# *Intellectual Property Protection Mechanisms in Research Partnerships**

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**Abstract:** A set of large, diversified, U.S.-based companies is investigated regarding the role and effectiveness of different intellectual property protection mechanisms (IPPMs) in the formation and execution of research partnerships. While the study confirms that resolving issues of IP protection is a fundamental consideration for all parties, this does not seem to have been an issue presenting insurmountable problems for large, diversified companies. Patents are found to be the most frequently used IPPM to protect both background and foreground knowledge in partnerships. Other IPPMs, and especially trade secrets, are also used extensively to protect know-how, especially in the early, forming stages of a partnership. Existing IP titles are quite useful when negotiating new partnerships. Prior experience with the research partners facilitates the formation of a new collaborative R&D agreement. IPR negotiations are reported to be more complex in horizontal partnerships and when universities are involved. Almost without exception, the sampled companies expressed serious concerns in reference to their recent experience with universities, especially with regards to negotiating IPR agreements with university technology transfer offices.

# *Intellectual Property Protection Mechanisms in Research Partnerships*

## I. Introduction

Research partnerships involving firms, universities and, less often, government agencies have grown in numbers and in importance in most industrial nations. This nearly two-decade old phenomenon is the result of a number of factors including, but not limited to, the complexity and speed of technical advance and the globalization of the world economy. Public policy has shifted over this period, especially in the United States, from discouraging such relationships on antitrust grounds, to encouraging new research joint ventures (RJVs) by modifying anti-trust regulations.[1] The Department of Justice and the Federal Trade Commission have adopted specific guidelines for companies to receive limited indemnification should anti-trust issues arise during partnership activities.[2]

Research partnerships are complex organizational arrangements. They take many forms ranging from infrastructures to support the informal sharing of information among partners to the creation of entirely new research entities. Some include large numbers of firms joining together to set industry standards. Others are truly one-on-one research ventures with specific technological goals. Still others are specific product-focused partnerships with either customers or suppliers aimed at solving a particular problem and thereby generating more business with just one other firm.

[1] Herein we use the terms research partnership and research joint venture (RJV) interchangeably. For a discussion of trends in RJV activity and legislative initiatives to encourage RJV formations, see Hagedoorn, Link, and Vonortas (2000).

[2] Many RJVs are not registered with the Department of Justice since firms make preliminary decisions as to the potential anti-trust exposure before filing.

Intellectual property protection mechanisms (IPPMs) – such as patents, copyrights, trademarks, and trade secrets – are considered to be critically important to research partnerships because sharing of information is key not only to the initial formation of the research partnership but also to its ability to complete successfully the designed research. Extant economics and business literature anticipates that the use of IPPMs in research partnerships depends on many factors relating to the type of knowledge to be protected, the kind of competition in the specific industry, the organizational characteristics and culture of the owner of the knowledge as well as of its partners (e.g., competitors, suppliers/buyers, universities), the nature of the partnership, the objectives of the partnership, and the position of the partnership in the continuum from the early planning stage to termination (Hertzfeld et al., 2001).

Yet, there is a conspicuous absence of empirical analysis, beyond anecdotal information and case studies, about the use of different IPPMs in research partnerships, the role that these mechanisms are expected to have, and the relative effectiveness of these mechanisms in protecting intellectual property in a research partnership context.[3] Our exploratory research in this area was indented to begin to fill this conspicuous void, accounting for all aspects of intellectual property in formal collaborative R&D agreements.

This paper presents a set of results from a multi-year, multi-faceted project on IPPMs. It describes findings from a sizable set of firms that were investigated with regards to their assessment of the role and effectiveness of IPPMs used in the formation and execution of research partnerships. The samples of surveyed and interviewed firms include large, diversified, U.S.-based companies.

[3] Jaffe's (2000) review emphasizes by omission the void of information about patents, much less other mechanisms, as a means to protect intellectual property in a collaborative research setting.

All in all, our findings confirm the hypothesis that resolving issues of IP protection is a fundamental consideration for all partners. While there is strategic variation among firms regarding the way they approach the issue of IPRs in research partnerships, our evidence does not, however, indicate that this has been an issue presenting insurmountable problems for large, diversified companies. Patents are found to be the most frequently used IPPM to protect both firms' existing technologies when entering into an RJV (background knowledge) and the technology created by the RJV (foreground knowledge). Other IPPMs, and especially trade secrets, are also used extensively to protect know-how and tacit knowledge, especially in the early, negotiating stages of a partnership. Existing IP titles – especially patents – are reportedly quite useful when negotiating new RJVs. Prior experience with the specific research partners facilitates the formation of a new collaborative R&D agreement. Finally, IPR negotiations are reported more complex in horizontal RJVs and when universities are involved. Almost without exception, the sampled companies expressed serious concerns in reference to their recent experience with universities, especially with regards to negotiating IPR agreements with university technology transfer offices.

The remainder of the paper is organized as follows. Section II considers conceptual issues related to the protection of IP in research partnerships. Identification of these issues will lead to a better understanding of the complexity of IP-related activities associated with the organization of research partnerships. The design of the study and the data collection process are described in Section III. Section IV discusses our survey and interview findings. Section V presents a summary of an exploratory econometric analysis of a portion of these data relating to the importance of patents in protecting background and foreground knowledge in partnerships. Finally, Section VI concludes the paper with summary remarks.

## II. Conceptual Issues Related to Intellectual Property and Research Partnerships

Economic theory places intellectual property (i.e., knowledge) at the heart of its appraisal of collaborative R&D. Both transaction costs and mainstream industrial organization theory consider the particular characteristics of technological knowledge – a latent public good whose creation and productive use are characterized by uncertainties – to be deterministic of both the incentives to form a research partnership and the economic impacts of such an association.

The explanation of RJVs provided by transaction cost theory is straightforward. Joint ventures are considered hybrid forms of economic organization (Williamson 1996) that aim at economizing on transaction costs. In the area of R&D specifically, these costs may be high due to asset specificity and spillovers resulting in incomplete contracts and the possibility of opportunistic behavior. Theory predicts that in order to circumvent opportunism, the more specific assets are and the most costly contracts are, the greater the incentive to integrate. Integration may, however, also entail costs in terms of rigidities, the more so the more valuable flexibility is in a particular industrial/technological setup. Theory thus concludes that intermediate forms of organization – hybrid governance structures – will be efficient under such conditions (Menard 1996).

The basic message from industrial organization theory with respect to cooperative R&D is also clear (Vonortas 1997). The nature and magnitude of the impacts of collaboration in R&D will not be the same across the board, but are expected to vary with respect to market organization, strategic motives and interaction between firms, and the process of technological accumulation in an industry.

The workhorse model in this theory has been directed towards studying the incentives for and impacts of cooperative R&D. This model has assumed a two-stage game in which firms choose levels of innovative activity in the first stage and compete in the product market in the second. Innovative activity is measured in terms of R&D dollars. A firm's (call it firm 1's) first-stage objective is to incur the optimum R&D expenditure to maximize profits from its output choices in the second-stage game. The first-stage objective can be written as:

$$(1) \qquad \max_{x_1} \pi_1 = p[\mathbf{q}(\mathbf{x})]\ q_1(\mathbf{x}) - C_1(\mathbf{x})\, q_1(\mathbf{x}) - x_1$$

where **q** is the vector of outputs and **x** the vector of R&D expenditures of the firms in the industry, C is unit cost, and the subscript 1 corresponds to the firm in question. Importantly, in such models it is assumed that $\partial C_1/\partial x_1<0$ and $\partial C_1/\partial x_j \leq 0$ $(j \neq 1)$; that is, the innovation expenditures of a firm always lower its own marginal cost of production and may lower the cost of its rivals. In other words, intellectual property protection is not complete and spillovers may exist.

A standard result of these models is that, in a non-cooperative situation, private investment in the imperfectly appropriate R&D is likely to be sub optimal. The equilibrium solution can often be brought closer to the social optimum by allowing firms to collaborate in R&D. Assuming that firms collaborate in the first stage in a research partnership but compete in the second stage of the game, we can express the partnership objective as being to maximize all partners' profits, Π, with respect to the collaborative R&D expenditure, X:

$$(2) \qquad \max_{X} \Pi(X) = \sum_i p[\mathbf{q}(X)]\, q_i(X) - \sum_i C_i(X)\, q_i(X) - X$$

The chances for the cooperative R&D setup to result in higher rates of innovation and higher profits than the non-cooperative set up tend to increase with the degree of knowledge spillovers, *ceteris paribus*.

While the extent of knowledge spillovers seems, however, to be an important determinant of the willingness to cooperate, the *ceteris paribus* assumption may be a strong one to make. Benefits to partnership members will depend on their willingness to exchange information. This, in turn, will be affected by several factors, most importantly the nature of the R&D (e.g., substitutive, complementary). Some models indicate that firms prefer to collaborate in complementary R&D (e.g., vertical cooperation, suppliers-buyers), while others show private benefits in substitutive R&D (e.g., horizontal cooperation). The latter is primarily the case when the establishment of standards is an objective of collaboration. Overall, information is expected to be exchanged to a larger extent if partners are not direct competitors.

Extensions of atemporal models like the one above have added to imperfect appropriability other important features of innovation such as the idea of cumulative R&D. In these models, firms start with a stock of (background) technological knowledge and every time period they add to that stock through both their own R&D expenditures and the R&D expenditures of their competitors (Joshi and Vonortas 1997). For example, consider an industry with two firms, i and j, and discrete time, t=1,2,…. There are two stages in each time period as above. In stage 1, the set $(x^i_t, x^j_t)$ of R&D expenditures of the two firms is determined. R&D expenditures, via some production function, increase the stock of technological knowledge available in period t, $(K^i_t, K^j_t)$. These stocks of knowledge, in turn, determine the unit cost of production for each firm in period t, $C^i(K^i_t, q^j_t)$, where $q^j_t$ is the t-period output of firm i. Given

an initial stock of knowledge $K^i_0$ in period 0 and a spillover rate $0 \leq \theta \leq 1$, technological knowledge is assumed to evolve according to:

$$(3) \qquad K^i_t = K^i_{t-1} + k^i_t = K^i_{t-1} + x^i_t + \theta x^j_t$$

That is, technological knowledge in period t is composed of the technological knowledge accumulated in the previous t-1 periods and the increment to this stock of knowledge in period t, through the R&D expenditures of both firms. Again, the idea is to examine under what conditions cooperative R&D improves on non-cooperative equilibria in terms of social welfare. Firms maximize profits similar to expressions (1) and (2) above which are, then, compared. Cooperation can accommodate different types of research partnerships. On the one extreme, it can involve joint decision-making for R&D investment but separate execution and no further communication of results between partnership members beyond existing market spillovers. On the other, it can involve both joint decision-making and joint R&D undertaking with full communication of results between partnership members. Many other possibilities – with incomplete communication of results – lie in between.

Strategic management literature also places IP at the core of its argument for R&D cooperation. The analytical focus here has been on the conditions that facilitate effective resource deployment and learning to accommodate innovation in environments of technological complexity and high market and technological uncertainty. Research partnerships have been considered as a vehicle to shape competition and implement strategic change. The co-ordination and sharing of the value chain with partners, the joint creation of value, the accumulation and reconfiguration of resources, the development of new resources, the building of new capabilities

and core competencies, and organizational learning in partnerships have attracted most attention by management analysts.

The legal literature views IPRs issues in research partnering to revolve around adequate arrangements between the collaborating parties that safeguard their private intellectual property while maximizing the benefit of joint research. The means for sharing the results of such research *ex post* also raise important considerations. When partnerships involve government funding, the question arises of how to price and whether to restrict access to third parties. Cross-border research partnerships add a dimension of creating the correct procedures for sharing and protecting the intellectual property from international joint research. The problems here result from the lack of harmonization across national IPRs systems. National patent systems differ, sometimes extensively, and such differences can be a source of legal uncertainty and friction between partners.

Partners often enter into an RJV possessing valuable and multiple types of knowledge (i.e., intellectual property), part of which is then contributed to the research effort. This knowledge may be shared among the partners (and with third parties on occasion) for the term of the partnership and, in some instances, even after partnership termination. Similarly, the likely product of a successful research partnership is technology that may qualify for protection by one or more IPPMs (Karalis 1992).

Furthermore, IPRs "facilitate the very formation of the [joint] venture itself, because they codify discrete quanta of technology that the partners license into the venture, making it easier to keep track of which partner contributed the technology" (Merges 1995, p. 1570). IPRs also allow the partners to manage the output of the alliance. IPRs represent important assets that the partners must allocate if and when they wind up the alliance. IPRs provide evidence of the work

of the partnership and this also saves time and energy because partners need not, at the time of dissolution, specify in detail all the research results produced by the venture. IPRs also "organize relations" between the venture and its parents by providing a discrete asset that the venture can license or assign (Merges 1995). Perhaps most important, IPRs define the limits of the partnership's rights with respect to its technologies. In the absence of IPRs, the partners would need much more detailed contracts specifying technology rights.

IPPMs involved in research partnering are likely to take at least one of four forms: patent, copyright, trademark, and trade secret protection. Each type of IPPM has specific requirements that must be met before protection will vest, and each suggests important considerations for firms contemplating the formation of a partnership.

IP licensing arrangements among partners, and between the partners and the alliance, may raise concerns under the antitrust laws about horizontal collusion by competitors and potential competitors. The horizontal combination of firms, and the acquisition of one firm by another, is in the United States controlled by section 7 of the Clayton Act. Section 7 prohibits a firm from acquiring the assets of another when the effect "may be to substantially lessen competition, or tend to create a monopoly … in any line of commerce." If two firms become fully or substantially integrated, there is a "merger" for purposes of the Clayton Act, even if the integration is labeled a joint venture.[4] Thus, section 7 is broadly applied to regulate the formation of joint ventures as well. The analysis of a merger under section 7 is complex. First, the court will define the relevant product and geographic markets involved in and affected by the merger, and then determine the post-merger level of market concentration using the horizontal

[4] See *United States v. Penn-Olin Chem. Co.,* 378 U.S. 158, 175 (1964).

merger guidelines promulgated by the Department of Justice and the Federal Trade Commission.[5]

Until the early 1980s, many firms were reluctant to enter research partnerships because they were uncertain as to how the alliance would be treated by the courts if challenged. As a consequence, the Justice Department issued its *Antitrust Guide Concerning Joint Research Ventures* in 1980.[6] The *Guide* stated that the rule of reason would be applied to enforcement regarding RJVs and encouraged joint venture activity in markets where "foreign (or any other) competition was eroding market power of the partners, making old technology obsolete, or otherwise necessitating large-scale joint efforts to develop new or improved technology." According to the *Guide*, these factors would be considered in assessing the competitive effects of the RJV.

Although the *Guide* stimulated some activity, it was largely ineffective in encouraging many firms contemplating the formation of a RJV (Friedman 1992; Sennett and Dyhrkopp 1998). In 1984, however, Congress enacted the National Cooperative Research Act in order to ensure that the Clayton Act did not deter firms from entering into research and development joint ventures. In 1993, the Act was amended to include production joint ventures as well and is now referred to as the National Cooperative Research and Production Act (NCRPA). The NCRA and the NCRPA specify that RJVs are not *per se* illegal, but that they should be evaluated by the rule of reason standard, "tak[ing] into account all relevant factors affecting competition, including, but not limited to, effects on competition in properly defined, relevant research, development,

[5] See *Antitrust Merger Guidelines*, (1984). The Hart-Scott-Rodino Antitrust Improvement Act of 1976, 15 U.S.C. § 18a. gives the Justice Department and the FTC the power to review major acquisitions before they are consummated. On October 1, 1999, the Justice Department and FTC issued a draft of the *Antristrust Guidelines for Collaborations Among Competitors*.

[6] *Anitrust Guide Concerning Joint Research Ventures* (1980).

product, process, and service markets." Use of the rule of reason analysis to test joint ventures is based on the inherent assumption that innovation is more likely to flourish through competition than through collective endeavors (Einhorn 1999). For instance, a partner in a joint venture may be reluctant to pursue a line of research that could jeopardize its technology investments, or the joint venture might lead to ancillary restraints such as a patent pool. NCRA and NCRPA said that RJVs can disclose their research intentions to the Department of Justice, and by so doing, the members of the RJV receive certain benefits if their research actions are challenged under antitrust law. In particular, such voluntary disclosure guarantees that even if found to fail a rule-of-reason analysis – found guilty for attempting to monopolize a market, for example – they are subject to actual rather than the standard treble damages under U.S. law.

Generally speaking, RJVs raise fewer anticompetitive concerns that other types of joint ventures because RJVs are far removed from the product production and marketing stage (Link and Bauer 1989; Winslow 1985). Single firms may underinvest in R&D because it is often easy for competitors to use or misappropriate information and technology. Likewise, IPPMs can be "leaky" in the sense that firms may free ride by imitating or inventing around patented inventions or processes protected by trade secrets. Thus, rivals that may otherwise be reluctant to invest in R&D may do so if potential free riders join them in the investment. Including potential free riders as RJV partners may encourage socially desirable innovation that might not otherwise occur. The NCRPA recognizes this, so that if it appears that no anticompetitive effects are likely, the Justice Department will not challenge the RJV and any related IP licensing agreements.

The role of IPRs in RJVs was more specifically addressed in the *Antitrust Guidelines for the Licensing of Intellectual Property*, issued by the Federal Trade Commission and the

Department of Justice in 1995. According to the *Guidelines*, an RJV involving IPRs is analyzed using the following inquiries:

- Which relevant market is affected? Usually, this will be the innovation market – the competition in research and development to create new or improved products or processes, as well as the close substitutes for research and development.
- Does the joint venture restrict competition in the innovation market? The degree of market concentration and market shares of the firms will be considered. Does the joint venture unduly restrict competition in other markets by means of collateral restraints? IPR licensing agreement and restrictions may be such restraints.
- If there are anticompetitive effects, are there any offsetting efficiency benefits? If the potential for combining IPRs and other assets is such a way that makes successful innovation more likely or faster, or with reductions in cost, these efficiency benefits may allow the RJV to form nonetheless.

Furthermore, the *Guidelines* suggest that in some instances, joint ventures need not have a significant sharing of risk to lead to an efficiency-inducing integration of economic activity. Evidence of a pro-competitive purpose and structure providing incentives for efficiency-enhancing conduct by participants can also be important and will be considered.[7]

Under the *Guidelines*, therefore, partners may share information relating to the technology to be developed. A patent cross-licensing agreement can be used for the joint venture where pooling of patents is necessary to avoid blocking patents or reasonably necessary to the

[7] The 1999 *Guidelines* recognize that cooperation and collaboration between competitors often are procompetitive, allowing the firms to expand into foreign markets, fund expensive innovation efforts, and lower production costs. The *Guidelines* also recognize that firms participating in collaborations, such as joint ventures or strategic alliances, remain potential competitors, even if not actual competitors for certain purposes (e.g., R&D) during the

research of the joint venture. If the joint venture will own the patent rights, market entry can be regulated by licensing agreements for a substantial period of exploitation if reasonable (Katsh 1985). Antitrust concerns arise when joint venture partners reduce output of new information or the rate of use of existing information, or the rate of output in existing product markets (Winslow 1985).

Several other considerations are relevant (Katsh 1985). Antitrust concerns may arise if the industry is concentrated and the patent pool members account for a substantial share of sales or output in the industry or there are high barriers to entry in the market. Exclusive grantbacks may be challenged if they extend unreasonably beyond the original patents. Where trade secrets are involved, noncompetition and confidentiality agreements are enforceable if they are for a reasonable period, though if the restrictions on competition in the products or services are unrelated to the joint venture, they will be considered unreasonable. Where the joint venture develops a new technology based on the IP contribution of partners and new technology generated by the joint venture, the partners may agree on a method for determining the royalty rate and terms of the licensing package, including field of use restrictions, as long as they are reasonable.

All in all, the legal issues regarding IPRs in R&D cooperation are complex. Contracts are typically customised to the particular circumstances around the agreement relating to the partners, affected industry(ies), markets, technology, and regulatory environment.

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collaboration. IPRs are considered important in identifying and assessing the relevant market affected by the collaboration.

## III. Design of the Study and Data Collection Process

The sampling goal of our study was to survey 250 firms that are known to have participated in at least one RJV as evidenced by their notification in a *Federal Register* filing. As discussed above, the NCRA created a registration process of voluntarily disclosed RJVs to the Department of Justice and the Federal Trade Commission. Notices of all RJVs containing, among other things, the research intentions and a list of all RJV participants are published in the *Federal Register*.

From January 1, 1985 through December 31, 2000, 830 RJV notices have been published in the *Federal Register*.[8] Our sample population was delimited to the 288 RJVs listed between January 1, 1995 and December 31, 1998. The reason for excluding pre-1995 RJVs was the anticipation that it would be difficult by now to identify knowledgeable contact individuals in the participating organizations. The reason for excluding RJVs filed in 1999 and 2000 was the expectation that sufficient time was needed before IPPM issues would be realized. These 288 RJVs represent 2120 entities – firms, universities, or government agencies.

Additional filters were imposed in order to arrive at a population sample of 250 firms. First, by the nature of the study, all RJVs where one member was a foreign firm or a government agency were deleted. This filter reduced the population of potential survey participants from 2120 to 823. Second, all closely-held (private) firms were removed since necessary supplementary data such as sales, investments, and industry classification is frequently difficult to obtain in longitudinal form. This second filter reduced the population to from 823 to 454

[8] *Federal Register* filings are being recovered from the CORE and NCRA-RJV databases maintained at the University of North Carolina, Greensboro, and The George Washington University, respectively. These filings are certainly not the population of all research partnerships. Link and Bauer (1989) first demonstrated this fact. Our telephone interviews confirm that firms tend only to disclose their collaborative research activities if they expect that such activities may be suspect of an antitrust violation.

publicly-traded U.S. firms. From these, 250 representative firms were selected. The selection criteria in this third filter were based on firm size and industry: *a priori*, we view the selected sample of 250 firms as representative of all public firms involved in RJVs registered with the U.S. Department of Justice during 1995-1998.

The contact person in each firm was the general counsel or patent counsel. Each was contacted prior to sending the survey, and during the pre-survey period 12 declined to participate. Of the 238 surveys sent, 54 were returned yielding a response rate of 22.7 percent. Comparative statistics on the population sample of 250 firms and the 54 firms responding to the mail survey are shown in Table 1. On average, larger firms, as measured by sales, were more likely to respond to the survey. Firms in SIC 35 (industrial and commercial machinery and computer equipment) and SIC 36 (electronic and other electrical equipment) responded more frequently; firms in SIC 37 (transportation equipment) and SIC 60 (depository institutions) responded less frequently.[9]

[9] A probability of response model was estimated with sales and industry dummies as repressors. None of the variables entered significantly, however. Thus, no control for response bias is included in the econometric models that follow.

**Table 1**

**Survey Sample and Population Sample of Firms**

| Characteristics | Survey Sample (n=54) | Population Sample (n=250) |
|---|---|---|
| **Mean Sales ($M) *** | $18,402 | $13,845 |
| **Median Sales ($M)** | $4,166 | $2,963 |
| **SIC 28** | 13.0% | 12.1% |
| **SIC 35** | 14.8% | 19.7% |
| **SIC 36** | 14.8% | 22.2% |
| **SIC 37** | 5.6% | 7.1% |
| **SIC 38** | 11.1% | 7.1% |
| **SIC 60** | 6.3% | 8.0% |
| **SIC 80** | 9.1% | 5.6% |
| **All other industries **** | 40.7% | 18.2% |

* Sales data came from the CorpTech database.

** No other industries were represented by more than 10 firms.

Key: SIC 28 – chemicals and applied products; SIC 35 – industrial and commercial machinery and computer equipment; SIC 36 – electronic and other electrical equipment; SIC 37 – transportation equipment; SIC 38 – instruments and related pro0ducts; SIC 40 – railroad transportation; SIC 60 – depository institutions; SIC 80 – health services.

In addition, in-depth telephone interviews were planned with each of the 54 firms in order to explore several new topics. Twenty-three general counsels were available to participate in this phase of the study; information gleaned from the interviews was used to assist in the interpretation of the quantitative survey information.

## IV. Descriptive Analysis of Survey and Interview Findings

A major finding from this study is the extensive variation across firms concerning their approach to IPRs protection issues related to their RJV activities. It was virtually impossible to detect a single dimension across which one can categorize the reported differences in approach. This was not totally unexpected, of course, as it has been strongly argued in the past that firm behavior reflect both internal factors – management preferences, established company routines – and external factors – technology characteristics, market structure, regulatory environment,

government policy (Nelson 1994). In addition, our sample of surveyed and interviewed firms was relatively small and biased toward large, diversified firms. One possible dimension, which has also been pointed out by earlier studies dealing with IPRs (Levin et al. 1987) is the broad industrial group at the 2-digit or 3-digit SIC level.

On the whole, our findings support the emphasis of the existing literatures on the importance of IP in appraising cooperative R&D. Interestingly, however, the representatives of the large industrial firms interviewed in this study did not think that the success of RJV formation in the past has hinged on issues relating to IP protection. They tended to view IP as one of many issues that need to be negotiated and clearly resolved before the RJV began, but they did not generally describe such issues as being a "showstopper."[10] In their opinion, it had been dealt with satisfactorily with few exceptions.[11] Ranking higher in importance are issues that go to the heart of creating profit-making opportunities for the firm such as expected sales that will result from the RJV activity and managing people coming from different firms with different corporate cultures.

Interviewees reported a number of different types of RJVs that their firms enter based on their needs and expectations. Some of these involve very little research; rather, they are attempts to share information and set industry standards. These RJVs tend to incorporate several, if not all, of the major players in an industry, hence frequently listed with the Department of Justice so that firms can receive antitrust indemnification. Existing patents are often brought into this type of RJV so that the participants can share just enough information to accomplish their purpose.

[10] IPR protection was reported relatively more cumbersome, potentially a "showstopper," in horizontal RJVs.

[11] About 10 percent of the time RJVs involving firms only will not get started because of IP issues, and such occurrences mostly involved firms in the same industry. This "failure" rate doubles when an university is involved because of lack of expertise in university technology transfer offices and lack of negotiating authority by the technology transfer officer. See below for further discussion.

Tacit know-how is rarely communicated in this type of RJV, thus the need for additional secrecy measures is not acute. Electronics and communications technologies companies are often participants in standards-setting RJVs.[12]

Firms frequently mentioned their involvement in vertical RJVs formed with customers and/or suppliers. In this instance, the goal is often to solve a specific technological problem related to identifiable products. The close business association between the firms and their different industrial focus facilitate the negotiation of IPPMs. Intellectual property remains important, but since the problem to be solved is usually very specific there is often limited danger of extensive IP disclosures.

Fewer companies reported being involved in research partnerships with competitors (i.e., horizontal RJVs), with the exception of standard-setting RJVs. Horizontal RJVs, the typical focus of economic theory, were reported the most difficult to negotiate from an IPR perspective because they involve sharing critical research output with rivals. Following our expectations, the petroleum industry is one where horizontal RJVs have been used frequently to address environmental concerns. This, of course, is the textbook case of imperfectly appropriable R&D, of peripheral value (beyond compliance) to the companies involved but of high social value.

Our survey indicated that, in the vast majority of circumstances, the in-house counsel is the individual primarily responsible for negotiating intellectual property rights in RJVs (Table 2). The legal offices of the surveyed large, diversified firms had up to 60 solicitors dealing with intellectual property. R&D personnel frequently have a key negotiation role too (Table 3). These results were confirmed by the phone interviews.

[12] Several very large RJVs in the CORE and NCRA-RJV databases seem to be of this kind.

**Table 2**

***Who within in your company is primarily responsible for negotiating intellectual property rights issues in a research partnership?***
**(n=54)**

| Responsible Party | Frequency (%) |
|---|---|
| In-house Counsel | 69.8 |
| President of Chief Executive Officer | 3.8 |
| Chief Technology Officer | 7.5 |
| R&D Director | 13.2 |
| Other * | 5.7 |

* Examples include researchers, and outside counsel.

**Table 3**

***R&D personnel (frequently / infrequently / never) have a key role negotiating intellectual property rights issues in a research partnership?***
**(n=54)**

| Have a Key Negotiating Role | Frequency (%) |
|---|---|
| Frequently | 72.2 |
| Infrequently | 24.1 |
| Never | 3.7 |

Mixed views were expressed with regards to the use of "boiler plate" IP protection clauses in contracts for collaborative R&D. Several firms reported that prior experience has resulted in standard forms that are used as a starting point of negotiations. They build on these more or less extensively – they customize to a larger or smaller extent – depending on the case. The case is usually defined by the nature of the technology, the nature of the partner and prior experience with the specific partner, and the nature of the partnership itself. We think that this is an issue for further investigation as the specific picture may be influenced by the composition of

our sample. One wonders whether smaller firms, lacking an in-house staff of IP attorneys and with much smaller IP portfolios, would be able to customize their approach at the same rate.

Information on the role and effectiveness of alternative IPPMs used in the formation and execution of research partnerships is summarized in Tables 4 through 6. Patents are most frequently used by firms to protect existing technology (background knowledge) when entering into an RJV, followed by trade secrets, copyrights, and trademarks (Table 4).[13]

**Table 4**

**IPPMs for Background Knowledge**
**(n=54)**

| IPPM | Frequency of Use * | | | | |
|---|---|---|---|---|---|
| | **= 4** | **= 3** | **= 2** | **=1** | **= 0** |
| **Patents** | 38 | 9 | 3 | 4 | 0 |
| **Copyrights** | 4 | 9 | 20 | 18 | 3 |
| **Trademarks** | 4 | 3 | 15 | 25 | 7 |
| **Trade Secrets** | 13 | 24 | 7 | 5 | 5 |

* 4 = most frequently used; 1 = least frequently used; 0 = not used

However, one very important finding from the telephone interviews was that when entering into the discussions for a new RJV, firms most often employ a confidentiality agreement, a non-disclosure agreement, a non-compete agreement, or all of the above. Since discussions in the context of the RJV may be formal or informal and since the personnel involved may have a sizable amount of know-how and tacit knowledge, the firm can best protect its IP by binding its employees to strict non-disclosure rules. Patents are explicit knowledge and

[13] Patents were treated as a general protection mechanism in our survey, although, as Merges and Nelson (1994) point out, patents vary in scope and that has consequences on the innovativeness of the patenting firm' rivals. It follows then that relative use of patents as an IPPM in RJVs could vary with the ability of the firm to capture greater or lesser scope of coverage.

constitute a major asset brought to the negotiations, but the knowledge is public and the IP problems revolve around how to structure the sharing of the use of the patented knowledge.[14]

The use of existing IP titles for negotiating RJVs cannot be underestimated. Hall and Ziedonis (2001) have also underlined the use of patents as bargaining chips and a means of avoiding hold-up problems in recent years; our communications with industry representatives showed a similar trend, although no systematic data were collected in this regard.

Patents are also the most frequently used IPPM by firms to protect technology developed in a research partnership with only other firms (Table 5) and when universities are also involved (Table 6). Tables 5 and 6 are visually very similar, but that similarity – when a university(ies) is present and not – is important to emphasize. As with background knowledge, one also notices the high incidence of "trade secrets". It must be stressed here that non-disclosure agreements were omitted as an option in the questionnaires. Although a few companies wrote them in under "other," the high significance given to trade secrets may have acted as a proxy substitute for this category of protection.

**Table 5**

**IPPMs for Foreground Knowledge: Only Firms as Partners**
**(n =54)**

| IPPM | Frequency of Use * | | | | |
|---|---|---|---|---|---|
| | **= 4** | **= 3** | **= 2** | **=1** | **= 0** |
| **Patents** | 41 | 5 | 3 | 5 | 0 |
| **Copyrights** | 4 | 8 | 21 | 18 | 3 |
| **Trademarks** | 1 | 3 | 11 | 28 | 11 |
| **Trade Secrets** | 11 | 27 | 8 | 2 | 6 |

* 4 = most frequently used; 1 = least frequently used; 0 = not used

[14] The same argument can be made for copyrights and trademarks since they are also publicly registered. Trade secrets can be protected by non-disclosure agreements.

**Table 6**

**IPPMs for Foreground Knowledge: Firms and University(ies) as Partners (n=54)**

| IPPM | Frequency of Use * | | | | |
|---|---|---|---|---|---|
| | **= 4** | **= 3** | **= 2** | **=1** | **= 0** |
| **Patents** | 41 | 3 | 3 | 4 | 3 |
| **Copyrights** | 3 | 13 | 20 | 12 | 6 |
| **Trademarks** | 1 | 3 | 6 | 31 | 13 |
| **Trade Secrets** | 7 | 20 | 16 | 3 | 8 |

* 4 = most frequently used; 1 = least frequently used; 0 = not used

Intellectual property protection is easier and faster to negotiate when previous negotiations have taken place between the parties of a prospective collaborative agreement (Table 7).

**Table 7**

***When my company has previously been involved in a collaborative research venture with the same party(ies), IPPMs are easier and faster to successfully negotiate with the same parties.***
**(n=54)**

| Response | Frequency (%) |
|---|---|
| 7 = strongly agree | 18.5 |
| 6 | 27.8 |
| 5 | 24.1 |
| 4 = neutral | 3.7 |
| 3 | 5.6 |
| 2 | 5.6 |
| 1 = strongly disagree | 11.1 |
| 0 = no opinion | 3.7 |

To explore the relative difficulties of negotiating IPPMs, the general counsel in each firm was asked to respond to the following statements:

(a) Intellectual property rights negotiations are more complicated when another firm(s) in the same industry(ies) as my company is involved in an RJV with my company**.**

(b) Intellectual property rights negotiations are more complicated when a university(ies) is involved in an RJV with my company.[15]

(c) Intellectual property rights negotiations are more complicated when a foreign-based firm(s) is involved in an RJV with my company.

Respondents were instructed to use as a basis for comparison an RJV involving firms in a vertically-related industry. The responses in Tables 8-10 clearly indicate that negotiations are more complex when other firms in the same industry(ies) or universities are involved in the venture. As shown in Table 8, two-thirds of the general counsels agreed with this proposition.

[15] This question was motivated by the preliminary findings of Hall, Link, and Scott (2001), which found this to be the case among participants in ATP-sponsored research partnerships.

Almost a similar percentage (63%) agreed that university involvement increased the complexity of negotiations (Table 9).

**Table 8**

***Intellectual property rights negotiations are more complicated when another firm(s) in the same industry(ies) as my company is involved in an RJV with my company.***
**(n=54)**

| Response | Frequency (%) |
|---|---|
| 7 = strongly agree | 22.2 |
| 6 | 27.8 |
| 5 | 16.7 |
| 4 = neutral | 11.1 |
| 3 | 9.3 |
| 2 | 7.4 |
| 1 = strongly disagree | 0.0 |
| 0 = no opinion | 5.6 |

**Table 9**

***Intellectual property rights negotiations are more complicated when a university(ies) is involved in an RJV with my company.***
**(n=54)**

| Response | Frequency (%) |
|---|---|
| 7 = strongly agree | 24.1 |
| 6 | 18.5 |
| 5 | 20.4 |
| 4 = neutral | 16.7 |
| 3 | 13.0 |
| 2 | 0.0 |
| 1 = strongly disagree | 0.0 |
| 0 = no opinion | 7.4 |

The establishment of an RJV with a university was reported to be the strongest and most deeply felt problem area for the surveyed companies in terms of IP protection. They have all pointed to a growing trend in universities to be "more aggressive" or "greedy" in their

negotiations with firms on IP issues for joint research ventures. Table 10 below summarizes key comments made by representatives of the 23 firms who were personally interviewed in this study on the specific topic.

**Table 10**

***University/Industry Relationships in RJVs***

| Topic | No. of Companies Citing Problem | Other Adjectives Used by Respondents |
|---|---|---|
| Universities harder to deal with now | 5 | Impossible, Grim, Outrageous demands |
| Universities don't understand business | 6 | Risk adverse—put risk where it doesn't fit<br>Less flexible than companies |
| Universities have become greedy | | |
| Want to own all IP | 2 | Assume invention is worth a lot of money |
| IP viewed as significant source of income | 7 | |
| Technology Transfer office/officers are inexperienced | 8 | Don't know how to make a deal<br>File too many patent applications—waste money |
| Small staffs | 6 | |
| Frequent turn over of University TTO staff introduces discontinuities in negotiations | 3 | Naïve<br>Too long to get things done |
| Technology Transfer office has little authority to commit the university | | |
| Statutory restrictions | 4 | State government/universities |
| Lack of flexibility | 2 | |
| Find ways to work around Technology Transfer Office and University Administration | | Professors/researchers interested in performing the research;<br>Use as a way to work-around technology transfer office<br>Sometimes set up separate company to do research |
| Professors/researchers easier to deal with individually | 6 | |
| Publications | | Usually publish with a delay—e.g. after patent application is filed |
| A problem but generally can find ways to work around it | 6 | |
| Other | | |
| Use outside consulting firms to manage IP | 1 | Experienced firms hired by university much easier to deal with than technology transfer office |
| Use for recruitment of new employees | 3 | |
| Create long-term strategic relationships with universities | 2 | Umbrella agreements – one agreement to cover several scientists within the same university |

The consistency among the respondents was striking. Without exception, the companies found great difficulty in dealing with the university technology transfer offices or officers. Although they cite variations in the levels of competence in these offices, they find them generally inexperienced in their position, hard to negotiate with, lacking in business knowledge, mired in time-consuming functions, and lacking in authority to make a final commitment for the university.[16] At best, some companies were sympathetic where these offices and the technology transfer process in public universities were hindered by restrictive state statutes.

Also consistent among respondents is the feeling of change over the past twenty years in dealing with universities. They describe the situation today in quite negative terms, focusing mainly on the universities' seeming obsession on generating income from intellectual property. Companies describe the expectations of the universities as unrealistic, particularly in light of the fact that most IP does not have a high value, and the expense needed on the firm's part of taking an invention and making it into a successful commercial product. Universities, according to the firms interviewed, do not understand the business process well enough and demand ownership and income from IP generated in the university in disproportionate to the contribution.

The other striking and uniform position of industry is to try to work directly with research personnel in the university and to bypass the technology transfer office. They find working with researchers relatively easy, and they can often use the research staff to exert leverage on the university and intervene with the university administration to negotiate and generate an agreement satisfactory to the company.

One company mentioned the relative ease of dealing with professional consulting firms and other organizations hired by the university to handle their IP in lieu of having an internal

[16] University personnel were not interviewed in this study. As a future effort it would be very useful to conduct

technology transfer office. These intermediary firms were found to have more expertise and understand the business process better than universities themselves.

A number of interviewed companies responded that they had faced many fewer problems with university agreements when using a strategy of developing long-term strategic partnerships with universities instead of negotiating specific research agreements. Such partnerships cover a multitude of situations and provide a flexible and predictable base for cooperation. Both universities and companies appear to be able to find more common ground for success in this fashion than with a one-time specific research venture.

It is interesting that the right to openly and freely publish research results, a fiercely guarded principle of academic research, does not appear to be the key difficulty in the negotiations on research partnerships with universities. A compromise on this issue (usually in the form of a delay in publication until IP rights are secured) seems to be acceptable to researchers, universities, and sponsoring companies.

There was less agreement regarding the extent to which foreign firm involvement in an RJV increased the complexity of negotiations: about half of the respondents agreed with that proposition (Table 11). The supplementary information provided in the telephone interviews underscored that working with foreign firms on RJVs was more complex and difficult. The fact that virtually all interviewed companies are global in their outlook, however, meant that the existence of a foreign partner only meant that there were a few more legal problems to solve. No company indicated that this was a barrier to entering into an RJV. They consistently found dealing with Europe easier than dealing with Pacific Rim nations on intellectual property issues.

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interviews of personnel handling IP matters for universities.

The most often stated problem area with foreign firms was agreeing on the choice of laws clause to apply in case of a dispute.

**Table 11**

***Intellectual property rights negotiations are more complicated when a foreign-based firm(s) is involved in an RJV with my company.***
**(n=54)**

| Response | Frequency (%) |
|---|---|
| 7 = strongly agree | 9.3 |
| 6 | 20.4 |
| 5 | 22.2 |
| 4 = neutral | 27.8 |
| 3 | 14.8 |
| 2 | 3.7 |
| 1 = strongly disagree | 0.0 |
| 0 = no opinion | 1.9 |

Finally, telephone interviews found no consistency within companies as to how they handled the fees earned from the commercial exploitation of their intellectual property and from RJVs. In some cases the money went back to the research division or to the researchers as an incentive for additional R&D. In other cases it went directly into the company's general accounts. And, some companies have established separate profit-oriented technology transfer divisions that negotiate and market the IP for the whole company. These divisions are evaluated on the returns generated by the intellectual property commercialized outside the company. Most companies regard the legal support for IP and RJVs as part of their corporate overhead and do not charge the divisions directly for these services.

## V. Patent Importance

The survey findings in Tables 4 through 6 lend themselves to a more systematic, yet still exploratory, analysis. To investigate firm characteristics associated with patents being reported as the most frequently used IP mechanism to protect existing technology when entering an RJV (Table 4), we created a binary variable, *PAT1*, equal to 1 if the general counsel listed patents as the most frequently used IP mechanism to protect existing technology, and 0 otherwise. A simple model to explore inter-firm differences in the relative importance of patents can be represented as:

(4) $PAT1 = f(RJVEXP, GENCOUN, \text{Industry})$

*RJVEXP* represents the experience of each firm in research joint ventures as measured by the number of RJVs it was involved in between 1995 and 1998, inclusive. *GENCOUN* represents the general counsel's involvement in the negotiation of intellectual property rights issues as measured by the data in Table 2; *GENCOUN* equals 1 if the general counsel was the main responsible party for negotiating intellectual property rights issues, and 0 otherwise. To control for industry effects, the 2-digit SIC characterizing the firm's primary lines of business is included in the model. As shown in Table 1, over 50 percent of the firms in the survey sample are in four 2-digit industries: SIC 28 measured as *D28*, SIC 35 measured as *D35*, SIC 36 measured as *D36*, and SIC 38 measured as *D38*. However, since only *D38* enters the models significantly the other industry dummies are collapsed into the intercept for reporting purposes.

The probit results in Table 12 indicate that prior firm experience in RJVs has a positive effect on the probability that the firm will rely on patents over other mechanisms to protect its

background knowledge when entering into an RJV (column (2)). Reliance on patents is relatively higher for firms in SIC 38 (instruments). The term indicating the role of the general counsel in intellectual property negotiations (*GENCOUN)* enters positively (column (2)) but not significantly.

**Table 12**

***Determinants of the Probability of Patents being the Most Frequently Used IPPM to Protect Existing Technology***

Probit Estimates: Dependent Variable, *PAT1*

| Variable | Coefficient (s.e.) | |
|---|---|---|
| | **(1)** | **(2)** |
| Intercept | -0.117 (0.359) | -0.394 (0.386) |
| *RJVEXP* | 0.009 (0.018) | -- |
| *ln(RJVEXP)* | -- | 0.366 (0.183) ** |
| *GENCOUN* | 0.602 (0.422) | 0.348 (0.446) |
| *D38* | 1.176 (0.613) * | 1.173 (0.618) * |
| | | |
| Log likelihood | -29.72 | -27.75 |
| Pseudo $R^2$ | 0.095 | 0.154 |
| Chi Square (3 df) | 6.20 | 10.13 |
| N | 54 | 54 |

* significant at .10 level
** significant at .05 level
*** significant at .01 level

Similarly, Tables 13 and 14 report the probit corresponding to the data in Tables 5 and 6, respectively. The dependent variable in Table 13, *PAT2*, equals 1 if the general counsel listed patents as the most frequently used IP mechanism to protect foreground knowledge in an RJV involving only other firms, and 0 otherwise. The dependent variable in Table 14 *PAT3*, equals 1 if the general counsel listed patents as the most frequently used IP mechanism to protect foreground knowledge developed in an RJV involving both firms and universities, and 0 otherwise. When universities are involved, experience in RJVs is the identified determinant.

**Table 13**

***Determinants of the Probability of Patents being the Most Frequently Used IPPM to Protect Technology Developed in an RJV Involving Only Firms***

Probit Estimates: Dependent Variable, *PAT2*

| Variable | Coefficient (s.e.) | |
|---|---|---|
| | **(1)** | **(2)** |
| Intercept | 0.006 (0.361) | -0.061 (0.389) |
| *RJVEXP* | -0.011 (0.019) | -- |
| *ln(RJVEXP)* | -- | 0.014 (0.185) |
| *GENCOUN* | 1.019 (0.444) ** | 0.927 (0.457) ** |
| *D38* | 1.022 (0.641) | 1.049 (0.636) |
| | | |
| Log likelihood | -26.07 | -26.25 |
| Pseudo $R^2$ | 0.125 | 0.119 |
| Chi Square (3 df) | 0.058 | 7.11 |
| N | 54 | 54 |

* significant at .10 level
** significant at .05 level
*** significant at .01 level

**Table 14**

***Determinants of the Probability of Patents being the Most Frequently Used IPPM to Protect Technology Developed in an RJV Involving a University(ies)***

Probit Estimates: Dependent Variable, *PAT3*

| Variable | Coefficient (s.e.) | |
|---|---|---|
| | **(1)** | **(2)** |
| Intercept | -1.613 (0.539) *** | -2.153 (0.759) *** |
| *RJVEXP* | 0.045 (0.022) ** | -- |
| *ln(RJVEXP)* | -- | 0.609 (0.322) * |
| *GENCOUN* | -0.409 (0.688) | -0.553 (0.736) |
| | | |
| Log likelihood | -11.02 | -10.99 |
| Pseudo $R^2$ | 0.172 | 0.174 |
| Chi Square (3 df) | 4.58 | 4.64 |
| N **** | 43 | 43 |

* significant at .10 level
** significant at .05 level
*** significant at .01 level
**** *D38* predicted perfectly that patents are the most frequently used IPPM, thus 11 observations were dropped.

## VI. Conclusion

The results in this paper confirm the hypothesis that IP protection is a fundamental consideration for all research partnership members. While there is strategic variation among firms regarding the way they approach the issue of IPRs, however, the evidence in this paper does not indicate that this has been an issue presenting insurmountable problems for large, diversified companies with specialized legal resources. If such firms consider it beneficial to engage in research cooperatively, IP protection is one of several negotiated problems but typically not the "showstopper".[17]

Patents are the most frequently used IPPM by firms to protect both background knowledge and foreground knowledge in research partnerships. Exploratory econometric analysis suggests that patents do not have a homogeneous effect in IP protection. Rather, the use and presumably effectiveness of patents, at least in the context of RJVs, is not independent of the experience of the firm with such an organization form.

In order of general importance, patents are followed by trade secrets, copyrights, and trademarks. Virtually all firms surveyed and interviewed reported that they routinely rely upon some form of IP protection to guard know-how and tacit knowledge carried by their employees, especially in the early stages of exploring the possibility of a partnership with other firm(s). Such protection may include confidentiality agreements, non-disclosure agreements, non-compete agreements, or all of the above. Often overlooked as a form of IP protection, the routine use of

[17] The question remains about smaller firms. While several interviewees implied that patents are even more important for small firms in entering RJVs, we do not have extensive direct evidence.

such early stage agreements is, perhaps, even more effective than patents during the research partnership.

Firms stress the importance of using existing IP titles – especially patents – when negotiating to enter into new RJVs. The use of existing patents as "currency" seems to be even more important for small firms to substitute for a lack of widespread market recognition. The use of patents as bargaining chips is in agreement with other recent literature that has substantiated the role of intellectual property rights (IPRs) as a means of avoiding hold-up problems (Hall and Ziedonis 2001).

Prior experience with the same research partners – companies as well as universities – facilitates the formation of a new collaborative R&D agreement by reducing red tape and by speeding up negotiations on intellectual property issues. IPR negotiations were reported to be more complex when other firms in the same industry(ies) are involved in the venture (i.e., horizontal RJVs) as well as when universities are involved. With respect to the latter, industry sounded especially concerned with the increasing "aggressiveness" and "greediness" of universities in their negotiations with firms over IP for expected research outputs from the partnerships, an observation stressed by Siegel et al. (2003).

University-industry relationships concerning intellectual property ownership and rights have reached a critical point. Negotiations have become very strained and much more difficult to resolve in recent years. The major issue is on value and income from IP and on overcoming the different perceptions of firms and universities. It also appears that the formation and staffing of special offices within universities to handle these negotiations has, from an industry viewpoint, created additional tension and difficulty in completing these agreements.

There are bright spots too. A seeming successful solution has been the development of long-term, formal strategic partnerships with a few specific universities that cover a multitude of situations and provide a flexible and predictable base for cooperation. Moreover, the frequently documented tension between academic needs for the timely publication of research results and the needs of firms for keeping results private did not appear to be an insurmountable problem. The interviewed firms have reportedly found ways to work around that problem.

Views were mixed regarding the extent to which foreign firm involvement in a research partnership increased the complexity of IP negotiations. For the most part, European firms were considered easier to deal with in collaborative R&D than East Asian partners. Views were also mixed regarding the use of "boiler plate" IP protection clauses in contracts for collaborative R&D. Several firms reported that prior experience has resulted in the use of standard forms as a starting point upon which they can build upon more or less extensively depending on the case (e.g., the nature of the technology, of the partner, and of the partnership itself).

These results have important implications. One implication is that incentives for cooperative R&D are very much affected by the ability of firms to protect their intellectual property. Although IP protection was not seen as a showstopper in the case of large, diversified companies, the question is till open regarding the extent of importance to smaller firms in negotiating new RJVs. Another implication is that the exclusivity given by analysts from a variety of disciplines to patents when studying IP issues in technology-based firms is unjustified. Many other IPPMs, especially trade secrets, are being actively employed while negotiating and undertaking cooperative research. A third implication is that, in addition to their traditional role as mechanisms to protect intellectual property, patents have now become bargaining chips to gain entrance into desired partnerships and influence the direction of the cooperative activity.

Important implications relate to university-industry collaboration. To the extent that the reported characterization of aggressiveness and frequent overestimation of the value of university IP for short and medium term returns is correct, it may simply reflect temporary adjustment problems of universities in an environment significantly different than the one they were used to before. It may, however, also reflect deeper adjustment problems that have to do with the compatibility of university organization with collaboration with industry. Still, several firms reported successful solutions to the negotiation problems with universities, hinging on the ability to maintain longer-term relationships.

Finally, it is fair to say that efforts to create model contracts for cooperative R&D – see, for example, the European Framework Programs – are bound to be successful only to the extent that they provide a minimum acceptable standard. While several firms reported that prior experience with R&D cooperation has resulted in standard IP protection rules upon which they build more or less extensively on a case-by-case basis, no firm reported using "boiler plate" contracts for collaborative R&D. This agrees with what appears to be the practice in Europe where partners in government funded cooperative R&D ventures tend to sign customized side agreements regarding IP protection in addition to the mandated common basis.

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