

Advanced Technology Program Information Infrastructure for Healthcare Focused Program

Richard N. Spivack¹

*Economist, Economic Assessment Office of the Advanced Technology Program,
National Institute of Standards and Technology, US Department of Commerce*

Abstract

This paper describes an initiative begun by the Advanced Technology Program² in 1994 referred to as the Information Infrastructure for Healthcare (IIH) focused program. The IIH focus program began with an initial exchange of ideas among members of the private and public sectors (industry's submission of "white papers"³; workshops conducted by the ATP; meetings held between individuals from both groups) to identify those technologies necessary for the development of a national information infrastructure in healthcare. A discussion of the development of the focus program through a "white paper" process notes differences that existed between what the ATP had hoped to gain through this method and how the private sector responded. A statistical description of the participants as well as a brief discussion of the ATP review and selection process is included.

1. Introduction

The Advanced Technology Program (ATP) at the National Institute of Standards and Technology (NIST) is a cost-sharing program designed to partner the federal government with the private sector to further both the development and dissemination of "high-risk"⁴ technologies which offer the potential for significant, broad-based economic benefits for the nation. In this program, industry proposes research projects to the ATP to be judged in competitions for funding based upon both the technical and economic/business merits of the proposal. From 1990 through 2000, the ATP held "General/Open" competitions each year open to all technologies.

¹ Richard N. Spivack is an economist in the Economic Assessment Office of the ATP.

² The ATP statute originated in the Omnibus Trade and Competitiveness Act of 1988 (Pub. L. 100-418, 15 U.S.C. 278n) and was amended by the American Technology Preeminence Act of 1991 (Pub. L. 102-245)

³ A mechanism by which industry conceptualizes the problems it is having difficulty addressing, including the kinds of technological barriers that must be overcome

⁴ High risk technologies are defined as technical challenges "that should result in a dramatic change in the future direction of technology. Risk may be high in developing single innovations, integrating technologies, or both." *ATP Proposal Preparation Kit*, U.S. Department of Commerce, NIST, November 1999, p. 29.

From 1994 through 1998, the ATP awarded most of its funding through “focused-program”⁵ competitions in which a suite of projects was funded to mobilize technology to address a particular problem. Thirty focused program competitions were held, each with a unifying set of project goals. The following is a synopsis of one of these programs, the Information Infrastructure for Healthcare focused program (IIH) which conducted three solicitations in 1994, 1995, and 1997.

The IIH focused program was initiated in 1994 amid a nationwide discussion of the rising costs of healthcare and the quality of care offered. The objective of the ATP IIH focus program was to develop the information infrastructure technologies needed to cut dramatically the 20% of the United States’ \$1 trillion healthcare cost spent on paperwork, and to improve the quality and flexible delivery of care by faster broad access to better information. ATP awards for research made possible new technological capabilities in firms, allowing them to introduce advanced functionalities into their existing IIH products and to introduce new products. These awards allowed the smallest firms to extend their limited resources and gave them additional ability to overcome research barriers impeding the attraction of private venture capital funding. It encouraged large companies to pursue enabling, high-risk research and development in a time of tight discretionary budgets.

2. ATP and Focused Programs

In response to the ATP’s initial request for white papers leading to the development of focused programs, close to one thousand papers covering a range of technologies were submitted and sorted by a technology taxonomy. A subset of this total addressed healthcare issues providing both the scope and technical detail required. Papers were submitted by companies, individuals with companies, associations of companies, university professors, members of other organizations, and private citizens without organizational affiliation. Some were submitted by large consortia offering a comprehensive roadmap for the ATP in developing a partnership with industry. The white paper process provided a place for people to share their ideas and an opportunity for the ATP to more clearly define the goals of the focused program. The white papers submitted to the ATP addressed a set of published criteria including: technical ideas; economic benefit; industry commitment; and, need for ATP funding.

It becomes the responsibility of the designated program manager (PM) to further refine the scope of the proposed program by broadening the relationship already established with the private sector. The PM for the IIH focused program organized a small focus group followed by a public workshop attended by representatives from industry, as well as the non-profit and academic communities.⁶ From the resulting general discussion held at the workshop, a consensus developed, identifying infrastructural information technologies as offering the best means to achieve a significant reduction in healthcare costs while at the same time increasing quality of care as well as offering the possibility for a significant positive impact upon the U.S. economy. Information technologies for healthcare also offered one of the most clearly defined areas of technological development requiring the public/private partnership offered by the ATP. The role of the ATP was thus defined as one

⁵ “Focused programs are defined as multi-year efforts aimed at specific, well-defined technology and business goals. These programs, which involve the parallel development of a suite of interlocking R&D projects, tackle major technology problems with high payoff potential which cannot be solved by an occasional project coming through the general competition. By managing groups of projects that complement and reinforce each other, the ATP can have the greatest possible impact on the economy.”

⁶ Advanced Technology Program, "Information Infrastructure for Healthcare (94-04)", U.S. Department of Commerce, NIST, 1994, p. 15.

of fostering cooperation and communication and serving as the catalyst needed to bring together the members of the information technology and medical communities to achieve the stated objectives.

Additional interactions were held between the PM and representatives from the private sector complementing the discussions held at the workshop and identifying the increased demands placed upon the U.S. healthcare industry to raise the quality of service, to extend consistent quality between rural and urban areas, to provide accurate measures of success, and to accomplish all of these with lower costs in a timely fashion while establishing national standards for the electronic transfer of patient records and related medical documents. This information, offering quite different notions of technological innovation in this area, fell into three distinct categories: a systems approach to an entire technological field; identification of a technological area purported to offer special promise for significant economic spillovers if "bottlenecks" are addressed; and, specific technical ideas that will, if supported, ultimately result in particular products.

Specific technologies identified in the IIH white papers included, but were not limited to, development of:

- Information tools to automate, validate and distribute clinical practice guidelines for mass use. These could include clinical practice guidelines that capture the current "best practices" for an array of medical situations.
- The tools to enable healthcare providers and quality/cost monitors to browse and to extract data automatically from a multitude of scattered clinical and administrative databases, without requiring changes to the existing databases.
- Tools that facilitate the production of clinical notes and, as a byproduct, gather the codified clinical data and store it in a database system.
- An interoperable open-systems architecture to serve as an interface between independent healthcare information systems.

This input gave impetus to the final scope of the proposed focused program in the development of information infrastructure. As defined here, information infrastructure development includes: the integration, synthesis, and definition of any information that needs to be shared across the enterprise; and, the means by which to transport, store, and access that information in a way that enhances, rather than impedes, user productivity.

3. Information Infrastructure for Healthcare Focused Program

The *ATP Information InfraStructure for Healthcare Focused Program*⁷ solicitation kit identified the program's goals as follows:

Technical Goals

To establish the technologies for:

- Reliable storage and retrieval of complex medical information for varied applications;
- Real-time, data-driven medical decisions;
- Real-time data entry by mobile medical personnel;
- Real-time global transport of complex medical records with accuracy, speed, and security;
- Computer-based medical training, diagnostic, and reference tools.

⁷ Advanced Technology Program, "Information Infrastructure for Healthcare (94-04)", U.S. Department of Commerce, NIST, 1994.

Business Goals

To gain the capability to develop products that will:

- Reduce unit healthcare costs;
- Improve quality of healthcare (higher treatment success rates and avoidance of complications);
- Capture global market share of new and improved products and services.
- Undertake infrastructural development focusing upon ‘tools’ and prototype systems to enhance the flow of information between existing ‘legacy’ systems in the healthcare enterprise while being scalable from a single provider’s office to a fully integrated healthcare system. Infrastructural development is intended to enable enterprise-wide integration of information among all sectors of the healthcare industry and is expected to encompass the following:

A model of the program, which would result in a portfolio of required technologies, is presented in figure 1 in the form of a “pyramid” consisting of three categories, which should be read from bottom to top: (1) Infrastructure Development Technologies (e.g.,

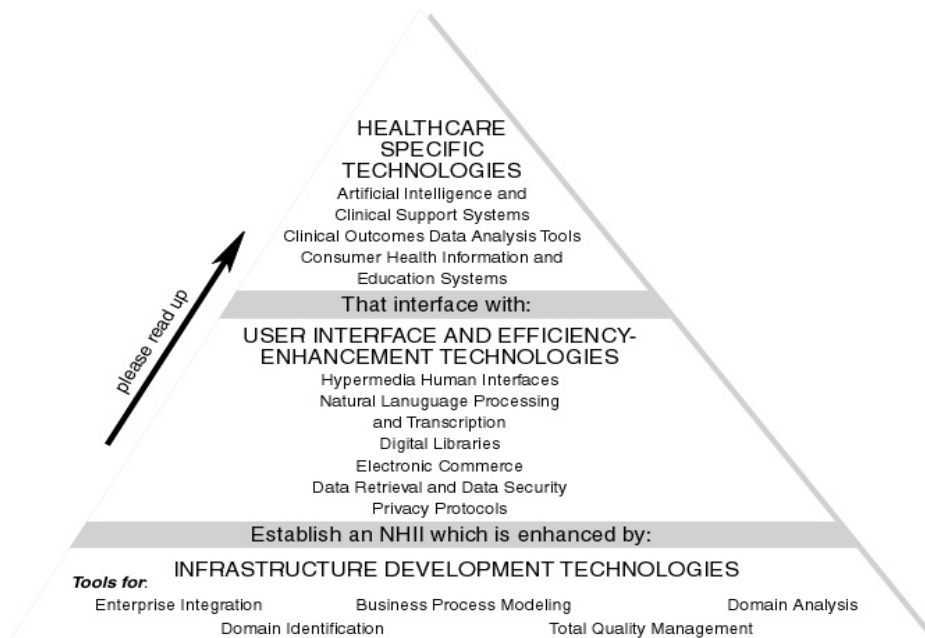


Figure 1

tools for enterprise integration, business process modeling); (2) User Interface and Efficiency-Enhanced Technologies (e.g., hypermedia human interfaces, natural language processing, data retrieval & advanced search mechanisms); and (3) Healthcare-Specific Technologies (e.g., clinical decision support systems, consumer health information and education systems).⁸ Each level is represented as being distinct from the next with the notion being that development of those technologies in the lower levels should precede development of those above, resulting in a “bottom-up” approach. This logic influenced the announcement of the first and second solicitations whereby only those projects which “fit” into the respective levels were to receive funding. It became obvious, after a period of time, that there was considerable interplay among the designated levels and that components from more than one level may be proposed in any given project. This thinking was

⁸ Ibid, p. 4.

incorporated into the announcement for the third solicitation recognizing that technological R&D in this industry requires simultaneous development of “infrastructural” technologies throughout the entire pyramid.

4. IHH Focused Program Awardees⁹

Table 1 below provides summary statistical data from the three IHH solicitations held between 1994 and 1997, in which 221 proposals were received and 32 awards were made to 79 participants. R&D funding totaled \$295 million, representing a commitment of \$146 million from the government and \$149 million from the private sector.

Table 1 IHH Focused Program Participation

	1994	1995	1997
Total Number of Proposals Submitted	59	68	94
Total Number of Projects Funded	16	10	6
Type of Award Participant			
Single Applicant	10	7	6
Joint Venture	6	3	
Total Number of Participants	43	32	6
Type/Size of Organization			
PS (For-Profit Small Company)	17	12	6
PM (For-Profit Medium Company)	6	4	
PL (For-Profit Large Company)	6	5	
NP (Non-Profit)	7	8	
U (University)	4	3	

A casual observation reveals the dominant role of small for-profit companies (PS) across all three solicitations. These companies participated both as single applicants (SA) as well as members of joint ventures (JV). SA award recipients included start-ups as well as research organizations in medium and large size companies. The JV’s were varied consisting of several types of organizational structures in both size and scale, and with different orientations to technology development. They included a diverse group of large and small companies, non-profit organizations, and universities. In some instances, competitors joined to overcome rather complex technical issues. The IHH focused program encouraged the formation of collaborations among computer and medical professionals and organizations to enhance the development of needed technologies.

5. New Format for Proposal Solicitation, Review and Selection

Beginning with fiscal year 1999, the ATP merged the concept of focused program competitions and general competitions, resulting in an “Open” format, combining the best features of previous competition models. Under an open competition a proposal selected for funding that is synergistic with an existing focused program is managed under that

⁹ The statistical data included in the tables and charts that follow are from the Business Reporting System (BRS) database maintained by the ATP Economic Assessment Office. Begun in 1994, the BRS provides a comprehensive data tool used for tracking purposes on a routine and regular basis and for measuring progress of projects against business plans and projected economic benefits as outlined in the project proposals and updated over the course of the projects.

program. In other cases proposals developing complementary technologies that form a critical mass will be "bundled"¹⁰ together and treated as a virtual focused program managed in a manner similar to that of announced focused programs. In the case of healthcare informatics, proposals which in the past would have been submitted under the IHH focused program competition will be directed towards the Information Technology Source Evaluation Board (SEB)¹¹. Those proposals selected for funding will be administered as part of the IHH focused program. ATP continues to work with industry and other organizations to define and update current challenges and opportunities in medical informatics.

In future competitions it is anticipated that those companies wishing to submit proposals which address elements of any of the three levels identified in the pyramid (see figure 1) may do so. Alternatively, companies may wish to submit proposals offering innovative solutions to those technical challenges outlined in the white paper authored jointly by ATP and industry titled, "Initiatives in Healthcare Informatics," and accessible on the ATP web site. New technical areas not addressed in either the IHH focused program, or in the white paper, or in other ATP focused program areas are also encouraged. All proposals submitted to the ATP will be evaluated solely for their scientific and technological merit and their potential for broad-based economic benefits, with parts weighted equally. No longer is there a need to determine whether a proposal falls within the scope of a specific technical program.

The introduction of this new Open Competition is part of an on-going process on the part of the ATP to improve upon its operations, in this case by offering a vehicle by which industry may respond more quickly to common barriers and opportunities without the delay brought about by the development of a focused program.¹²

6. Conclusions

The ATP IHH focused program has contributed significantly to accelerating the development of infrastructural tools as well as the user interface and efficiency-enhancement technology necessary for a National Information Infrastructure for Healthcare. It has encouraged their development from the "bottom up" rather than imposing them in a "top down" fashion, which could have resulted in restrictions on the types of technologies developed. The driving force behind these advances remains the development of open, interoperable, yet secure systems--systems that will provide the medical community with the capability to integrate diverse information and business systems as well as the data necessary to support continuous quality improvement, thus addressing several primary issues of critical importance in today's delivery of healthcare.

The IHH focused program has also acted as a catalyst in establishing collaborations bringing together the stakeholders and providing the opportunity to pursue cross-disciplinary projects, with participation from healthcare providers as well as computer scientists and information technology specialists. In several cases the collaborations that

¹⁰ The "bundling" of proposals for the purpose of creating a "virtual" focused program will only occur when a critical mass of proposals in a shared domain has been achieved. Any proposal that does not fall within an announced or virtual focused program is managed independently.

¹¹ The SEB is the primary means by which all proposals are reviewed. Membership is comprised solely of federal employees possessing technical and business expertise.

¹² Developing a focused program often encompasses a one-to-two year period. A program manager is assigned to a particular industrial sector in response to industry needs and asked to define whether or not ATP has a role. Current focused programs were designed with a finite time horizon. Those programs which were scheduled for multi-year competitions were intended to complete a body of work as established in the program definition or as modified due to changes in the technology environment. Both developing a new focused program and modifying an existing one were lengthy, laborious processes.

were formed included companies that never had nor, under ordinary circumstances, never would have worked together.

These efforts have led to a reduction in the likelihood of closed systems and have increased industry entry opportunities for small to medium-sized companies. For the end-user, this program has accelerated market acceptance and enabled industry to improve medical care while lowering costs.

Today, with rapid changes in both technology and in the delivery of healthcare, there are new challenges in healthcare informatics research. The Advanced Technology Program provides an excellent vehicle by which for government-industry partnerships in this domain will accelerate the development of high-risk technologies with promise of significant commercial payoffs and widespread benefits for the economy.

References

- [1] Blum, Bruce I. and Karen Duncan, eds., *A History of Medical Informatics*, Addison Wesley, Reading, MA (1990).
- [2] Etzkowitz, Henry, Andrew Webster, and Peter Healey (eds.), *Capitalizing Knowledge: New Intersection of Industry and Academia*, State University of New York Press, Albany, New York (1998).
- [3] National Science Foundation, *Comparing National Efforts at Technological Foresight, Science Indicators*. Chp. 6. National Science Foundation, Arlington, VA 1998.
- [4] U.S. Department of Commerce, National Institute of Standards and Technology, *ATP Proposal Kit* , November 1999.
- [5] U.S. Department of Commerce, National Institute of Standards and Technology, Advanced Technology Program, *Information Infrastructure for Healthcare* (94-04; 95-10; 97-03), 1994, 1995, 1997.
- [6] U.S. Department of Commerce, National Institute of Standards and Technology, Advanced Technology Program, *Program Idea Guide*, May 1997.