



## IBM Research and Development

*Innovating for business success in small and medium business*

IBM has a long history of evolving to meet the needs of its clients. In the 1950s, IBM provided the punch card technology that clients demanded and pioneered the computer business in anticipation of coming changes. In the 1970s, IBM electric typewriters were found in most offices, but as they began to give way to computer mainframes, IBM was again at the forefront. In the 1980s, IBM ignited the PC revolution, which continues to transform the way companies do business and people live their lives. And in the 1990s, clients needed more than a hardware vendor, so the company shifted its focus to become a leading provider of information technology and business services.

Throughout all of these changes, the key engines for IBM's technical innovation have always been IBM's research division and product development labs.

Since 1945, IBM Research has created significant technology for products and services at IBM as well as for the entire IT industry. Now, IBM is committed to putting the talent, energy and knowledge of its researchers to work on solving its clients' greatest business challenges. This paper outlines some of the ways in which IBM Research is actively solving problems in small and medium businesses, and helping clients achieve transformational innovation and business success.



***IBM and innovation***

IBM invests approximately \$5 billion a year in research and development. In 2005, the company earned 2,941 patents in the United States, more than any other company. In fact, IBM has earned more U.S. patents than any other corporation for 13 years in a row. The company and its researchers have also been honored with six U.S. National Medals of Technology, five U.S. National Medals of Science, four Turing Awards and five Nobel Prizes.

***IBM Research***

Research has eight laboratories around the world and employs over 3,000 people. Our researchers work in a variety of disciplines, ranging from physics and electrical engineering to computer science and advanced mathematics.

IBM Research has created innovations that have progressively transformed technology, including:

- **DRAM**
- **FORTRAN**
- **Relational databases**
- **Speech recognition technology**
- **RISC architecture**
- **Scalable parallel systems**
- **CMOS**
- **Silicon-on-insulator chips**
- **Silicon germanium chips**



**T.J. Watson Research Center**



**Almaden Research Center**

**Austin Research Laboratory**



**China Research Laboratory**

**Haifa Research Laboratory**



**India Research Laboratory**

**Tokyo Research Laboratory**

**Zurich Research Laboratory**



**IBM Research and  
small and medium business**

IBM Research is actively working with many of its clients, bringing the fruits of its technology research and development to help solve critical business problems for small and medium businesses. To meet the needs of any specific situation, IBM has several different ways in which it works with its clients:

**On Demand Innovation Services**  
**First-of-a-Kind projects**  
**Client visits and briefings**  
**Client Research projects**

**On Demand Innovation Services**

On Demand Innovation Services (ODIS) gives IBM clients access to dedicated researchers and consultants who specialize in high-end business transformation and technology consulting. Through ODIS, clients can benefit from a wide array of IBM Research innovations, tools and expertise when solving their business problems. The fifteen ODIS practices are:

**Advanced Call Center Automation:** Designs and helps deploy natural language voice recognition and voice mining solutions.

**Advanced Networking Solutions:** Cutting-edge models, algorithms, software and expertise help quickly and accurately design, monitor and optimize enterprise networks and networked applications.

**Business Optimization and Analytics:** Designed to optimize, plan, model, analyze and transform companies into on demand businesses.

**Collaboration:** Assesses, designs and implements innovative tools to support communication among employees, suppliers, partners and clients.

**e-business Systems and Architecture:** Designs and helps deploy cutting-edge applications, middleware and Web content.

**Grid and Autonomic Solutions:** Cutting-edge models, software, designs and expertise help quickly and efficiently evaluate, design, pilot and optimize grid and autonomic capability in distributed computing systems.

**Information Mining and Management:** Helps clients gain business insight from structured and unstructured data, text, voice, video, etc.

**Innovation Management:** Introduces new ways of thinking, working, managing and structuring businesses – and new tools and capabilities for doing so.

**Mobile Enablement:** Applies new wireless and pervasive technology to help improve security, reliability and integration.

**Model-Driven Business Transformation:** Focuses on closing the gap between business initiatives and their IT-based solutions.

**Product Lifecycle Management:** Improves product development processes through better tools, methodologies and collaboration.

**Risk and Compliance:** Designed to help companies meet and manage complex regulatory requirements, and to anticipate and mitigate operational risks.

**Security and Privacy:** Accesses, designs and implements enhanced security processes and tools.

**Supply Chain Solutions:** Optimizes, plans, models and analyzes complex supply chain and transportation processes.

**Technology-Based Learning:** Provides a set of tools designed to improve teachers' productivity, a prototype that assembles just-in-time learning for users, and a methodology that helps measure the value or effectiveness of a learning program.



## IBM Research and Development

A number of small and medium business clients have used IBM's On Demand Innovation Services. Clients can tap into the largest private research organization in the world to get help in solving their business challenges.

### **On Demand Innovation Services for an internationally recognized leader of flow control products**

A worldwide manufacturer of fittings, valves, actuators and support systems for residential, commercial and industrial markets needed to update its manual inventory system and reduce inventory levels. The company had licensed mySAP software three years earlier and was using a separate inventory reporting and planning system, which was labor-intensive and did not support frequent planning of new inventory targets.

IBM helped define and migrate the inventory optimization and planning process to SAP by incorporating an analytical approach for calculating inventory targets developed by IBM's Research and Integrated Supply Chain team into SAP's NetWeaver Business Intelligence. The impact of the SAP and IBM solution has been dramatic; the new inventory optimization system placed approximately 15,000 products online, realized \$400,000 in inventory-asset savings within three months of implementation, reduced inventory levels by 13 percent, and decreased the time it took to generate reports from hours to minutes.

### **On Demand Innovation Services for a custom manufacturer**

A manufacturer and marketer of chemicals, fibers and plastics products desired to replace its manual planning process for distributing chemicals with an automated, optimal planning system. In 6 weeks, IBM researchers and business consultants teamed to design, develop and deliver a mathematical modeling system that generated a significantly better allocation of constrained resources to satisfy demand for custom manufacturing and distribution of chemicals. The system is based upon a robust IBM Research tool called the Watson Implosion Tool (WIT), which is used inside IBM and at customer locations worldwide.

### **On Demand Innovation Services for a major electronics manufacturer**

A major electronics manufacturer was hampered by a costly and cumbersome procurement system. Submitting supplier orders took numerous members of staff, making excessive phone calls and fax exchanges. The company decided to leverage new technologies to improve procurement processes.

IBM Research formed a core part of the customized solution development, which included an extensible markup language (XML)-based system to provide e-Procurement with an open architecture to integrate with legacy and ERP systems through the Internet – allowing small and medium suppliers easy access to the company.

This solution enabled the manufacturer to cut the procurement cycle time in half, while extending its supplier base around the globe. Procurement costs were reduced by nearly three percent for savings of \$100 million, purchasing staff was reduced by 19 percent, and inventory storage time was reduced by half.

### **On Demand Innovation Services with a private non-profit institution**

A private, non-profit institution that promotes greater understanding and cooperation between the United States and Asia expressed a strong interest in working with IBM to develop a systematic way of supporting their Innovators Network. IBM Research teamed with BCS to define how social network analysis could be used to identify barriers within their organization that could prevent or inhibit their ability to achieve their business transformation into an innovative institution.

**First-of-a-Kind projects**

The IBM First-of-a-Kind (FOAK) program fosters collaboration between leading-edge clients that want to become early adopters of innovative technology and IBM scientists who are eager to conduct research in the marketplace. Researchers develop innovative technology prototypes and the client uses them in its business environment to solve existing problems. Both sides benefit in this collaboration.

Recent FOAK projects with key clients in small and medium business have:

- **Created the office of the future**
- **Enabled projected images to be seen on any surface**
- **Allowed non-experts to create Web sites**

**First-of-a-Kind project creates the office of the future**

IBM researchers teamed with an office equipment manufacturer to create BlueSpace. This office of the future integrates architecture, furniture and several breakthrough technologies to allow users control of their workspace's lighting, temperature control, information displays and other physical settings. By seamlessly connecting the many devices in a typical office to each other, to the Internet and to the user, pervasive computing extends business applications to a new generation of devices. Innovative components of BlueSpace include the Everywhere Display, which projects content onto any surface; BlueScreen, an information and control center with interactive icons; and Bluey, an office companion that understands voice commands. BlueSpace makes offices more interactive and useful for people by creating a personal work environment and fostering collaboration.

**First-of-a-Kind project helps an institute launch a Web site quickly and easily**

The public relations department at a not-for-profit organization wanted a tool to give it complete control over the look and content of its Web site without relying on the IT department to make necessary and frequent updates. In response to this need, IBM Research created a rapid development tool that enables non-technical users in the small and medium business domain to create dynamic Web sites without coding or technical skills. The Web site was up and running in a matter of weeks to show what the institute had to offer and enabled its customers to view catalogs and order items online. The Easy Website Builder tool is both easy enough for non-programmers to use and powerful enough to push application development into the domain of the business units, leaving IT specialists to provide a centralized run-time infrastructure.



**Client visits and briefings**

IBM Research hosts special client visits at two Industry Solutions Laboratories (in Zurich, Switzerland and in Hawthorne, New York) and at IBM's other six research laboratories. These visits typically run for a day or two with a customized agenda determined by each client's primary visit objectives and key areas of interest. During these visits, subject matter experts and senior technical leaders are available for presentations and discussions of Research's activities in important new technologies that may be germane to the company's future business direction.

IBM Research often presents its Global Technology Outlook, a futuristic "over the horizon" view on key technology trends and their implications to enterprise and SMB customers in the automotive, aerospace, retail, petrochemical, electronics, financial services, healthcare and life sciences, telecommunications, travel and transportation, and general manufacturing industries. During visits to the ISLs, clients can also experience demonstrations of some of Research's numerous advanced technology prototypes and exhibits, many of which were developed through the FOAK program.

Last year, IBM Research hosted over 80 client visits and briefings worldwide for small and medium businesses.

**Client Research projects**

IBM Research's renown makes it also a very desirable collaborator to other companies with their own significant research investments. The company's efforts are very broad and deep, and their impact is profound on not only IBM's, but also on the science and technical communities at large. Besides the technologies normally considered to be associated with the design and manufacture of computer information systems, IBM Research pursues research activities in areas of basic science, physics, mathematics, physical sciences, chemistry, biology, materials science, manufacturing research, business processes and decision support and efforts in these areas are closely aligned with the interests of IBM's clients. Further, with the growing pervasiveness of computing technologies in almost every aspect of business and personal life, many basic technology research areas are also relevant to the business needs of its industrial and commercial clients.

IBM Research sometimes engages directly with clients on specific projects that require the unique expertise and specialized skills of its researchers. Projects with IBM Research can be focused and structured around a very specific domain of research work, which has been identified as being of common interest by technical teams or on a broad problem defined by clients. Through such projects, a client could gain greater knowledge of IBM's portfolio of research tools as well as direct insight and leadership from its researchers.



Since 2003, IBM Research has engaged in a range of projects for small and medium clients, including:

- developing a remotely managed service to deliver desktop management services for a contracting service and a temporary staffing office
- designing a service to help enable rapid compliance with retail and government tagging mandates for a product supplier
- creating an intelligent inventory system for a retailer
- helping make contract management an easier and less costly proposition for selected IBM Business Partners and clients

### IBM Desktop Management Services

IBM researchers created the underlying infrastructure and standard processes to automate and remotely deliver desktop management services to support the desktop and notebook computers that companies rely on in IBM's Desktop Management Services offering. This service encompasses a full range of capabilities: anti-virus, software distribution, application support, virtual help desk, spam filtering, software usage, backup and restoration, password resets and more. IBM clients choose what they need and pay on a per-seat, per-month basis – enabling their technical staff to spend time on other business-critical issues.

### Intelligent Inventory Management for a European retailer

A European retailer needed to centralize and automatically generate order proposals to replenish inventory for its 80 locations and central warehouses. Accurate forecasts were also necessary, because demand for many of the retailer's items tends to be sporadic. IBM developed a system that gathers data on 70,000 items from the stores – over 5.6 million datasets. Data gathering occurs over a four-hour period after work hours. The system analyzes the data, creates order proposals for each supplier in each location and generates reports for immediate use. The system can determine the effect a previous promotion had on a particular item and forecast the inventory needed when a similar promotion is run again. The IBM team focused on the retailer's unique situation to create a proprietary plug-in for the IBM Advanced Inventory Manager that provides the do-it-yourself chain with automatic order proposals, daily reports and forecasts regarding the current state of their inventory. The new intelligent inventory management system achieved a very high service level in their 80 stores and extremely low stock-out probability. With the highly automated replenishment system, planners can focus on exceptions.

### IBM Express RFID Services

IBM Express RFID Services are designed to help enable rapid compliance with retail and government tagging mandates at a very affordable cost. Specifically developed to address the technical and pricing constraints of small businesses, the solution is remotely managed by IBM and easily deployed. While individual businesses will handle printing and tagging on site, IBM will compute tag data and then transfer it to RFID network environments at remote locations at a client's site. Equipment located in the client's facility will be monitored by an IBM operations center that provides help desk support, error resolution and maintenance dispatching. IBM Research worked closely with IBM Technology Services to conceive the service with an advanced end-to-end RFID solution prototype developed under a First-of-a-Kind solution program. IBM Research also contributed a standards-based RFID processing technology to the solution software.

### IBM Contracts OnLine

Contracts OnLine is a new service for end-to-end contract transactions on the web. Using an Internet browser, selected IBM Business Partners and clients can search, view, print, or download contracts, track status and view processing history as well as perform tasks such as review, approve, and sign contracts on line. Contracts OnLine is powered by On Demand Electronic Contract System (ODECS) technologies developed by IBM Research. Contracts OnLine helps to reduce the cost of processing contracts, improves the ease of contract execution, shortens the end-to-end execution time of contracts, and enhances business audit, control, and backup capabilities.

## IBM Research and Development

### China SMB Innovation Center Launched

In 2004, the China Research Lab became home to the Small and Medium Business Innovation Center, enabling SMB clients in China and throughout the world to tap into IBM Research's technology and expertise. One of the major challenges facing SMBs in China is the need to improve connectivity with suppliers, partners and customers. As the global supply chain continues to grow and get more complex, it is critical for SMBs to use innovative and open solutions to more efficiently conduct business with suppliers and clients all over the world.



During the past year, researchers in Beijing worked directly with one of China's largest department stores, and an IBM business partner to successfully deploy a supply chain management system based on IBM's on demand retail solution. This innovative solution for a Chinese retail business has successfully improved operating efficiency, lowered operating risks, optimized the structure of assets, boosted customer satisfaction and expanded new business for both the client and the business partner.

The China SMB Innovation Center is an incubator for new methods, tools and solutions that will assist clients and business partners in meeting their goals in the global SMB marketplace. Over the next few years, the center will focus on developing technologies for business process services and using open source to accelerate IT adoption in SMB at an affordable price, targeting the retail, distribution and power industries.

The center also gives researchers the opportunity to work with partners who understand the local business needs in China. IBM is providing independent software vendors with resources to develop open solutions to help SMB clients improve their global supply chains.

### IBM Engineering & Technology Services can help small and medium businesses innovate to win in their markets

Since its inception in 2002, E&TS has delivered innovative solutions to a broad range of clients in the manufacturing and services industries. To stay at the forefront of their industries, many companies are collaborating with E&TS to develop innovative products faster and more effectively; improve how they integrate complicated new technologies; gain access to valuable intellectual property; trim the time it takes to deliver products to market; and reduce development costs for new products. E&TS has demonstrated growth in the SMB marketplace through recent alliances to help companies:

- Strategically expand into new markets with integrated supply chains and consulting services
- Integrate the Cell Broadband Engine (Cell BE) technology into new computer systems for data-intensive applications such as medical imaging, aerospace, defense and other industrial segment products like petroleum exploration.
- Design and develop innovative products like a rugged touch screen solution and an application to enhance a mobile solution.

E&TS offers:

- Turnkey CMOS chip design
- Customized systems and devices
- Electronic design technology services
- Customized blades
- Embedded software development
- Cell simulation on demand
- Factory software
- Integrated supply chain
- BlueGene
- Security
- Telematics
- Cell-based platforms
- Video surveillance

## **The IBM Research Healthcare and Life Sciences Institute**

The IBM Research Healthcare and Life Sciences Institute is a virtual organization that drives invention and technology innovation specifically targeting the healthcare, life sciences and pharmaceutical industries. The Institute is focused on four client challenges:

- Improve the effectiveness, safety and cost of medical care through better diagnosis, treatment and operational efficiency
- Translate molecular biology research into medical care
- Develop new, more effective, drugs faster and cheaper
- Understand biological systems with predictive models

Working with clients in the healthcare, pharmaceutical and life sciences marketplace, the Institute explores the use of technologies, such as data and application integration to develop models for patient-centric electronic health records, pervasive and wireless technologies to improve safety and effectiveness at the point of care in the medical enterprise, and the mining of structured and unstructured data in biology, drug discovery and medicine.

### **Healthcare Innovation Centers**

The Almaden and Haifa Research laboratories have been designated as Healthcare Innovation Centers focused on clinical information technology needs. Both laboratories have significant expertise in working with SMB healthcare clients in the U.S. and Europe. The research is primarily focused on the infrastructure required to enable interoperability within and across healthcare enterprises, in particular the development of an infrastructure that will allow medical facilities to share medical documents according to Integrating the Healthcare Enterprise (IHE) standards.

IBM also focuses on pervasive technologies for monitoring at-risk individuals both remotely and at the point of care, and for collecting public health data. Also in the area of public health, IBM has developed a framework that allows rapid development of disease transmission models.

IBM's healthcare work draws on technologies such as services-oriented architectures, industry standards efforts, unstructured information (text and images), distributed and high performance computing, as well as event-driven computing and human factors.

### **Computational Biology at IBM Research – Life Sciences Innovation Centers**

The Computational Biology Center (CBC) at IBM Research consists of approximately 40 full-time researchers. The Almaden, Watson and Zurich laboratories have been designated as Life Sciences Innovation Centers and hold the bulk of IBM's computational biology expertise. Researchers at these sites have extensive backgrounds in computer science, mathematics, chemistry, physics, biology and pharmacogenomics.

The research model includes active collaboration with industrial, academic and government research organizations around the world. The nature of these collaborations varies greatly and is customized in each instance, but is always centered on scientist-to-scientist interactions, with the goal of validating IBM's technology, enhancing the understanding of relevant scientific challenges and, if appropriate, joint publication of new scientific results.

The CBC carries out work in five areas: bioinformatics algorithms (including the automated annotation of viral and microbial genomes), structural biology, functional genomics and modeling, biomolecular dynamics, and data management and integration. It also serves as a portal to the broader interests of IBM Research in areas relevant to the life sciences, such as grid and autonomic computing, high performance computing and storage, knowledge management and data mining.

The CBC works closely with the IBM Research Deep Computing Institute (DCI). The DCI is currently the home of a supercomputer named Blue Gene/W, which, at over 90 teraflops of computational speed, is currently the second fastest supercomputer in the world and the fastest privately held and unclassified supercomputer.

More than 70 percent of the available computational power of BG/W is currently directed towards simulation of biomolecular systems – in particular, long timescale studies of protein folding in solution and the dynamics of trans-membrane proteins.



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