

ROUNDTABLE PROFILE

BY ARNOLD GREENLAND

Editor's note: This is another in a series of articles profiling members of the INFORMS Roundtable.

O.R. at IBM

Technology and consulting giant boasts a long, rich history with operations research and advanced analytics.

THE IBM CORPORATION HAS A LONG AND DEEP HISTORY as a company that both uses operations research and, more generally, advanced analytics to run its business. It is also a place where practitioners and innovators in the field have chosen to work for decades. Many important contributions to the field have been made over the years, and those contributions continue to this day.

IBM is also one of the oldest, largest and most historical companies in the country. The company was founded 1911 as the Computing Tabulation Recording (C-T-R) Corporation, which means it is celebrating its 100th anniversary this year. With more than 425,000 employees world-wide, IBM is the second largest publically traded technology company in the world (as measured by market capitalization), the 31st largest corporation in the Forbes ranking and the 18th largest on the Fortune magazine list of largest companies in the United States.

IBM has had many very pivotal and important leaders over the years, but among the earliest and most colorful was Thomas J. Watson Sr. He was the person who adopted the motto "THINK," and it is possible to trace a century of innovation to the principles and values created for the company at that time. This focus on innovation can be seen by the fact that the company holds more patents than any other U.S.-based technology corporation and that many of its employees have garnered important recognition for their accomplishments (including five Nobel Prize winners and too many other prizes to mention in this short article). In addition, Thomas J. Watson Sr. created the Watson Scientific Computing Laboratory at Columbia University in 1945 that blossomed into the IBM Research Division. Today, the IBM Research Division has more than 3,000 researchers globally in nine labs around the world, and it is generally regarded as one of the most critical components to the success of the corporation over the decades.

Transformation of the company

ONE OF THE HALLMARKS of the IBM Corporation has been its ability to adapt the business to remain a vibrant and growing entity. While the company clearly began as a manufacturer of business machines, it has evolved into a company that provides a combination of hardware, software and services to its business and other organizational clients. A major milestone in the history of the company is typ-



IBM, headquartered in Armonk, N.Y., (pictured above), has a long and deep history of using O.R. and advanced analytics to run its business.

ically referred to as the "transformation," which began in the early 1990's when Louis V. Gerstner assumed leadership of the corporation. Gerstner is credited with turning around the fortunes of the company, which had begun to suffer in the late 1980s and early 1990s. He led the company into the services and software businesses. What is especially interesting, and gratifying to the audience for this profile, is that operations research remains a pivotal component of each and every one of the three core IBM businesses today.

Operations research and advanced analytics can be found in critical places throughout the company's many divisions, but the root of the power in O.R. can clearly be seen within IBM Research Division. The importance of operations research within the IBM Corporation began early in the development of the IBM Research organization as evidenced by the leadership of the eminent operations researcher Ralph E Gomory as director of the IBM Research Lab, then a senior executive in the corporation. Over the years, IBM Research has been the home for outstanding operations researchers such as Phil Wolfe, Alan Hoffman, Andrew Conn and Bill Pulleyblank, just to name a few. This leadership in the field of O.R. continues today under the direction of Brenda Dietrich, an IBM Fellow and VP for Business Analytics and Mathematical Sciences. Brenda leads an organization of more than 300 researchers, many of them O.R. specialists. Brenda has also been a leader in the O.R. field as a recent president of INFORMS and a regular participant in INFORMS meetings, committees and leadership.

All About the Roundtable

IBM has placed a big bet on business analytics and optimization as a critical strategy for the future.

IBM researchers continue to make critical contributions in the field of O.R. and leadership for the corporation in its focus on business analytics and optimization.

Where's the O.R.?

SO WHERE'S THE OPERATIONS RESEARCH at IBM? The answer is, simply, everywhere. We already mentioned the pivotal place of operations research and advanced analytics within the IBM Research Division, but it is also prominent in every division of the corporation: hardware, software and services. Consider first the company's hardware division. O.R. has been a key part of the manufacturing and fabrication capabilities of the company for its entire history, but most recently it can be seen impacting the operations of the chip fabrication operations that are focused in Fishkill, NY. Using a wide range of O.R. tools, including optimization, simulation and data analysis, IBM has tightened operations, increased productivity and improved profit by the activities of this operation.

As IBM has evolved into one of the largest software companies in the world, it has also included advanced analytics – and operations research in particular – in its growth and development plans. IBM has historically made software contributions to O.R., including the early development of optimization tools such as MPSX and OSL. More recently the corporation has chosen to grow its portfolio of analytics software tools by acquisition, spending more than \$14 billion in acquisitions in this area alone. Key acquisitions in this area include ILOG, which contains the popular and widely used CPLEX optimization product. In addition the ILOG suite has visualization, constraint programming, supply chain planning tools and a robust and popular rules engine (JRULES).

In the statistical and data mining area, IBM recently purchased SPSS, a fully functional statistical analysis package along with a highly competitive data and text mining capability in the SPSS Modeler product (previously known as Clementine). IBM also purchased the business intelligence tool, COGNOS, one of the leaders in that field. In addition to these major analytics tools, the corporation has purchased scores of smaller and more niche analytics and modeling tools that are being integrated into the portfolio, as well as having IBM Research participate in the development of new software tools internally.

INFORMS has two types of members: individual and institutional. The latter (usually a company) joins the INFORMS Roundtable and appoints as its representative the person in overall charge of O.R.

The Roundtable has been very active since its founding in 1982, with three meetings each year and much communication in between. It, its member institutions and its member representatives take a strong interest in how INFORMS serves the needs of practitioners, and have undertaken many initiatives and provided many services toward this end. These involve, for example, public awareness of O.R., both of the annual INFORMS conferences, continuing professional education, one of the prizes and various committees.

In addition, the Roundtable has an advisory responsibility to INFORMS. One bylaw states that it "... shall regularly share with INFORMS leadership its views, its suggested initiatives and its implementation plans on the important problems and opportunities facing operations research and the management sciences as a profession and on the ways in which INFORMS can deal proactively with those problems and opportunities ..." By tradition, it meets with the newly elected INFORMS president-elect each spring to discuss practice-related topics of interest to him or her, and with the entire INFORMS Board each fall to discuss topics of mutual concern.

The Roundtable membership comprises about 50 organizations. Further information is available at <http://roundtable.informs.org>.

This series of articles aims to share with the INFORMS membership at large some information and insights into how O.R. is carried on in practice today.



Fifty years ago, IBM CEO Thomas Watson delivered a speech at Columbia University to mark IBM's first half century in business.

Like the other divisions of the company, the Services Division houses a small capability in operations research and advanced analytics. While this capability is relatively new, it is growing rapidly as the corporation has created the Business Analytics and Optimization (BAO) practice within the Global Business Services (GBS) Division. While IBM has actually been a services provider for decades, these services were often bundled with the hardware sales. With the acquisition of PricewaterhouseCoopers Consulting in 2002, the company made a strong commitment to growing its services business, and the addition of BAO as a core service provided one of the critical recent decisions. An article published in the INFORMS digital journal, *Analytics* (analytics-magazine.org), entitled the "Analytics Journey" [1], Lustig, et. al., describe in detail the BAO practice. The key ideas driving the development of this business focus were articulated in the wildly popular and motivating

book by Davenport and Harris [2], which has turned out to be a source of much of the language of the analytics revolution that we are currently all involved in.

The key message is that one of the core services that companies want and need are precisely the solutions that O.R. practitioners have been developing and applying for years to their businesses. This business has grown dramatically in the last couple of years to the point where IBM includes some 8,000 professionals among the ranks of those that deliver BAO services. These professionals include a broad range of analytical talents from those who help client development strategies, those who build the IT infrastructures required to implement the analytics capabilities, to, of course, the advanced analytics practitioners who build and apply the operations research and advanced analytics tools that are the heart of the analytics revolution.

Accomplishments

AS A RESULT of the legacy of operations research within the company (and the promise of continued growth in the future), IBM can point to a great many accolades and accomplishments. Some have already been mentioned above, as they relate to IBM Research. Among its many other noteworthy accomplishments in the O.R. arena, IBM won the coveted Edelman Prize from INFORMS in 1999 for work in 1999 entitled "Extended Enterprise Supply Chain Management at IBM Personal Systems Group and Other Divisions." IBM

REFERENCES

1. Lustiz, I., Dietrich, B., Johnson, C., Dziekan, C., "The Analytics Journey," analytics-magazine.org, 2010.
2. Davenport, T.H. and Harris, J.G., "Competing on Analytics: The New Science of Winning," Harvard Business School Press, 2007.

has also been on six other Edelman finalist teams. In addition, IBM won the INFORMS Prize in 2000, and numerous IBMers have won other INFORMS prizes including the von Neuman Prize and the Wagner Prize (won just last year in the area of workforce planning).

In summary, IBM is a company that has had a long and distinguished history and a company that continues to adapt, grow and contribute to the technology marketplace. It is also a company that leveraged and relied on operations research for its past successes, and it is a company that has placed a big bet on business analytics and optimization as a critical strategy for the future. **IORMS**

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