Pathways to National Economic Benefits from ATP-Funded Technologies

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Abstract

An important component of the Advanced Technology Program's (ATP) economic evaluation plan for tracking project progress and outcomes is the administration of an electronic survey on a regular basis to participants in all projects funded since 1993. Progress of projects is compared against business plans and projected economic benefit goals outlined in their proposals. The resulting Business Reporting System (BRS) database is used for ATP project management and for evaluation research. Based on BRS data compiled through December 31, 1996, filed by 480 companies in 210 projects, funded in 19 competitions, this paper provides an overview of pathways to achieving targeted commercial and broader economic goals. Progress reports for the group of projects provide a variety of evidence of (a) opportunities for economic spillovers and national economic benefit and (b) activities supporting technology diffusion.

The ATP's Business Reporting System: A Tool for Economic Evaluation

The use of comprehensive surveys of ATP projects and participants has been a central component of ATP program evaluation from the beginning. In the early years of the program, the ATP relied on third-party surveys of projects to determine their progress. In early 1994, the ATP implemented the Business Reporting System (BRS), a comprehensive data collection tool for tracking, on a routine and regular basis, progress of projects against business plans and projected economic benefits outlined in the project proposals and updated over the course of the projects. The survey system, electronically administered, has been implemented for projects selected in 1993 and since, from their inception. To ensure maximum confidentiality of information and detail concerning the multiple commercialization activities of joint venture members, data is collected at the individual participant level (directly from individual companies, universities, and not-for-profit organizations) within a project.

The survey information collected through the BRS comprises part of the integrated ATP database framework. It is used for ATP project management, as well as for performing evaluation research. Over time, the data is expected to support comprehensive analyses of the behavior of firms conducting R&D and developing new technologies, of their business progress, and of resulting economic benefits.

The Business Reporting System consists of five major parts:

- *A Baseline Report*. At the beginning of the project, in the Baseline Report, companies identify areas of anticipated applications of the technology being developed with ATP funding. They identify quantitative business goals, including cost and/or performance targets; key attributes of the technology needed to achieve these goals; planned strategies for commercialization; e.g., in-house production, licensing, and strategic alliances. They outline their strategies for protecting intellectual property; and identify their plans for disseminating non-proprietary information.
- *Anniversary Reports*. Annually, in the Anniversary Report, companies expand upon the baseline information to identify new applications of the technology and to cover progress towards implementing commercialization strategies. They report on new intellectual property created, early business developments, collaboration experiences, attraction of new funding, new intellectual property created, and dissemination of information through conferences, publications, and other mechanisms. They also provide a summary of company financial data.
- *Closeout Report*. At the project conclusion, in the Closeout Report, companies update Anniversary Report information and identify remaining technical and business barriers to commercialization of the technology, define specific business goals for the following five-year period, and indicate expected future effects of the ATP project outside that organization.
- *Post-project Reports*. Following the end of ATP funding, companies report three times—once every two years—concerning actual progress in commercializing the technology and impacts inside and outside the organization attributable to the technology.

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- *Quarterly Reports*. At the end of each quarter, other than the initial and anniversary quarters, companies report the most significant business developments (if any) related to the ATP projects.

Companies funded in FY 1993 and later are required to submit these reports under the terms and conditions of their ATP awards. Under ATP's agreements with project participants, all information reported through the BRS is considered proprietary and confidential. Information is released and published only in aggregate, summary statistical form. Any quoted material is presented without attribution. Nothing is released on an individual company or project basis unless the company explicitly agrees to the disclosure or the same information is publicly available such as through company press releases or Internet sites.

The BRS supports three objectives: (a) to track business progress against company plans for achieving commercialization and broad-based economic impacts; (b) to develop short-term statistical indicators of results; and (c) to build a database to support long-term evaluation of ATP's economic impact.

This paper provides a snapshot of pathways to achieving impact of projects funded in competitions held from 1993 through 1995. It draws on the BRS to capture plans for commercialization and diffusion of ATP-funded technologies resulting from 210 projects as reported by 480 separate organizations funded during FY 1993–1995. The information is based on business reports filed through December 31, 1996. The 210 projects are a subset of 352 projects funded by the ATP from 1990 through 1997. Not included are 72 projects funded in FY 1996 and 1997 because they had not yet begun reporting at the time the data were analyzed, the 60 projects funded between 1990 and 1992 because they were funded prior to implementation of the BRS, and nine projects that would have been in the BRS but were cancelled.

Data Show Opportunities for Economic Benefits

Of the subset of 480 organizations in 210 projects, 375 companies in 208 projects have reported plans for commercializing one or more applications of the ATP-funded technologies. Not surprisingly, most universities, non-profits, and government laboratories have not provided plans for commercialization, but they have reported plans for dissemination of non-proprietary information concerning technology developed with ATP funds. These plans of businesses for commercialization and of non-profits for knowledge dissemination are important because they point out two different kinds of pathways by which the technologies will have future economic impact: (1) directly through products and processes introduced in the marketplace by the innovators, and (2) indirectly through the knowledge created by the innovator and disseminated to others.

Development of Enabling Technologies

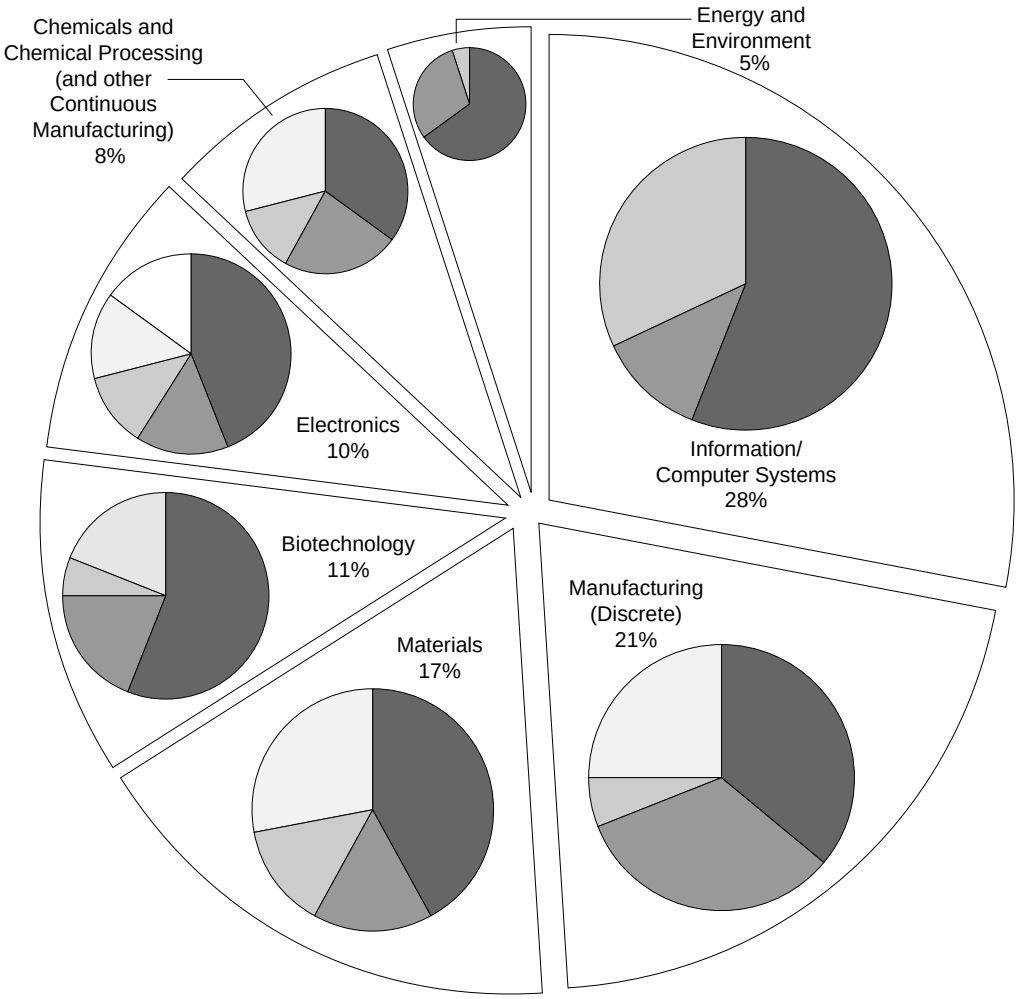
The ATP funds technology development projects, on a cost-sharing basis with industry, through both General Competitions, open to all technology areas, and Focused Competitions, targeted to specified technologies and specified goals. Many projects and entire Focused Programs, consisting of sets of related projects, involve an interdisciplinary mix of science and technology fields. The ATP uses its own 5-digit, hierarchical technology classification system to identify technology areas under development by different organizations and projects. Individual companies self select primary and secondary codes which best describe their areas of R&D.

Figure 1 summarizes the technologies according to their first and second level code assignments. More than one-fourth of the technology development projects directly involve Information Technology/Computer Systems, either hardware or software. Discrete manufacturing and materials comprise major parts of the remainder. These three areas of concentration reflect the fact that seven of the 12 ATP Focused Program areas funded in FY 1993–1995 involve substantial information technology and/or materials processing and manufacturing technology. (This distribution differs somewhat from other technology classifications published by the ATP because the distribution shown in Figure 1 (a) reflects only the projects funded in FY 1993–1995; (b) reflects R&D activity at the organization level for joint ventures, whereas, other ATP classifications are at the project level (i.e., organizations in a given joint venture project do not necessarily work in the same technology area); and (c) is based purely on the number of organizations working in a given technology area, not on the relative amount of funding to the technology area.)

Further analysis of projects funded in these broad technology areas begins to capture the interdisciplinary nature of the work. For example, the second-tier analysis in Figure 1 shows that six percent of the work in Manufacturing (Discrete) involves "intelligent" manufacturing; 12 percent of the work in Information/Computer Systems is hardware. A third-tier analysis (not presented) would show that computer hardware has a strong electronics component. Digital data storage is one example. This next level of analysis also would reveal the overlapping of projects across disciplines and the difficulty of classifying them. For instance, some computer systems components and related manufacturing technologies are assigned to the Electronics category; e.g., Displays and Semiconductors and Microelectronic Fabrication technology.

Identification of Business Opportunities

Nearly 400 project participants have identified more than 1,000 applications of the technologies under development and provided commercialization plans for nearly 800



Source: Business Progress Reports from 404 organizations in 208 projects funded 1993-1995

LEGEND for Breakdown of Technology Areas

Information/Computer Systems

- Computer Software, **56%**
- Computer Hardware, **12%**
- Other/Not Specified, **32%**

Manufacturing (Discrete)

- Automobile Manufacturing, **36%**
- Machine Tools, **33%**
- Intelligent Manufacturing, **6%**
- Other/Not Specified, **25%**

Materials

- Composites, **42%**
- Coatings, **16%**
- Metals and Alloys, **14%**
- Other/Not Specified, **28%**

Biotechnology

- Human Diagnostic Biotechnology, **56%**
- Human Therapeutics, **19%**
- Biomolecular and Biomimetic Materials, **6%**
- Other/Not Specified, **19%**

Electronics

- Displays, **44%**
- Electronic Instrumentation/Sensors and Control Systems, **15%**
- Optics and Photonics, **12%**
- Semiconductors and Microelectronic Fabrication Technology, **14%**
- Other/Not Specified, **15%**

Energy and Environment

- Energy Distribution/ Conservation, **65%**
- Energy Resources/ Generation, **30%**
- Other/Not specified, **5%**

Chemicals and Chemical Processing (and other Continuous Manufacturing)

- Catalysis/Biocatalysis, **35%**
- Separation Technology, **23%**
- Process Control, **13%**
- Other/Not Specified, **29%**

Figure 1. Technologies under development

applications spanning the spectrum of SIC industries. Figure 2 illustrates the diverse application areas of the enabling technologies funded in the Materials area. A detailed examination of individual reports reveals more explicitly the diverse linkages. For example, company reports for one project involving metal and alloy technology reveal planned applications in electrical power generation (SIC 49), chemical processing (SIC 28), and pulp and paper machinery and bearings (SIC 35). A single-company project involving coatings reports applications in seals (SIC 30), industrial machinery for printing rolls, pump components, bearings, and power transmission and computer displays (SIC 35), and sensors (SIC 38).

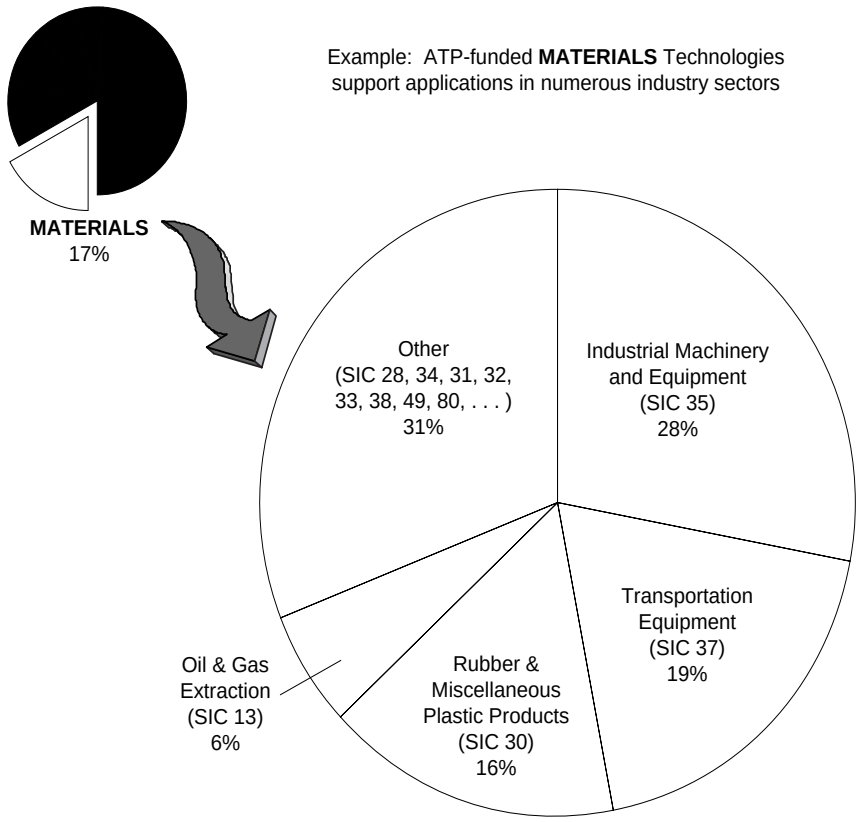
Commercialization occurs through eventual embodiment of the ATP-funded technology in a product, service, manufacturing process, or in some combination of these. Figure 3 summarizes the percentages that are expected to occur in each form. This figure suggests that most commercial deployment of ATP technologies will occur through manufactured products, with the focus on new, as compared with improved, products, processes or services. Responses to a follow-up question further indicate that for 35 percent of the applications, companies envision their application to be a "new-to-the world" solution to a market need or problem. Such applications represent opportunities to create totally new markets.

As shown in Figure 4, many companies envision that products and processes embodying the ATP-funded technology will be used in multiple stages of production extending from Raw Materials Production to End User. Sixty-three percent of the technology applications involve relatively early-stage Components Manufacturing.

The entry of the ATP technology into an early stage of the production cycle, in combination with the diversity of applications expected to result from individual projects and technologies, increases the opportunity for downstream customers/users to experience market spillovers (consumer surplus). This is, of course, especially true where an ATP-funded technology has significant cost or performance advantages over existing/defender technologies.

Business Goals

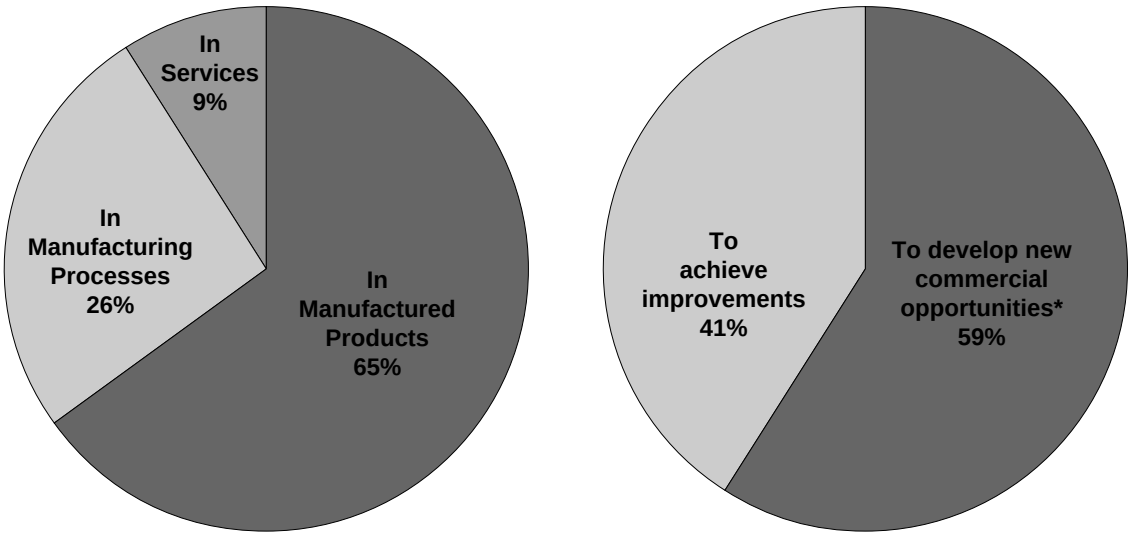
In the Baseline Reports, companies are asked to categorize, define, and quantify their business goals for the ATP-funded R&D projects. As shown in Figure 5, performance improvements appear to be a somewhat more commonly expected and significant goal than cost reduction.



Note: "Other" SIC catagories are defined in Appendix G.

Source: Business Progress Reports for 778 applications being pursued by 375 companies in 207 ATP projects funded 1993-1995.

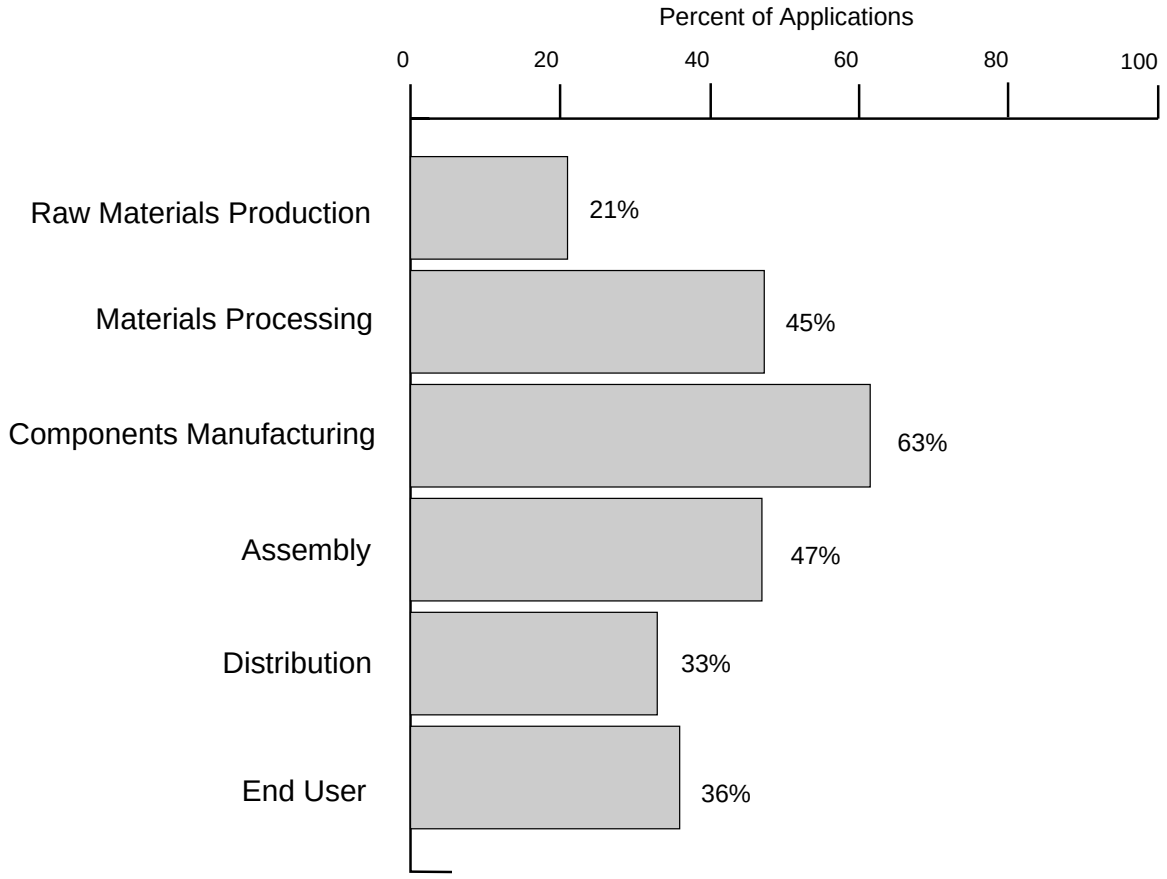
Figure 2. Plans for diverse applications of ATP-funded technologies



Note: *In response to a follow-up question (not depicted), project participants indicated that 35% of applications represent "New-to-the-world" solutions to a market need or problem.

Source: Business Progress Reports for 778 applications being pursued by 375 companies in 207 ATP projects funded 1993-1995.

Figure 3. Types of commercialization expected



Note: Most companies plan to address more than one stage of production; many plan to address more than two.

Source: Business Progress Reports for 778 applications being pursued by 375 companies in 207 ATP projects funded 1993-1995.

Figure 4. Stages of production in which the ATP-funded technologies are expected to be used

For 29 percent of applications, a performance improvement in the range of 100–500 percent or more is anticipated. For 28 percent of applications, a cost reduction of 25 percent or more is expected. Improvements of these magnitudes, particularly when combined with the emphasis on "new" products or lines of business, are consistent with definitions of "discontinuous" or "breakthrough" innovations used in the joint Rensselaer Radical Innovation Research—Industrial Research Institute Project funded by the Sloan Foundation (Leifer 1997). (Of course, for some projects, even a small per unit cost reduction or performance improvement can represent a significant achievement and important competitive advantage when measured across a large production volume.) Other data show that one-third of applications are expected to involve some combination of cost reduction and performance improvement over existing technologies.

Table 1 illustrates with a list of quantitative examples how ATP funding is expected to affect the technological capabilities of companies as measured by expected changes in the attribute identified as most critical to commercialization for a specific application. Quantification of cost and performance advantages of the ATP-funded technology, such as provided by this business goals analysis, is useful in tracking project progress as well as assessing business opportunities and estimating the potential magnitude of economic spillovers. Both "with" and "without ATP" goals are needed to assess the potential for ATP funding to make a difference relative to what would have occurred without government funding. An *ex ante* comparison of baseline values with project goals for key technology parameters/attributes helps to identify the anticipated degree of technological advancement and to assess the expected impact of the project. An *ex post* comparison of progress made against cost/performance targets will make it possible to assess the level of actual technical accomplishments within a business and economic context.

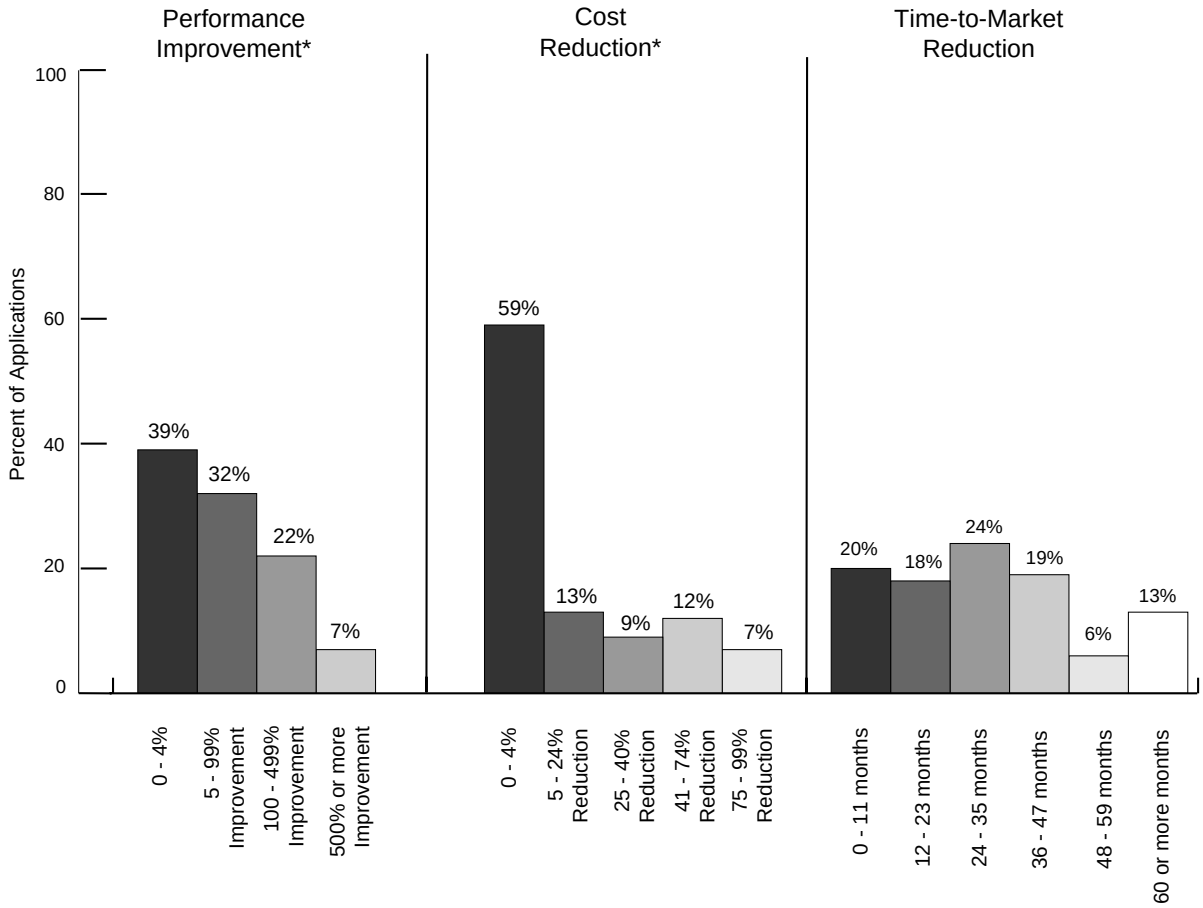
Acceleration of R&D is another commonly cited business goal of ATP projects. As shown in Figure 5, nearly all the companies expect some reduction in the time it will take to complete the R&D phase and bring their products to market/or implement new production processes as a result of ATP funding. A reduction of at least two years is anticipated for 62 percent of applications; with a reduction of four or more years expected for 19 percent of applications and a reduction of two to nearly four years expected for 43 percent of applications.

The importance of the acceleration aspect of ATP

Table 1. Examples of effect of ATP funding on company goals for the technology

Baseline	Goal with ATP Funding	Goal without ATP Funding
1 kw/$10,000	10 kw/$10,000	3 kw/$10,000
60 microseconds process speed	10 microseconds process speed	60 microseconds process speed
$100 cost	$25 cost	$100 cost
3,300 hours lifetime	10,000 hours lifetime	5,000 hours lifetime
2,500 cars/day	2,875 cars/day	2,500 cars/day
34 trains/day	51 trains/day	34 trains/day
1,000 CPU time	10 CPU time	100 CPU time
60 degrees C	100 degrees C	60 degrees C
800 nm	200 nm	800 nm
$60,000 per unit	$1,000 per unit	$10,000 per unit
1 test/day	5 tests/day	1 test/day
40 bases/minute	2,000 bases/minute	533 bases/minute
$500/medical test	$50/medical test	$500/medical test
1 gene/day sequencing	100 genes/day sequencing	5 genes/day sequencing
3.9 gigabytes data storage	60 gigabytes data storage	4.7 gigabytes data storage
$62/gigabyte	$1/gigabyte	$25/gigabyte

Source: Business Progress Reports for 778 applications being pursued by 375 companies in 207 ATP projects funded 1993-1995.



Note: *In a response to a different question, project participants indicate that one-third of applications involve some combination of cost reduction and performance improvement over existing products, processes, and services.

Source: Business Progress Reports for 778 applications being pursued by 375 companies in 207 ATP projects funded 1993-1995.

Figure 5. Quantitative business goals

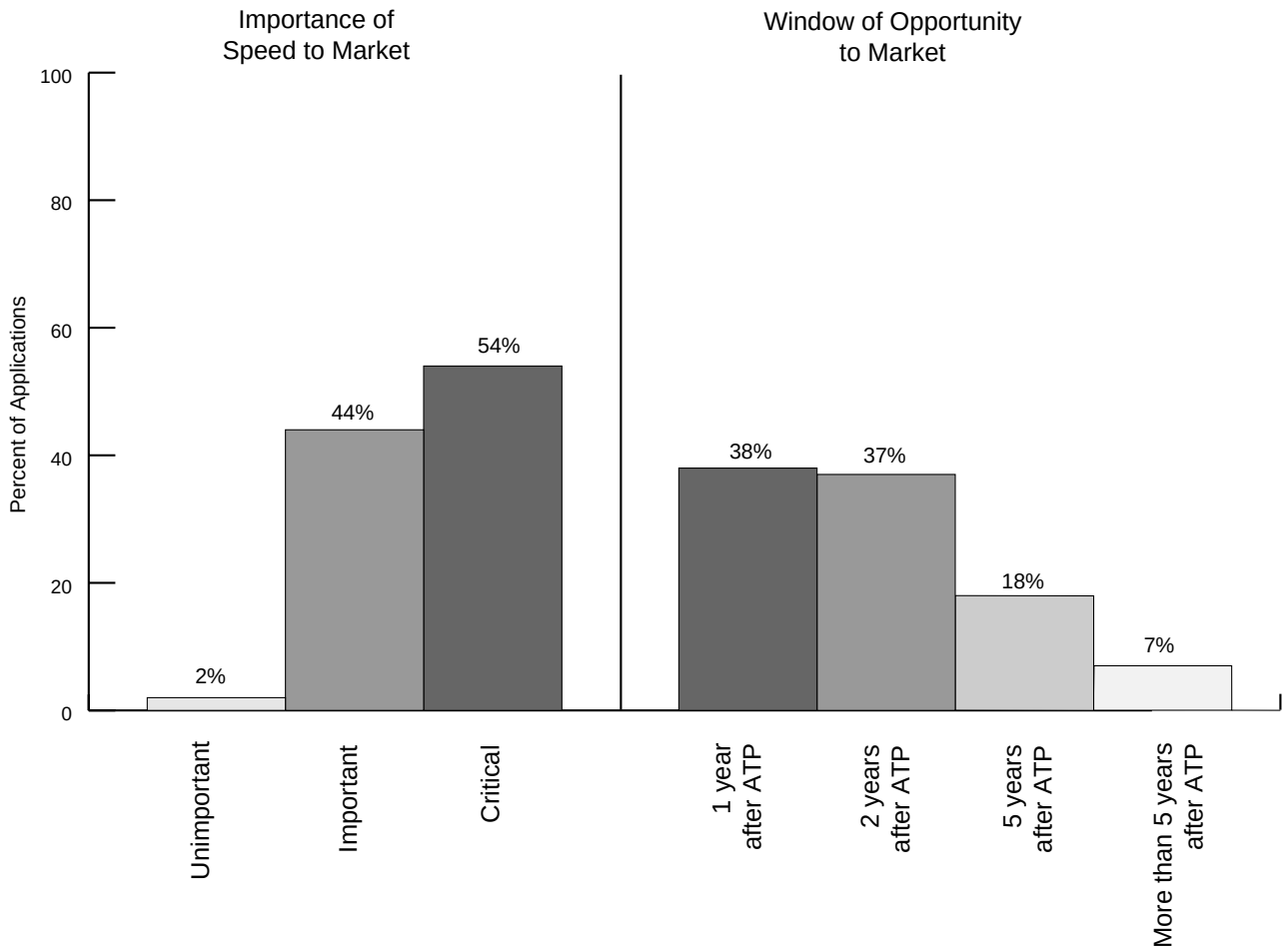
funding is reflected in Figure 6. For 98 percent of applications, speed-to-market is considered "important" or "critical;" it is considered "critical" for more than half the applications. Further emphasizing the importance of acceleration, the window of opportunity for 75 percent of the applications to enter the marketplace is considered to be within two years after ATP funding ends; i.e., it appears that companies believe they would miss the opportunity, or a significant part of it, without the acceleration enabled by ATP funding.

The following are some additional business goals cited in company business reports:

"Achieve broad adoption . . ."
"Be #1 supplier of . . . technology"
"Expand applications into . . . industry"
"Obtain a licensee by end of ATP"
"Become global expert in . . . technology"
"Diffuse technology to cover 5 technology niches"
"Increase market share by . . ."
"Be recognized as leading vendor of . . ."

Identification of Commercialization Strategies

As their primary means of commercialization, most ATP-funded companies plan to achieve commercialization for at least one application through production of a product or service in-house, in their own existing or planned facilities. As shown in Figure 7, in-house production is the focus for 65 percent of applications. For 24 percent of applications, licensing to others is the primary strategy; for 43 percent of applications, licensing is the primary or secondary means of commercialization. For 79 percent of applications, including some of those where in-house production is the primary means, licensing to others is a possible supplementary means, if not the primary focus. Thus companies recognize the opportunity to increase their revenues beyond what their internal production facilities can support. At the same time their actions increase opportunities for diffusion of the technology to other firms and potentially other applications and industries. Jaffe (1996) confirms that the potential for licensing the technology to others is a factor that makes economic spillovers relatively



Source: Business Progress Reports for 778 applications being pursued by 375 companies in 207 ATP projects funded 1993-1995.

Figure 6. Importance of market timing

more likely.

Close supplier-customer linkages are important to successful technological innovation. Among the work that addresses this issue, von Hippel (1994) suggests that such linkages can increase the productivity of the innovation through more efficient communication of technological and market information. Given the large number of small companies involved in the projects, and the rather early stages of production they address, one would expect a large number to pursue strategic alliances for commercialization. From Figure 8 one might think the companies are not relying heavily on strategic alliances with customers, suppliers, partners in joint production, or distributors for commercialization. But further analysis at the company level reveals that (a) 91 percent of companies plan at least one of these types of alliances and (b) at least one of these types of alliances is planned in pursuing 88 percent of applications (graph not presented). As one might anticipate, the subset of reports from small businesses reveals that strategic alliances to pursue commercialization are more important for small businesses than for larger ones. Small businesses plan alliances with customers as a primary strategy for 31 percent of applications and as a primary or secondary strategy for 54 percent of applications (compared with 25 and 41 percent respectively for all respondents); small businesses plan alliances for joint production as a primary strategy for 21 percent of applications and as a primary or secondary strategy for 47 percent of applications (compared with 17 and 32 percent respectively for all respondents); small businesses plan alliances with distributors as a primary strategy for 22 percent of applications and as a primary or secondary strategy for 38 percent of applications (compared with 15 percent and 27 percent respectively for all respondents).

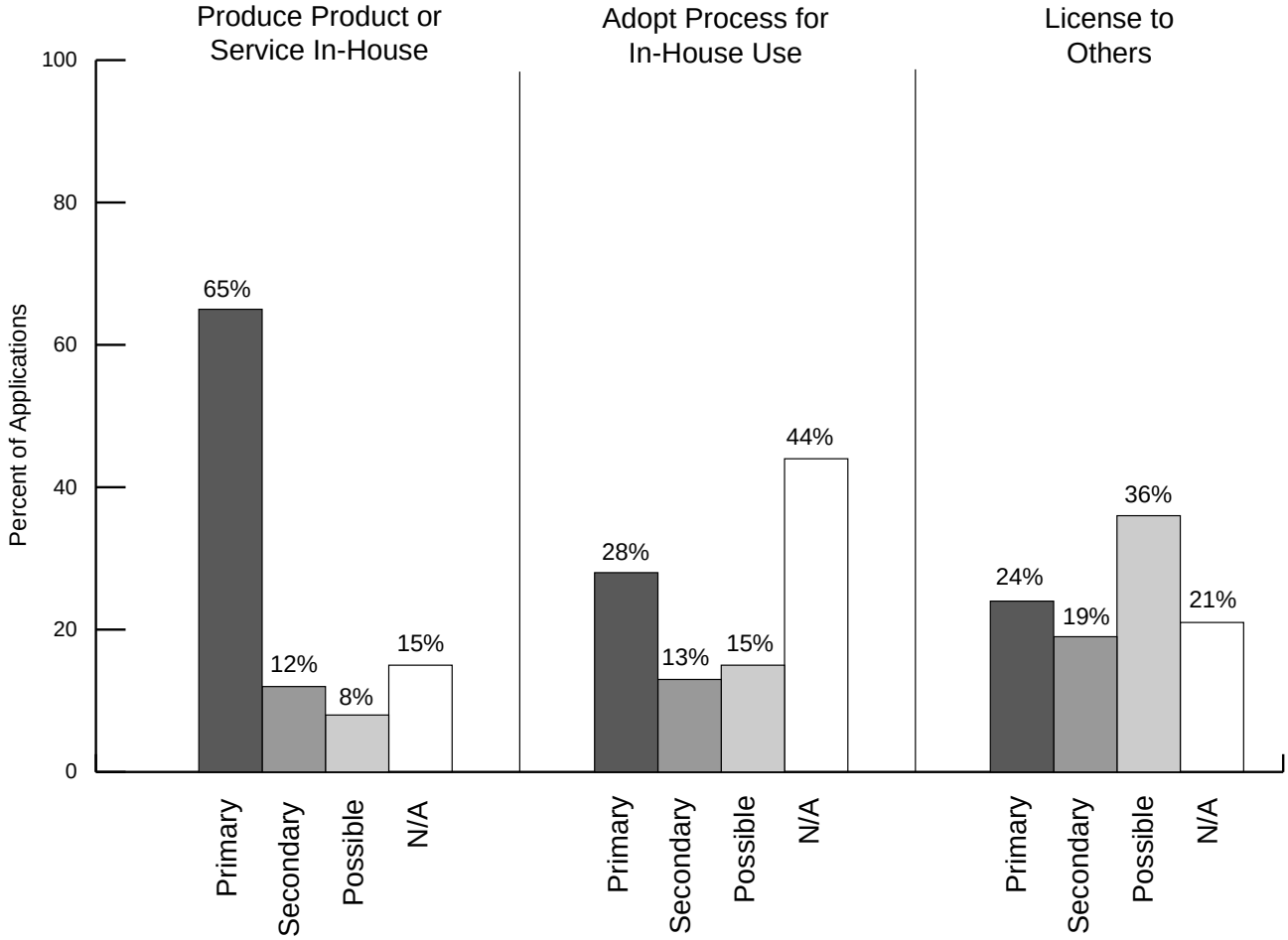
Protection and Disclosure of Intellectual Property

Protection of intellectual property through formal patent and copyright mechanisms provides legal protection against use of an invention without permission or compensation. The patent or copyright thus converts the intellectual property into a potential income-earning asset, and, for many applications and industries, is critical to the ability of

the innovator to commercialize a new technology. In return for patent protection, however, the innovator must agree to public disclosure of the patented invention and (to a lesser extent) copyrighted material. Disclosure provides a means of attracting commercial partners interested in licensing or joint production opportunities, and thus reinforces the private commercial purposes of the intellectual property protection; however, it also is a mechanism for unintended knowledge spillovers—to competitors or others who may be in a position to exploit the knowledge without paying for it. (See Jaffe 1996.)

Both aspects of patent and copyright protection are important to achieving maximum commercialization, diffusion, and social benefit of the ATP-funded technologies: Patent and copyright protection afford ATP-funded firms the necessary incentives to undertake costs of product development and marketing needed to launch a commercial product, and may help open new licensing and other partnering opportunities. The wider the commercial use of the technology and the greater the spread of information concerning resulting products and processes, the greater the opportunity for market spillovers to users and customers and for knowledge spillovers to others in a position to make use of the knowledge for their purposes.

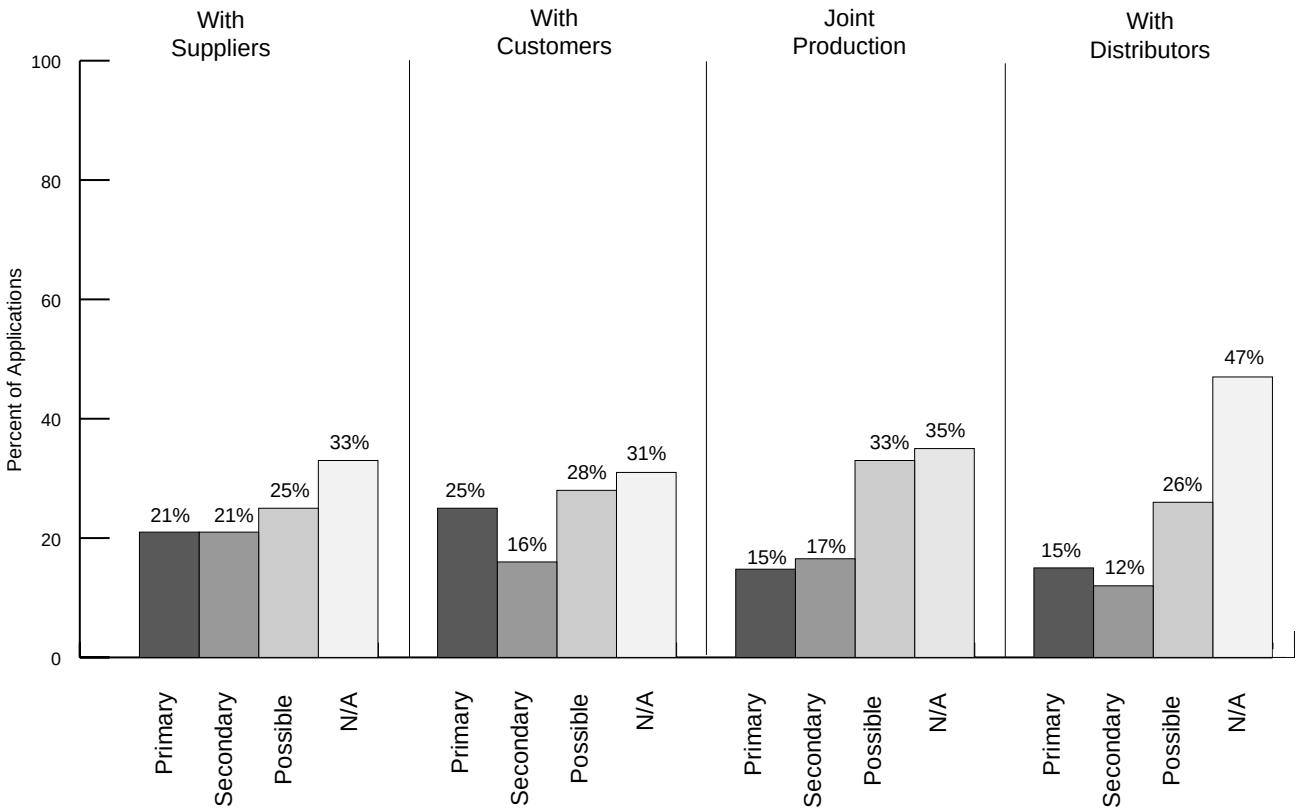
Most companies report plans to protect intellectual property created in their ATP project, whether they plan to produce in-house or to license the technology to others. As shown in Figure 9, patent protection, copyright protection, and maintenance of trade secrets are listed respectively as primary strategies by 61 percent, 27 percent, and 51 percent of companies. A more detailed analysis (not shown) indicates that ten percent of the companies listed all three strategies as primary; 15 percent listed both patents and copyrights as primary; and 25 percent listed both patents and trade secrets as primary strategies. Thus some combination of legal protection and secrecy/first mover advantages appears to be a common strategy. Of course, to the extent that companies patent their technology they cannot expect to maintain secret the same knowledge; but companies may identify some aspects of their technology best



Note: Some companies reported more than one strategy as "Primary."

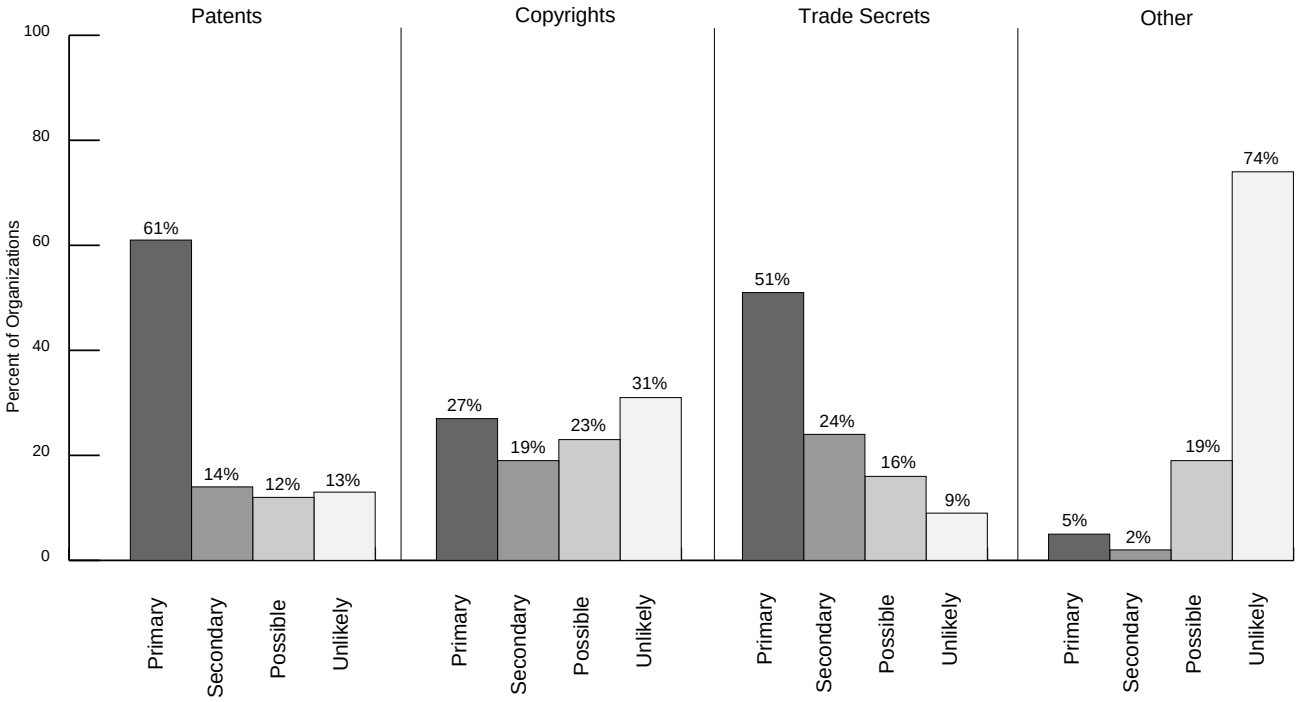
Source: Business Progress Reports for 778 applications being pursued by 375 companies in 207 ATP projects funded in 1993-1995.

Figure 7. Strategies for commercializing ATP-funded technologies



Source: Business Progress Reports for 778 applications being pursued by 375 companies in 207 ATP projects funded 1993-1995.

Figure 2. Plans for diverse applications of ATP-funded technologies



Source: Business Progress Reports from 480 organizations funded 1993-1995.

Figure 9. Intellectual property strategies planned

protected by patent and other aspects best protected by secret, and thus combine the two strategies.

Organizations receiving ATP awards in the FY 1993–1995 competitions report that the ATP-funded technologies build on, and intellectual property rights are protected by, nearly 2,000 preexisting patents. Companies seeking title to new intellectual property created with ATP funding have reported to NIST 105 new patents filed and 7 copyrights filed; and 11 patents have been issued. Often initial patents predate the ATP project, and the ATP project focuses on bringing the technology beyond a rough concept.

Dissemination of Non-Proprietary Information

Published papers, conference participation, news articles, press releases, and Internet sites provide additional dissemination of information about ATP-funded technologies. Although some companies are more active than others in dissemination, many are very active in publishing papers, issuing press releases, and making public presentations concerning their R&D activities. Universities and other research organizations, with agreement from the for-profit companies holding title to ATP-funded intellectual property, have also been active in disseminating non-proprietary information about their ATP-funded technology development. Table 2 provides a summary of the activity through December 1996 in published professional journal articles and conference papers alone.

According to the BRS data, more than half the projects covered in this study have produced published conference papers, and approximately one-fourth have produced published articles in professional journals. On average, about 1.8 conference papers have been presented and 0.6 professional journal articles published per project.

Conclusions, Related Work, and Future Directions

Findings are that opportunities for economic spillovers from the portfolio of projects in the BRS appear strong, and for the most part consistent with the original peer-review proposal assessments. Project participants have identified more than 1,000 applications of the technologies under development and provided commercialization plans for nearly 800 applications spanning the spectrum of SIC industries. Most applications involve new products with significant performance improvements over existing/defender technologies, offering dramatic possibilities for productivity improvements. Many are "new-to-the-world-products" aimed at brand new markets. Most companies seek to address stages of production relatively early in the production chain, for example, materials processing or component manufacture, creating maximum opportunity for intermediate producers/customers at multiple later stages, and even in multiple application areas, to experience market spillovers.

Opportunities for additional economic spillovers through technology diffusion are being enhanced by patent and licensing activity and dissemination of non-proprietary information. Licensing to others is a primary or secondary strategy for commercializing a large percentage of planned applications, and conference activity and publication of papers have been vigorous.

This paper is based on part of a more comprehensive study that addressed a number of indicators of progress of ATP-funded projects (Powell 1997a). Findings from the 1997 report are largely consistent with the findings of two third-party surveys of projects not in the BRS. Silber & Associates (1996) surveyed projects funded from 1990 through 1992 after approximately two-to-three years of funding. Solomon Associates (1993) surveyed ATP's first competition awardees after just one year of funding. The BRS captures much greater detail than the third-party telephone surveys, explicitly covering the evolution of a myriad of applications. And, of course, the BRS captures the voices of awardees directly without a third party intervening. Although specific summary statistics differ somewhat, analyses of BRS data generally confirm earlier survey results that ATP awards are "enabling [industry] to afford and engage in high risk research," "stimulating collaboration and formation of strategic alliances," "shortening the R&D cycle," "helping attract additional funding," and "creating new business opportunities," among

Table 2. Dissemination of non-proprietary information from ATP-funded projects

	Papers in Professional Journals	Papers Presented at Conferences
Total Number of Papers	131	372
Number of Organizations Reporting Papers	54	154
Number of Projects Reporting Papers	47	110

Note: Across the 208 projects reporting, an average of 0.6 professional journal articles were published and 1.8 conferences papers presented per project. Thirty-six percent of the projects produced at least one professional journal article; 53 percent of the projects produced at least one conference paper.

Source: Business Progress Reports from 210 ATP projects funded 1993-1995.

the many other effects reported by those earlier studies.

Results of the current study are also consistent with and confirmatory of preliminary results given in a recently published conference paper which analyzed data for ATP projects funded in 1993–1995, but with only the 1993 projects (41 companies reporting) having completed at least one year of ATP funding (Powell 1997b).

A study currently underway, using more recent data, features ATP-funded small firms (with fewer than 500 employees) in comparison with all organizations receiving awards in the period 1993 through 1996 (Powell 1998). The study identifies a number of general issues and "strategies for success" for small firms cited in the literature, and it examines the experience of ATP-funded small firms in employing such strategies and considers effects of ATP funding. Findings of the study of a broad array of characteristics and experience of small firms are that small firms are undertaking challenging R&D and pursuing aggressive commercialization goals for a large number of commercial applications, with plans to license for a substantial portion. They seem to be using federal financing to leverage internal company funding, to expand the level, scope, and challenge of their R&D efforts, and to accelerate the R&D process. They are actively engaging in collaboration to achieve their R&D and commercialization goals. They are progressing in early commercialization activities at a pace at least equivalent to the portfolio of all organizations. Together, these characteristics and signs of progress appear to indicate that ATP-funded small firms are pursuing necessary "strategies for success."

Evaluation of the long-run impact of the portfolio of ATP-funded technologies lies in the future. Most of the projects are still at a relatively early stage. Only about 15 percent of the projects covered in the BRS database had been completed at the time data was collected for this paper. Many of the technologies will require considerable additional development and, in the case of medical technologies, undergo FDA regulatory approval before commercialization. The full economic impacts across diverse applications and industries will typically unfold over a number of years—likely a decade or more after the initial ATP-funded research.

As the BRS grows, new types of analyses become feasible. The small-firm study described above represents ATP's first effort to use BRS data to investigate a subset of ATP participants. Future work will (1) extend the BRS to post-ATP project data collection, (2) analyze other ATP subgroups, and (3) use the BRS in conjunction with other data sources to support a variety of evaluation studies, including case studies and econometric analyses.

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