safety-related research joint ventures. These traditional methods and models are based on assumptions about what firms would do absent a research joint venture. Those readers who are interested in a more advanced discussion of the effects on social welfare from a research joint venture should consult these articles.
- 4 When referring to "traditional methods" of analyzing research joint ventures, the author is specifically referring to three analytical methods developed by Ordover & Willig, Grossman & Shapiro, and Katz, respectively, *supra* note 3.
- 5 These particular categories were developed by Grossman and Shapiro, *supra* note 3, at 321.
- 6 See 35 U.S.C. § 102-03 (1988) (an invention must be novel, non-obvious and useful to receive a patent).
- 7 *Id.*
- 8 See, Katz, *supra* note 3, at 527. The gains to efficiency resulting from the *ex-post* (post-research) dissemination of the research results are discussed *infra* at note 12 and accompanying text.
- 9 Grossman and Shapiro, *supra* note 3, at 319; "The potential for spillovers is greatest for basic research, decreased

- as we move for the development of specific products or prototypes." *Id.*
- 10 See *infra* Section III A, 3. for a more detailed discussion of public goods.
- 11 Jean M. Miller, *Contractual Joint Ventures Between Parties With Complementary Research Programs— Is the Theory of Potential Competition Available to Render the Agreement Unreasonable Under Section 1?*, 68 J. PAT. & TRADEMARK OFF. SOC'Y 48, 52 (1986).
- 12 For a definition and discussion of the potential synergistic gains from a research joint venture, see *infra* note 13 and accompanying text.
- 13 Christopher O. B. Wright, *Comment, The National Cooperative Research Act of 1984: A New Antitrust Regime for Joint Research and Development Ven-*

- tures*, 1 HIGH TECH. L.J. 133, 148 (1986).
- 14 Grossman & Shapiro, *supra* note 4, at 323.
- 15 Grossman & Shapiro, *supra* note 4, at 317.
- 16 *Id.* at 323.
- 17 *Id.*
- 18 *Id.* at 317, 323. Certainly, many industry members would benefit from any information that suggested pre-production safety innovations.
- 19 Grossman & Shapiro, *supra* note 4, at 324.
- 20 *Id.*
- 21 *Id.* 22
- 22 Grossman & Shapiro, *supra* note 4, at 324.
- 23 Michael L. Katz & Carl Shapiro, *How to License Intangible Property*, 101 Q.J.

- ECON. 567, 580 (1986).
- 24 See e.g., STEVEN SHAVELL, *ECONOMIC ANALYSIS OF ACCIDENT LAW* (1987).
- 25 *Id.* at 8.
- 26 *Id.*
- 27 In some instances legislators may define the appropriate level of due care. For the purposes of this discussion, it is assumed that the courts will ultimately define the level of due care through interpretation of the legislative intent as applied to the facts of a particular case.
- 28 See note 4, *supra*.
- 29 This factor is implicitly incorporated into the inquiry of what the individual firms would do absent the research joint venture.

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