Best Practices for University-Industry Technology Transfer:
Working with External Patent Counsel

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Preface and Acknowledgments

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Executive Summary

The processes for transferring research results from university laboratories to commercial application are complex and varied, and it has been difficult to define the ingredients of success, however success is defined. Moreover, the general understanding of university-industry technology transfer has been driven primarily by anecdote and case analysis rather than by systematic research and analysis. This need to better understand technology transfer practice is exacerbated both by increasing expectations of universities to act as agents of economic development and by the need of universities themselves to function more efficiently and effectively.

This study was undertaken to examine empirically one set of university technology transfer practices - those concerned with using external patent counsel. This included the use of external patent counsel in applying for and obtaining patents on university inventions, and related activities such as licensing, defending patents, and even selecting inventions for patenting. A complementary purpose of the study was to examine various performance indicators of the university technology transfer function.

The study sample consisted of 27 research universities in the South, as well as a comparison group of 10 universities from elsewhere in the U.S. Data gathering, which focused on a three-year period from 1990-1992, consisted of telephone and in-person interviews, using a standardized interview protocol. Respondents were those institutional officials who were responsible for the technology transfer function. Data analysis consisted primarily of computing descriptive statistics of the incidence of various transfer practices in using external patent counsel. In addition, some correlational analysis was conducted to determine relationships between practices and transfer outcomes - in effect, empirically defining *best practice* in these institutions.

The results verify the impressions of many technology managers, specifically that simply obtaining patents on faculty inventions does not guarantee outcome success: strong royalty income and productive licenses. Across the sample as a whole, filing patent applications and obtaining patents were only weakly related and were essentially unrelated to down-stream royalty income. In addition, we found great disparity across institutions in terms of royalty productivity, with only six of the southern universities exceeding a royalty return-on-investment (ROI) of one percent (royalty revenues divided by total R&D expenditures). The "benchmark" institution in the South reached an ROI of 5.81 percent.

The results of the best practices analysis indicated that royalty productivity was related to institutions adopting a "business-like" approach to their mission and technology management. This approach was characterized by relative autonomy in selecting and engaging patent counsel, and the authority to evaluate results, control costs, and approve compensation for services.

The results also indicated that those university technology transfer managers which select and engage patent counsel based on substantive experience, subject matter expertise, and working experience with faculty inventors are more successful when measured by outcome success (royalties) and input success (patent applications and patents awarded). In contrast, programs which tend to select and engage patent counsel on the basis of extraneous criteria such as in-state location or prior relationship with the university, tend to do less well on both patenting and royalty performance.

It was recommended that both universities and intellectual property law firms share best practices and methods in working together, and that this dialogue be guided by a greater attention to downstream commercialization results.

Best Practices for University-Industry Technology Transfer: Working with External Patent Counsel

Background and Issues

The U.S. system of universities is considered by most observers to be the world standard for academic science. Whether one examines measures as disparate as Nobel Prizes, citation indices, or their contribution to the training of Ph.D.- level scientists, U.S. universities have achieved an enviable level of excellence.

Less clear is how much U.S. universities have contributed to economic competitiveness and societal well-being. In the past 10 to 15 years, several changes in state and federal policy and law have been implemented in order to address this concern. Most notable of these have been changes to patent laws and grant policies to facilitate the transfer of academic science to practical applications. The Bayh-Dole Act of 1980 gave universities unprecedented flexibility to manage and commercialize faculty inventions. In addition to clear title for inventions originating in the university, significant incentives for faculty were provided through royalty sharing.

Since the enactment of Bayh-Dole in 1980, university programs to patent and license faculty invention have rapidly expanded in scope and aggressiveness. While there are no solid data on the number of academic institutions with full-fledged programs, the Association of University Technology Managers (AUTM) now has members from 260 academic institutions, free-standing medical centers, and allied organizations.[i] This enrollment represents a rapid expansion since 1985 when AUTM membership represented less than 100 institutions.

Over this period, universities have had to become adept at a variety of practices critical to managing successfully their intellectual property portfolios. However, universities are also breaking new ground here; it is not immediately obvious what are the best practices to pursue. As one example, universities have become regular clients of intellectual property lawyers. Universities generally use outside counsel for most intellectual property needs, including writing United States and foreign patent and trademark applications, defending intellectual property from misuse and infringement, providing advice on copyright issues, and in many cases, providing advice on licensing terms and agreements. Although a growing number of academic institutions have attorneys or paralegals on staff who focus on intellectual property issues, almost all are represented in formal applications and actions by outside counsel. According to the AUTM licensing survey,[ii] over $44 million was expended by universities in 1992 for these services. What remains unclear for many is the most beneficial way to use this external expertise.

As clients, universities behave much differently than do business organizations. Companies are established to achieve commercial goals, which may become broader as their technologies become more dominant. Universities are not focused exclusively on maximizing business advantage or profits; they are more concerned with maintaining scientific excellence and realizing their mission goals. Among these, the dissemination of scientific knowledge is paramount, and intellectual property protection is simply one tactic to this end. In contrast, companies view the cost of intellectual property protection as a necessary expense in that proprietary technology is considered a business asset. Universities may view that same cost as inessential to their core mission; therefore, it is burdensome overhead to be avoided or shifted whenever possible.

These differing goals and perspectives also tend to yield different modes of patenting activity, and by extension, different ways in which external patent counsel is used. Consistent with their missions, universities are often more inclined to seek patent protection early in the innovation process and with a broad set of claims. Companies, consistent with more focused business objectives, might be more inclined to seek narrower protection and to delay filing until an invention is well developed in their laboratories.

All of these differences in culture, attitude, and behavior have necessitated adjustments in the corresponding attitudes and practices of intellectual property attorneys who serve university clients, and in the university clients themselves. This variance in culture and behavior has created problems and tensions for both university technology managers and lawyers.

Prior attempts in the literature by university technology managers or intellectual property lawyers to deal with these tensions have been limited to the exchange of "pointers" or "operating tips" based on individual experience and trial and error. As the variety of relationships and wealth of experience has increased, it was felt that a carefully designed empirical study might elicit some patterns of best practices and inter-institutional consensus which might be helpful to both university clients and intellectual property lawyers.

Even though working with outside patent counsel is quite widespread, the processes by which counsel are selected, the methods for evaluating quality, and the methods for cost management are not uniform and are problematic for most academic technology managers and lawyers.

The goal of the study was to describe the range of practices by which external patent counsel is used by university technology programs, and to establish if any practice or set of practices appeared to be related to successful performance in those programs. Success in technology transfer can be defined in many ways, so the survey was organized to look at two criteria of success: "input" success and "outcome" success.

Input success was defined by numbers of U.S. patent applications filed and U.S. patents awarded, as well as indices derived from those data. Input factors measure an institution's commitment to technology transfer by the level of effort to promote invention disclosures by faculty and to protect inventions.

Outcome success was defined by the numbers of active licenses and the amount of annual royalty revenue, as well as indices derived from those data. Outcome factors measure the success of the institution's technology transfer program in terms of its ultimate objective: to transfer technology of value to the commercial marketplace. Outcome success is dependent not only on the abilities and skills of the technology program, but also on the quality of the research faculty, and to some extent, luck.

The operating hypothesis of the survey was that practices for selecting and retaining counsel and for cost management could be related to success indicators in such a way as to validate a set of "best practices" or "consensus practices", which could be identified by frequency of response and correlation between frequency of response and the indices of performance success.

The survey focused on a diverse group of university institutions with growing research programs in the southern United States. Historically, except for a handful of institutions, southern universities have not been among the leaders in either the scope of research under way or in the practice of technology transfer.

This survey explored the following research questions:

(1) *How do universities select counsel for patent services?* It was assumed that the universities in the South uniformly go to outside counsel for patent legal services and that the selection and retention of patent counsel is governed by an array of institutional policies and practices. In the case of public universities, pertinent state law and regulation govern those activities. Knowledge about these selection practices should help intellectual property law firms compete effectively and should assist all universities to obtain services of higher quality and responsiveness.

(2) *How do universities assess quality in patent legal services?* It is quite difficult to evaluate the quality of patent legal services. Furthermore, it is quite often difficult to grasp the sensitivity of a particular invention to the need for high quality legal service at the outset of a patent application case. Early work on an application is often done before the economic value and/or the full technical extent of a particular invention is established. Often technical errors in a patent application, the supporting search, or the subsequent prosecution of the application do not surface until a patent is issued and is being defended. In spite of these problems, universities are forced to pick and choose service providers using imperfect, subjective, and sometimes highly individualized criteria. Understanding best practices or consensus practices should help universities sharpen their selection criteria, and should help intellectual property counsel to be more responsive to the needs and expectations of university clients.

(3) *How can universities effectively manage patent legal costs?* Recent years have witnessed a steady ratcheting up of legal costs for university technology transfer programs. These include continuous increases in Patent Office fees, increasing rates charged by intellectual property lawyers, and other costs associated with the anticipated move to a "first to file" system. These are especially bothersome given the continuing cost reduction pressures associated with university administrative overhead. It is unrealistic to anticipate that universities can continue to tolerate increases in patent prosecution and maintenance costs. Cost control procedures will be increasingly important to clients and increasingly meaningful to providers. Universities will want to learn from each other, and knowledge about best practices is increasingly important. Intellectual property counsel with effective cost management mechanisms in place should have a competitive advantage in attracting university clients.

This study provides information on the practices of university technology transfer programs for use of outside intellectual property counsel, as well as information about the extent university-business technology transfer in the southern United States as measured by licensing activity and by patenting of university inventions. It is hoped that this information will help universities to evaluate technology transfer activities by comparing their practices to the results of this study. The study results may help universities reform and standardize practices for working with intellectual property counsel; it may also help intellectual property law firms to be more responsive to the unique needs of their academic clients.

Methods and Procedures

Sample. A survey sample of 27 institutions in the southern U.S. was selected as the primary focus of the study, which examined the years 1990-1992. Most were in the top 100 universities in the United States based on the size of the institution's annual research expenditures reported to the National Science Foundation. In addition, all of the sampled southern institutions had a member of the Association of University Technology

Managers on their technology staff, and all reported having undertaken some patenting activity in the recent past.

A national comparison sample of 10 institutions was selected, drawn from comparable types of institutions. That is, there were roughly the same percentages of land grant universities, biomedical-oriented institutions, and large-scale graduate institutions. In terms of input and outcome indices, the national comparison group was slightly better in terms of efficiency in processing patent applications and obtaining patents, and roughly comparable in terms of royalty outcomes. However, the national comparison sample had appreciably older programs than did the group from the South (on average, 20.2 years versus 11.8 years).

Individual respondents at all institutions were those responsible for the technology transfer function. Specific titles and reporting relationships varied from institution to institution.

Data collection procedures. A mixture of face-to-face and telephone interviews was used. Twelve institutions in the southern sample were contacted and participated in face-to-face interviews with open-ended questions. The balance of the institutions in the southern and national comparison samples were contacted and participated in telephone interviews, using the same questions asking for specific responses. A list of the participating institutions is attached (**Appendix A**). No institution which was asked to participate declined. All respondents were given an assurance of confidentiality regarding their individual responses. Telephone interviews lasted approximately 45 minutes; face-to-face interviews took one to two hours. There were no obvious (nor statistical) differences in the responses to the questions based on mode of data collection. All of the core questions were factual and/or forced-choice in nature.

Data Collection Instrument. The interview protocol was organized into four broad areas. Questions in Part A established background information on individual programs: age of program; average annual number of U.S. patents and patent applications (based on the last three years); number of licenses; annual royalty income (based on each institution's most recent reporting period); and average annual research expenditures (based on the last to or three years expenditures reported to NSF).

Part B of the interview protocol asked respondents about general practices in selecting and engaging external firms. This included criteria for locating and choosing firms. Part C asked several questions about use of external patent counsel as it pertained to particular issues of patentability and patent applications. Part D asked questions about how external patent counsel was managed during the engagement, particularly as it pertained to cost management issues.

Data Analysis. Prior to conducting descriptive and/or inferential statistical analysis, several processing steps were taken. For the most part, these consisted of developing data coding approaches to open-ended and/or dummy variables ("yes-no"). However, three performance indices were computed from the raw data. Two (application efficiency and patent efficiency) are *input indices* which relate to effort invested in the program. One (royalty return on investment) is an *outcome index*, which relates to the success of the program measured in financial return.

The input indices (application efficiency and patent efficiency) were calculated by dividing the average (over three years) annual research expenditure for each institution by the average (over three years) annual number of either applications filed or patents awarded respectively.

The outcome index (royalty ROI) was calculated by dividing the annual royalty revenue by the average (over three years) annual research expenditure. Obviously, this index was somewhat distorted by the fact that in any given year royalty revenues generally reflect a mix of current technologies and long-standing license agreements. Nonetheless, it provided an extremely useful benchmark measure.

Descriptive statistics consisted primarily of computing means and/or ranges. In order to analyze the data inferentially, simple Pearson correlations were computed between the various practice or predictive variables and the other indicators. Because of the low sample sizes, there was no attempt to conduct regression analysis or other multivariate approaches, nor to conduct a statistical test of significance between the southern and national comparison samples.

Results

Background and Performance Data

As noted above, data on performance indices (patenting and licensing activities by universities) provided a set of dependent variables for a **best practices** inferential analysis on how institutions use external patent counsel. However, because response rate by participating institutions was high, and the surveyed institutions represented a significant proportion of the academic research base in the South, the performance data provide an accurate regional indicator of the current state of university-business technology transfer in the region. The results also provide a valid benchmark of institutional performance data that individual universities can use to evaluate their performance in comparison to regional counterparts.

Age of Program. Age of program was simply the number of years an institution has been involved in patenting and licensing as identified by the assignment of continuing duties on either a part-time or full-time basis. Data were obtained from all 27 of the southern institutions. The age of the programs in the South ranged from one to 58 years, with a mean of 11.8 years. This compared to an average age of 20.2 years for the national comparison group. Of note, only 14.8 percent of the southern programs predated passage of Bayh-Dole in 1980, versus 40 percent in the national comparison group.

Patent Applications. On average, the Southern institutions applied for 15.3 patents, with a range across institutions from 0 to 42.3. The application input index (ratio of total R&D to applications) also showed wide variance across the region, with a range of $1.91 million per application to $61.68 M per application, and a mean of $9.99 M per application. This latter figure is roughly comparable to the national comparison group mean of $8 M per application.

Patenting Activity. On average, southern universities annually were awarded 7.5 patents (with a range of 0 to 40) during the 1990-1992 period. This compares to an average of 8.2 for the national comparison institutions. Considering the patenting input index, southern institutions had an average ratio of $21.66 million per patent awarded, with a range of $1.37 M per patent to $61.6 M per patent This is roughly comparable to the mean figure for the national comparison group of $18.29 M per patent. Assuming comparable R&D assets across the institutions, these data nonetheless suggest major disparities in intellectual property management practices across the region.

Licensing and Royalties. Twenty-six Southern universities reported an average of 28.11 active licenses, with individual responses ranging from none to 165. Universities in the national comparison group had an average of 68 active licenses, possibly reflecting the age of their technology programs.

Our responding institutions also reported on the percentage of their royalty revenue coming from the largest single license. For the southern sample, this ranged from 13.73 percent to 99.05 percent, with the average being 59.41 percent. This was roughly equivalent to the national comparison average of 51.4 percent.

Twenty-six Southern universities reported their annual royalty income, which ranged from none to $5,159,791. The average was $931,253. These disparities in gross royalty revenue are reinforced when one computes the royalty outcome index (ROI) described above. One way of thinking about this index is as a return on investment (ROI) for the institution. Thus the average ROI for the southern sample was 0.97 percent (compared to 0.79 percent for the national group), with a range from 0 to 5.81 percent. Of note, the highest ROI index in the South did not come from the institution with the highest aggregate royalties, and only six universities in the region exceeded a royalty ROI of 1 percent.

Although these outcome index data portray fairly robust technology transfer activity in the South, when compared with the AUTM Survey and other studies, they also reveal how far these institutions have to go. As one example, one can look at the royalty ROI index that was compiled and speculate on various "what if" scenarios that would elevate the average level of technology transfer performance in the region.

Looked at this way, what if all of the 27 southern institutions in our sample reached the level of a national benchmark such as Stanford, Columbia, or Michigan State? (Using our index, Stanford's royalty ROI is roughly 8.2 percent, Columbia's is 7.4 percent, and Michigan State's is 9.9 percent.) Better yet, what if all of the institutions in the region attained the regional benchmark of 5.81 percent? This would add $112 million in royalty revenues to our sample of 27 institutions alone. If one uses the multiplier reported in the September, 1993 AUTM Newsletter of 32.4. this would translate into $3.6 billion of additional economic activity, some of which would remain in the South.

These estimates may seen grossly optimistic, but even more conservative analytic assumptions yield robust figures as well. For example, if one had a more modest goal of raising those institutions below the regional mean to that average level of performance, this alone would bring an additional $10.6 million of royalty revenues across the sample, and some $343.4 million in additional economic activity.

What is most speculative in all of this is the potential yield in economic activity in the region. The figures above, of course, assume that resultant economic activity would remain in the South. Whether this is a correct assumption cannot be answered by the data at hand, although it could be addressed in a future study.

Interrelations Among Performance Indicators. We also explored via correlational analysis, some relations among the performance indicators. Of most interest, perhaps, was lack of relationships between them. For example, the two input indices (applications and patents awarded) were only weakly related, and neither was strongly related to the royalty ROI index. To interpret these findings, outcome success may depend more on the quality of the invention, and its market relevance, than on patentability. It appears that the best advice that a good patent counsel can give is when not to patent an invention, for reasons beyond patentability. Patents are not the same as market viability, and more focus on end-state commercialization would be advisable. Some of the correlations support this interpretation.

For example, we found that the more technology transfer a university does, the better it gets, as demonstrated by the correlation ($r = .95$) between the outcome index of royalty return on investment and gross royalty revenue. In effect, good deals lead to better deals. This does not mean, however, that sheer volume or the size of the R&D portfolio makes one better as measured by outcome success. In fact, there is some evidence, that a larger volume of R&D at the institution tends ($r = .21$) to depress the royalty ROI.

On the other hand, we found that the larger the size of the R&D portfolio, the more efficient the program tended to be in terms of our input indices. This was true of both applications ($r = .35$) and patents awarded ($r = .40$). In effect, the data suggest that many of the universities with larger research programs seem to be caught up in patenting and intellectual property protection as a service function, and not primarily as a commercialization vehicle.

Performance as measured by royalty return on investment also appears to be dependent on getting a single license with significant royalty flow (a "big hit") as indicated by the positive correlation ($r = .54$) between royalty return on investment and the percentage of royalty income from a single license, and between gross royalty and percentage of royalty income from a single license ($r = .61$). Many of the larger royalty revenue portfolios were fueled by a single license producing big revenues. Unfortunately, our data do not yield the optimal mix of wisdom, luck, inspiration and discipline that will result in such fortune. For example, while not testable here due to the small sample size, it may be the case that in the better performing programs (when measured by royalty ROI) there is a tighter relationship between patenting activity and downstream commercialization.

Finding and Selecting Attorneys

As described above, the "practice" component of this study focused on how institutions used and deployed external patent counsel in their technology transfer activities. The front end of these relationships, of course, involved basic decisions about firm exclusivity, criteria for selection, and incorporating a selection process.

Dealing With One Firm or Several firms. One set of questions concerned institutional practice regarding their exclusivity in using external patent counsel. Of the 27 responding institutions in the South, the majority (70.4 percent) reported that they deal with two or more firms and had lists of firms to use. By contrast all of the institutions in our national comparison sample used two or more firms, and all had lists of firms.

There were several factors which seemed to be related to using one vs. several firms. For example, in the South, programs which choose counsel on the basis of the attorney's relationship with the university tended to use a single firm ($r = .40$). Programs in which firms are selected through peer referral from other technology managers ($r = .45$), or because of expertise in a particular technical field ($r = .60$), tended to use more than one firm.

In the interviews, some respondents indicated that they had a "primary" relationship with one firm, and "overload" relationships with others. Some of the programs were clearly oriented to picking and choosing as needs and loads changed.

Did these exclusivity vs. variety practices make a difference in terms of program performance? Evidence indicates that this was the case, as programs that were more productive in filing applications, as measured by the ratio of total R&D to patent applications, tended to use two or more firms ($r = .25$).

Processes and Criteria for Selection of Patent Counsel. It was clear from both the southern sample and the national comparison group, that the selection of firms tended to follow an orderly (often mandated) process, was heavily steered by the technology manager, and was driven by several criteria. Our data also suggest that the way this process played out in a given institution also had implications for the effectiveness of the technology program.

For example, the clear majority (85.2 percent) of southern institutions, and all of the national comparison group, reported that the technology manager had an input into selection of intellectual property counsel. Of those programs in which the technology manager had input, he/she had exclusive authority in 34.8 percent of the cases.

Again, a majority of both southern (55.6 percent) and national comparison (70.0 percent) institutions had a process in place for adding new firms to the list of external counsel. In the southern institutions, that process was more likely to be driven by explicit law or organizational policy (59.3 percent) than to the national comparison group (40.0 percent). Older programs in the South were less likely ($r = .32$) to have a formal process for adding new firms to the list.

One question explored how the external firm came to the attention of the technology transfer program. The results indicated that this process tended to be heavily influenced by those closest to the technology, the inventor, and the network of technology managers at other institutions. That is, inventor referral was identified as important by 70 percent of the national group and 63.2 percent of the southern sample. This was followed by issues of existing relationship with the university (60 percent for national comparison group; 52.6 percent for the South), location convenient to the university (60 percent for national group; 47.4 percent for the South), and location within the state (30 percent for national comparison group, and 31.6 percent for the South). Peer referral from other technology managers was identified by 50 percent of the national comparison group, and by 63.2 percent of the southern sample. Unsolicited contacts from firms tended to be a relatively infrequent route for firms to establish a relationship with the university. This was identified by only 20 percent of the national comparison group, and by 31.6 percent of the southern sample. Of note, younger programs in the South tended ($r = .33$) to choose counsel on the basis of the firm's relationship with the university.

Two questions asked respondents about the importance of several selection criteria in using external patent counsel. One explored criteria for selecting or retaining a firm for a relationship. Again, the importance of technical familiarity and background was important . The criterion of "experience in a specific technical field" drew strong endorsement from both the national (90 percent) and southern (100 percent) respondents. This was followed by "experience in a broad or diverse range of technical fields" (70 percent for national group; 47.4 percent for South). Of comparable importance was "experience in dealing with university clients and university inventors" (90 percent for national comparison; 42.1 percent for the South). Of lesser importance was price (60 percent for national comparison; 63.2 percent for the South), location close to the university (50 percent for national group; 36.8 percent for the South), and location within the state (30 percent for the national group; 21.1 percent for the South). Of note, some respondents indicated that they were restricted to attorneys within the state.

Another question asked respondents about what factors would be important when deciding what firm to bring in on a particular patenting case. Again, the most common response tended to be related to issues of technology familiarity. The most important criteria were "experience with related inventions" (100 percent for

national comparison group; 73.6 percent for the South), and "experience with related technology" (100 percent for national comparison; 78.9 percent for the South). Interestingly, this was followed closely by "managerial" factors such as "cost" (70 percent of national group; 57.9 percent of the South), "experience with the inventor" (80 percent of national group; 52.6 percent of the South), and "experience with the university" (80 percent of national comparison; 21.1 perm of ft South). The difference between the older national group, and the younger southern sample, was parallel within the latter. That is, there was a strong correlation *(r* = .85) between age of the program and selecting a counsel on the basis of experience with the university. It is also worth noting that use of all the criteria was somewhat depressed for the southern sample, perhaps indicating a general disinclination to make hard choices among alternative external counsel. As another interpretation, it may be that there are simply fewer choices of external patent counsel available to southern institutions, or that those available are not experienced in working with university clients.

In addition to this descriptive picture of selection processes and criteria, the data also yielded some interesting relationships between these practices and some of our input and output performance measures. These analyses were conducted with the southern sample of cases.

In terms of patent application efficiency, indexed as the ratio of total R&D to applications filed, we found:

- Universities with a list of firms tended to file proportionately more patent applications ($r = .50$).
- Universities that need to follow specific state law or institutional policy in adding firms tended to file proportionately less patent applications ($r = .40$).
- Universities that use the criteria of experience with related inventions ($r = .67$), or experience with the inventor ($r = .48$), as selection criteria for picking a firm for a patent case tended to file proportionately more patent applications.
- Universities that use the criterion of cost in picking a firm for a case tended to file proportionately more patent applications ($r = .40$).

In terms of patenting efficiency, indexed as the ratio of total R&D to patents granted, we found that:

- Universities in which the technology manager plays a role in selecting external patent counsel tended to obtain proportionately more patents ($r = .49$).
- Universities in which state location ($r = .41$) or prior relationships with the university ($r = .35$) play a role in selecting external patent counsel tended to obtain proportionately less patents.
- Universities in which ability to meet a deadline is an important factor in choosing a firm tended to obtain proportionately less patents ($r = .45$).

In terms of royalty performance, as indicated by the ratio of annual royalties to total R&D, we found:

- Universities in which peer referral ($r = .39$), within-state location ($r = .43$), or prior relationship with the university ($r = .30$) are factors in choosing a firm tended to have a less favorable royalty ROI.

- Universities which use price ($r = .42$) or experience with a broad range of technical fields ($r = .28$) as criteria for choosing a firm tended to have a more favorable royalty ROI.

- In effect universities which use "market-relevant" criteria do better; universities which use "relationship-relevant" criteria do poorer.

Case and Cost Management Issues

Once a professional relationship has been established with one or more external patent law firms, the university technology office must have in place a set of management practices for deploying that capacity. These include various case management practices, as well as various approaches to managing the costs associated with using an external firm.

Case Management. The selection process and use of criteria tends to terminate in some sort of working relationship between the university and the external intellectual property firm. In about half of the programs this was a formal contract or engagement letter, with the balance operating under a more informal arrangement. Given some of the common misunderstandings about the needs, preferences, and limitations particular to university clients, and the propensity of law firms to miss cues, it is surprising that use of engagement letters to spell out expectations and operating procedures is not more common. In contrast, corporate clients often provide outside counsel with written "standing instructions" to deal with corporate strategies and procedural issues such as when to abandon applications, when to pay issues fees, and the like.

Another issue of case management was whether the university technology program would allow licensees or other commercial partners to either select a firm for prosecuting a patent application, or use in-house counsel. The overwhelming majority of both the national comparison group (90 percent) and the southern sample (96.1 percent) indicated that they would, albeit with qualifications. The most frequent qualifications were that the firm's client would be the university, that the university, would be the assignee recorded, and that the university would have the final word on any prosecution decisions.

Another set of questions concerned continuity of case management over different phases of the patenting process. For example did the university let the same firm that prosecuted the U.S. application prosecute international applications? Overwhelmingly, this was the case with both the national comparison (100 percent), and the southern group (96.3 percent). On a related issue, did the university technology program let the same firm that prosecuted the U.S. application maintain active patents? By the same margins, both the national comparison group (90 percent) and the southern sample (100 percent) indicated that this was the case.

These case management practices tended to have little relationship to the input or outcome indices. The exception:

- Those universities that used a contract or engagement letter with a firm tended to file proportionately less patent applications ($r = .30$).

- Those universities that allowed licensees or other commercial partners to select or prosecute an application tended to file proportionately more patent applications ($r = .32$).

Managing Costs. Several questions addressed issues relating to cost management of the relationship with

external patent counsel. All of the institutions surveyed requested cost estimates, but the timing and management of these cost containment practices varied a fair amount. For example, about half of the universities (50 percent of national comparison; 44.4 percent of southern group) requested rate information at the time a relationship is established. Cost estimates tended to be requested much more frequently regarding specific services: for a patent search or patentability opinion (80 percent for national comparison; 51.9 percent for the South); for a U.S. application (100 percent of national comparison; 70.3 percent for the South); and for a foreign application (80 percent for national comparison; 55.6 percent for the South). Some respondents suggested that the cost estimates provided a good indicator of how well the attorney understood the case and the invention.

Cost estimates were used for several different purposes within the university. One obvious application was to decide whether or not to proceed with a case (100 percent of national comparison; 88.9 percent of the southern group). For example, one respondent indicated that cost estimates were used to decide whether a referral would be made to an external technology transfer contractor, e.g., Research Corporation. A secondary, albeit important purpose, was cost control (80 percent of national comparison; 48.1 percent of the South). Presumably an estimate becomes a benchmark in those programs, against which actual costs are later compared. Estimates are also used to help negotiate a price with a firm (50 percent of national comparison; 18.5 percent of the South). Cost estimates are also used to select firms, although more so with the national comparison group (40 percent) than the southern sample(18.5 percent). Other miscellaneous uses of cost estimates were noted, such as their use in license negotiations and in deciding to continue prosecution of a complex or lengthy case.

Aside from obtaining cost estimates, the other side of cost management involves the review and approval of firm billings. In all institutions, national and southern, the technology manager is responsible for the primary review of bills. In a minority of cases (20 percent of national comparison; 22.2 percent of the South) billings are also reviewed by the university counsel. The technology manager also plays the predominant role in final approval authority for payment (50 percent of national comparison; 66.7 percent of the South). However, in a minority of cases, final authority is exercised elsewhere in the institutions. This includes the technology manager's supervisor (30 percent of national comparison; 11.1 percent of the South) or the university counsel (20 percent of national comparison; 7.4 percent of the South). In addition, southern institutions indicated a variety of other individuals who were responsible for final approval for payment, including the university business officer, vice presidents for research, and a foundation business manager. Perhaps this diffusion of authority reflects the less-developed nature of the technology transfer function in these institutions.

In open-ended questioning during the interviews, respondents described other practices that were used to manage costs, while maintaining program effectiveness. The most frequent suggestions were to delay filing until a licensee was found and/or to brief attorneys in advance as to institutional expectations regarding costs. In terms of internal practices, the respondents also suggested the sharpening and polishing of invention disclosures prior to submittal to counsel. Several respondents emphasized open and frequent communication between attorney and inventor, and the necessity for the technology program to carefully monitor and manage the whole relationship. Finally, some respondents mentioned the need to micro-manage cost issues, during the process of processing a case. For example, this might include keeping an "escape hatch" firm, getting comparative fee information on large and complex cases, and finding out in advance of billing when unexpected increases in costs develop.

It is interesting that most of these cost management tactics affect the margin of costs, but not the cost per

hour or the number of hours billed. Most respondents expected and received some break on hourly rates, but few expressed confidence in their ability to judge the overall fairness of costs. While most believed that they could identify excessive cost items, few felt confident that they could make subtle judgments about quality and cost tradeoffs.

Of course, the litmus test of any technology transfer process is whether the invention gets licensed, and becomes commercially successful. Two questions looked more deeply into the relationship between the quality of patenting work and its cost, and the responses were quite indicative of the ambivalence felt by our respondents.

For example, the majority of technology managers (60 percent of national comparison; 62.9 percent of the South) felt that the strength of a patent—in terms of its broad claims and novelty—was related to licensability "all of the time" or "most of the time." However, a much smaller fraction (10 percent of national comparison group; 3.7 percent of the South) of our respondents felt that the cost of a patent was related to its licensability "all of the time" or "most of the time." Summarizing, while technology managers know a good patent when they see one, they are less sanguine about the relationship between goodness and the cost pertaining thereto.

Supplementing the descriptive statistics on case and cost management practices, there were several noteworthy relationships between practices and various outcome or performance measures. These analyses were conducted with the southern sample of institutions.

In terms of patent application efficiency, indexed as the ratio of total R&D to applications filed, we found:

- Universities which ask for cost estimates prior to U.S. patent applications ($r = .39$) tended to file proportionately less patent applications.
- Universities which use cost estimates for cost control purposes ($r = .53$) tended to file proportionately less patent applications.
- Universities in which the university counsel has final approval for payment of bills ($r = .36$) tended to file proportionately less patent applications.

In terms of royalty performance, as indexed by the ratio of annual royalties to total R&D, we found:

- Universities which ask for cost estimates prior to U.S. patent applications tended to have a more favorable royalty ROI ($r = .44$).
- Universities which use cost estimates in negotiating a price with a firm tended to have a more favorable royalty ROI ($r = .54$).

In a related analysis, we also found that those programs in which the review of billings tends to be performed by officials other than the technology manager also tend to receive a smaller percentage of royalties from a single license ($r = .49$). In effect, they have a more diversified portfolio. This relationship also might imply that some technology managers do not have the autonomy to make the licensing arrangements which become the "big deals."

Considering the cost management findings as a whole, some interesting generalities emerge. It appears that careful, results-oriented decision-making at the front end of the transfer process yields benefits at the bottom line. That is, if one uses cost estimates at the onset of an engagement for cost control purposes, that may set a tone for the relationship that produces more valuable patents and better licensing deals and arrangements downstream. It may also be the case that only attorneys who are proficient in the technology arena are able to respond with reasonable cost estimates.

The more productive programs (in terms of royalty ROI) may look at spending money on patent counsel as akin to a business investment, drawing from limited funds. Front-end preoccupation with cost estimates and technical competency may reflect this business and marketing "culture". This might be contrasted with a program that emphasizes services to faculty or legalistic protection of the invention as goals in themselves. Clearly, these findings need to be fleshed out but they do provide empirical validation of some of the descriptive literature in the field.

Conclusions and Recommendations

This study served two purposes. One was to describe the input and outcome performance of southern research universities relative to the process of technology transfer, as well as to note both regional and national benchmarks. The second goal was to delve more deeply into one set of practices which presumably contribute to those performance indicators. Our conclusions and recommendations are accordingly split.

Technology Transfer Performance at Regional Research Universities

The most significant observation that can be made about the state of technology transfer across the southern universities is the great variability. Some programs rival and surpass national benchmarks of performance. On the other hand, some universities have essentially no technology transfer outputs and have programs which have been established only a few years. Southern universities could represent a much larger economic asset to the nation if they were able - as a group - to elevate their technology transfer performance to that of regional or national benchmarks.

There also seems to be a discontinuity between performance on patenting and protecting faculty inventions, and achieving bottom line transfer and commercialization outcomes. Only in a handful of programs does there appear to be a concentrated mission-specific effort to focus on downstream commercialization. Observation and informal data collected during the interviews suggest that "technology transfer" (construed as commercialization outcomes) is not high on the priority list of university or state leadership.

There is also suggestive evidence that some programs may simply be too small and/or physically isolated to easily "bootstrap" themselves into the next level of performance. Programs with one or two staff will naturally have difficulty in accelerating the pace of technology transfer at their institution without some external help.

These observations recommend some courses of action:

1. Accelerate efforts to spread best practices, tools, and methods for technology transfer throughout the region;

2. Explore state level policy incentives to a more aggressive posture on technology transfer;

3. Explore ways in which smaller or more isolated universities might act in a consortial manner to do technology transfer, both to obtain economies of scale and to elevate the level of practice;

4. Acting in a consortial manner, universities in the region should engage in other applied research projects focused on key technology transfer issues and problems.

Practices in the Use of External Patent Counsel

A summary conclusion for the use of external patent counsel might be: "Be businesslike, but be flexible". Several of the correlational findings strongly suggest that programs that use external counsel to their advantage tend to pursue that relationship with a disciplined business orientation and with downstream commercialization objectives in mind. The more productive programs tend to have more choices of counsel, use business-relevant criteria to make those choices, and do not get involved in patenting and licensing primarily as a self-validating service function for faculty.

Some relevant recommendations for universities:

1. Universities in the region can share the most useful business practices and tools that they use to manage transfer cases, as well as to manage their relationships with external counsel;

2. There can be a more systematic regional effort to build guidebooks or distilled wisdom on using external patent counsel, such as model engagement letters and standing instructions;

3. Universities in the region might host small, working conferences with a number of patent firms to share observations and to develop more effective ways of working together. These gatherings would be practice-oriented, and involve working attorneys and technology managers.

Some recommendations for intellectual property attorneys or firms:

1. Universities represent a different type of client, with goals and objectives that are often quite disparate from the corporate world. Attorneys and firms should be sensitive to these differences, and be willing to take extra time, effort, and expense to communicate with university technology mangers and inventors;

2. A successful working relationship between universities and external patent counsel seems to be based on substantive experience and demonstrated performance. When looking for new university clients, attorneys and firms should emphasize technical competence and breadth of experience, and not secondary criteria such as prior relationships or strategic location.

3. Successful commercialization of faculty invention is much more involved with business decisions than it is with legal issues. Attorneys and firms give advice concerning the strengths, weaknesses, and commercial value of inventions, not simply their patentability. In essence, firms should build a counseling relationship based on the business substance of specific research and inventions, not just on individual patent application cases;

4. Universities need procedures and models for their continuing relationships with patent counsel. Attorneys and firms can recommend procedures, including standing instructions, expectations for communications, and procedures for costing and billing.

End Notes

1. The Association of University Technology Managers, Inc. *The AUTM Licensing Survey Executive Summary and Selected Data, Fiscal Years 1991 and 1992.* October, 1993.

2. Ibid.

3. National Science Foundation. *Selected Data on Academic Science and Engineering R&D Expenditures: Fiscal Year, 1991.* NSF 92-329. Washington, D.C.: National Science Board, 1992.

4. National Science Foundation, *Science and Engineering Indicators - 1991.* Washington, D.C.: National Science Board, 1991. Appendix Table 5-29, p. 397.

5. Stevens, A. "Economic Impact of Academic Technology Transfer." In Association of University Technology Managers, *Newsletter,* September, 1993.

6. For those who are not statistically inclined, the correlation is used to describe the degree of relation between variables. As usually expressed via the Pearson correlation coefficient (*r*) it can range in absolute value from 0.0 to 1.0 with the former indicating no relationship and the latter a perfect relation. Since correlations can be either positive or negative, the effective range is -1 to +1. In the realm of the social sciences (as in this project), values closer to zero are more common.

7. Frequency data for this question, and for the ones reported in the next two paragraphs, was confined in the southern sample to responding institutions with two or more firms.

8. Sandelin, J. "Successful Licensing of Research Results". *Les Nouvelles*, Vol. 28, No. 3, pp. 127-129, September, 1993.

APPENDIX A

Participating institutions

The South

Auburn University
Clemson University
Duke University
Emory University
Florida State University
Georgia Institute of Technology
Medical University of South Carolina
Mississippi State University
North Carolina State University
Tulane University
University of Alabama-Birmingham
University of Alabama-Huntsville
University of Central Florida
University of Florida
University of Georgia
University of Kentucky
University of Miami
University of North Carolina-Chapel Hill
University of North Carolina-Charlotte
University of South Carolina
University of South Florida
University of Tennessee
University of Virginia
Vanderbilt University
Virginia Commonwealth University
Virginia Polytechnic Institute and State University
Wake Forest University

Other Regions

Colorado State University
Lehigh University
Oregon State University
Pennsylvania State University
Purdue University
University of California-Los Angeles
University of Maryland-Baltimore
University of Texas Southwestern Medical Center at Dallas
University of Washington
Washington University at St. Louis

The Southern Technology Council

The Southern Technology Council (STC), formed in 1986, is a division of the Southern Growth Policies Board which seeks to strengthen the Southern economy through the more effective development, commercialization, and deployment of technology.

The STC fosters cooperative initiatives among regional science and technology organizations in industry, government, and education, and functions as a forum for information and recommendations about best practices, strategies, policies, and programs. Its key areas of concern are industrial modernization and extension; R&D infrastructure and technology transfer; new enterprise development; and work force development

Mississippi Governor Kirk Fordice is the Council's current Chairman. Among its members, the Council includes representatives from 14 Southern states, regional corporations, and non-profit organizations, and the Southern Legislative Conference. While the STC is headquartered with the Southern Growth Policies Board in North Carolina's renowned Research Triangle Park, the Council's funding and activities are distinct from the Board.

For more information, please contact STC at (919) 941-5145. FAX (919) 941-5594.

The Southern Growth Policies Board

Created by the region's governors in 1971, the Southern Growth Policies Board is charged with creating strategies for economic development that address the diverse, interrelated factors that affect the South's economic base. The Board strives to complement traditional approaches to economic development with innovative strategies to strengthen the communities of our region.

Thirteen Southern states participate in and support the work of the Board - Alabama Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Virginia, and West Virginia. Puerto Rico is also a participant

Each of these states or territory has five members on the Board: the governor, a state senator and a representative, and two citizens appointed by the governor. Georgia Governor Zell Miller is the Board's current Chairman. This coalition of gubernatorial, legislative, and private sector leadership gives the Board a unique ability to create and disseminate successful development strategies in today's complex and interdependent world. In addition, an Associate Membership Program directly involves major Southern corporations, universities, local development districts, and other organizations in the work of the Board.

For more information, please write to the Southern Growth Policies Board, P.O. Box 12293, Research Triangle Park, NC, 27709, or telephone (919) 941-5145.