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THE EDELMAN GALA

2019 EDELMAN GALA PROGRAM

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IBM

Presentation of the Wagner Prize
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Mark Gallagher, CAP
2019 INFORMS Prize Chair

Recognizing Members of the Franz Edelman Academy
Peter C. Bell
Master of Ceremonies

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Ramayya Krishnan
INFORMS President

Pooja Dewan
2019 Edelman Award Chair

MASTER OF CEREMONIES

Peter C. Bell, Emeritus Professor & Adjunct Research Professor, Ivey Business School at Western University



Peter Bell has been a member of INFORMS (previously TIMS) for almost 50 years. The exact date that he joined predates INFORMS membership records but he thinks it was about 1970! He was elected an INFORMS Fellow (2006) and is a past winner of the INFORMS Prize for the Teaching of OR/MS Practice (2005). His INFORMS involvement includes serving as Vice President International Activities; chair of the Practice Section; associate editor of *Operations Research* and *INFORMS Journal on Applied Analytics* (formerly *Interfaces*); chair of the Edelman Prize Competition; judge for the Edelman, INFORMS, and Wagner Prize competitions; and membership on many INFORMS committees to select INFORMS Fellows, review journals, or appoint journal editors-in-chief.

Outside of INFORMS, Peter has been active with the International Federation of Operational Research Societies (IFORS), the umbrella international organization that includes INFORMS as a member society, serving on its Board for more than 20 years [including President (1995–1997), North American Vice-President (1989–1991), and Treasurer (2007–2012)]. At IFORS, he played a major role in organizing successful conferences in Beijing and Vancouver, was program chair of the first (and to date only?) conference on *Multimedia Operations Research* held in Santa Monica (1995), and served as founding editor (1993–2000) of the IFORS-sponsored academic journal *International Transactions in Operational Research.*

Peter was awarded "Emeritus" status of the Canadian Operational Research Society (CORS/SCRO) at the 2018 conference in Halifax, and is a past president and former council member. He was presented with the CORS/SCRO Award of Merit (2007) "for his significant contribution to education and the practice of operational research in Canada."

Peter earned BA (Hons) and MA degrees at Oxford, and MBA and PhD degrees at the University of Chicago, Graduate School of Business (now the Booth School of Business). His research program has produced more than 100 articles in academic and business journals, 16 books (authored, co-authored, or edited), and about 150 business cases.

He has served as a consultant to corporations, hospitals, small businesses, charities, and government agencies, and is (or was) a member of several boards of directors.

When not working, Peter collects and restores classic British motorcycles, tries to play decent golf, and also tries to capture memorable photographs.

Peter gratefully acknowledges the financial support provided for his career by the Ivey School of Business that provided employment for 41 years and the Natural Sciences and Engineering Research Council of Canada that continuously funded his research from 1979 to 2013.

He could not have done any of this without the support of Jennifer, his wife of 50 years, children Caroline and David, and grandchildren Madison, Evan, and Jase.

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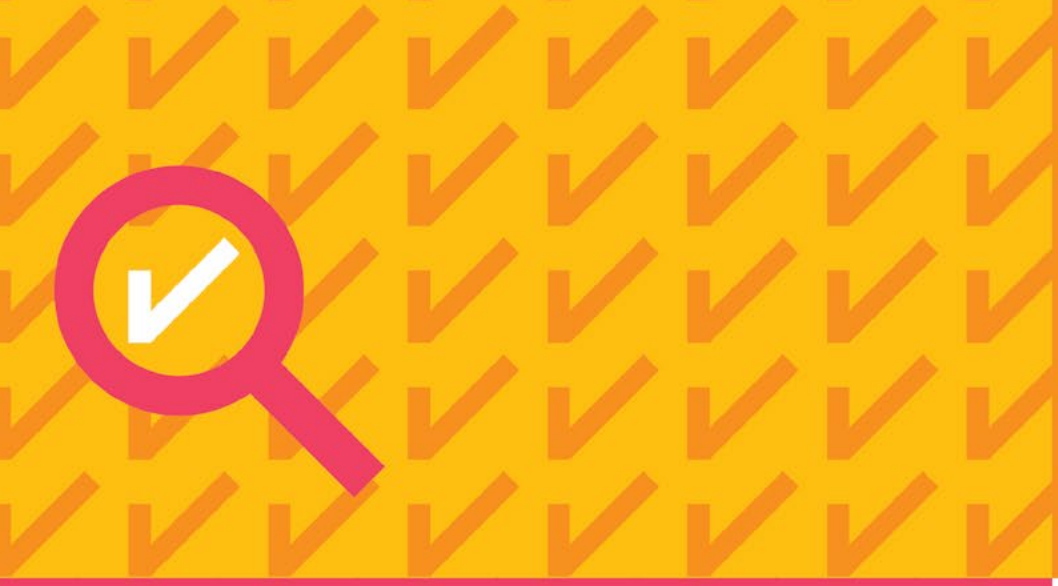
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ANALYTICS AND OPERATIONS RESEARCH TODAY

2019 EDELMAN PROGRAM NOTES

By Ramayya Krishnan, INFORMS President



Thank you for joining us as we recognize and celebrate the recipients of INFORMS' four most prestigious awards: Daniel H. Wagner Prize for Excellence in Operations Research Practice; UPS George D. Smith Prize; INFORMS Prize; and Franz Edelman Award for Achievement in Advanced Analytics, Operations Research, and Management Science.

These awards not only represent excellence in operations research (O.R.) and analytics, but are a vital component to INFORMS' efforts to communicate the value of these fields to decision makers and thought leaders across the globe.

Daniel H. Wagner Prize for Excellence in Operations Research Practice

Every year for the past two decades, the Daniel H. Wagner Prize has been awarded to teams that have combined clear intelligent writing with strong analytical content and a clearly verifiable and successful practical application.

The 2018 Wagner Prize recipients, a team of researchers from Cornell University, were recognized for their unique application of O.R. and analytics to increase bike-share efficiency. The researchers worked with Motivate, the operator of the largest bike sharing system found in New York, Chicago, and San Francisco, to develop an initiative to improve the allocation of docks to stations, and then create an incentive scheme to crowdsource rebalancing called Bike Angels.

Since implementing these solutions, Motivate has moved hundreds of docks in its systems nationwide and the Bike Angels program now aids rebalancing in San Francisco and NYC, where it achieved results comparable to Motivate's traditional approach to rebalancing but at far less financial and environmental costs.

UPS George D. Smith Prize

The INFORMS UPS George D. Smith Prize, named in honor of the late UPS Chief Executive Officer, recognizes universities that cultivate and maintain strong relationships between their students and industry partners to help better prepare young O.R. and analytics students and practitioners. Each year, the Smith Prize finalists are selected from among the world's leading university O.R. and analytics programs.

The 2019 finalists are the University of Cincinnati, Department of Operations, Business Analytics and Information Systems; University of Maryland, Department of Decision, Operations & Information Technologies; and University of South Carolina, Operations and Supply Chain Program – Management Science Department.

INFORMS Prize

The INFORMS Prize is awarded to organizations that have embraced O.R. and analytics in multiple projects for significant and lasting impacts.

The winner of the 2019 INFORMS Prize, Booz Allen Hamilton, has been a leader in strategy, technology, and engineering for more than 100 years. In the past decade, they have successfully executed more than 500 O.R. projects and today employ a team of more than 4,000 O.R. practitioners and professionals.

Franz Edelman Award for Achievement in Advanced Analytics, Operations Research, and Management Science

The Franz Edelman Award is the world's most prestigious award for achievement in the practice of O.R. and advanced analytics. The 2019 finalists have made significant contributions to wind

energy production, environmental protection, consumer fraud deterrent, school bus scheduling, airline safety, and contract pipeline management.

This year's finalists are Boston Public Schools, IBM, Louisville Metropolitan Sewer District and Tetra Tech, Microsoft, Spanish Aviation Safety & Security Agency (AESA), and Vattenfall.

With half of **Boston Public Schools' (BPS)** 55,000 students traveling to school by bus each day, planning the routes for hundreds of buses required 10 people and more than 3,000 hours. To simplify this process, BPS enlisted a team of researchers from MIT to create a new bus routing algorithm that was 20 percent more efficient in about 30 minutes. Once implemented, the solution resulted in the largest-ever one-year reduction in buses, leading to nearly $5 million in annual reinvestment back into schools. BPS has also used this innovative approach in efforts to re-align bell times for the benefit of its students.

A leading provider of information technology services for clients worldwide, **IBM** competes for highly complex IT services contracts to design, build, run, and maintain critical infrastructure and IT systems. To better manage these complex contract negotiations, IBM Services introduced O.R. and analytics tools to transform the process into informed decisions based on data-driven insights. This enables IBM to negotiate with the client, optimally cost and price IT services solutions, and predict the winnability of each deal being negotiated, ultimately increasing its relative contract win rate, and realizing a significant revenue increase.

In response to increasingly intense and more frequent rainfall that can overwhelm urban wastewater collection and treatment systems, **Louisville Metropolitan Sewer District (MSD)** enlisted engineering services firm **Tetra Tech** to implement RTC software solution Csoft®, which efficiently manages sewer networks in real time based on rain forecasts and sensor readings. This enables MSD to respond to rainfall and actual system conditions by maximizing all available storage, conveyance, and treatment capacities, while realizing over $200 million in savings and improving community waterways.

To more effectively identify and address online retail fraud, which accounts for tens of billions of dollars lost in the U.S. alone, **Microsoft** developed an innovative Fraud Detection System based on state-of-the-art AI, operations research, and automation. Using this new system, Microsoft has dramatically reduced its Fraud Loss Rate resulting in $75 million annual savings and improved both its False Positive Rate and the Bank Acceptance Rate of legitimate purchases generating over $1 billion in additional revenue.

To meet international aviation safety requirements, the **Spanish Aviation Safety & Security Agency (AESA)** partnered with the Spanish Royal Academy of Sciences to introduce analytics methodologies to support a State Safety Program (SSP). Their methodology, the Risk Management in Aviation Safety (RIMAS) tool represents the first time advanced analytics techniques have been used in a preventative approach to civil aviation, and has enabled AESA to realize a 25 percent reduction in annual equivalent safety costs, or nearly $230 million in savings.

As **Vattenfall**, one of Europe's largest producers of electricity, began significantly expanding its wind energy operations, it employed O.R. to realize hundreds of millions of dollars in savings. By combining O.R. techniques with technical knowledge, commercial insight, and system design, Vattenfall achieved an estimated savings of $11–$17 million per wind farm, and more than $170 million overall. In addition, Vattenfall has been able to maximize its power output, expand its pipeline, and is on track to reach its target of enabling fossil-free living within one generation.

On behalf of the INFORMS Board of Directors, thank you for joining us as we celebrate this year's finalists and winners and their incredible contributions, and for helping spread the word of how O.R. and analytics are saving lives, saving money, and solving problems.

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THE FCC'S BROADCAST INCENTIVE AUCTION

Reflections on Winning the 2018 Franz Edelman Award

By Jean Kiddoo,
Chair of the Incentive Auction Task Force,
Federal Communications Commission







For the Federal Communications Commission (FCC), receiving the 2018 Franz Edelman award was a tremendous honor. We competed against industry giants who had developed innovative and groundbreaking solutions to solve challenging operational problems. Winning the Edelman after competing against these impressive co-finalists showed the world that the brilliant group of optimization and analytics professionals we brought together from across various academic and consulting firms, together with our own dedicated team of spectrum policy and engineering experts, used highly sophisticated, and in many cases breakthrough techniques to accomplish what most people considered to be an impossible task – the world's first two-sided spectrum "Incentive Auction." This auction reclaimed radio frequency spectrum from television broadcasters to meet exploding demand for mobile broadband, 5G, and other wireless services. Preparing for the Edelman competition pushed us to focus on the magnitude of the challenges our team had faced and how many innovative methodologies and calculations had been accomplished, and winning it put a global spotlight on our achievement.

The auction was an audacious concept. Never before had anything like it been attempted, and while it sounded great in theory, planners knew that it would take a herculean effort to plan and design all of the new algorithms, heuristics, and other tools that would be needed to undertake a spectrum auction. It required the creation of a totally new simultaneous two-sided exchange where what was being sold was not what was being bought, and where the collection of goods

within both the "Buy" and the "Sell" markets were heterogeneous. Overcoming the many challenges required the analysis of massive amounts of data, the creation of complex optimization and feasibility models, new solution techniques, and the determination of appropriate policy objectives to serve American consumers, the wireless industry, and television broadcasters.

Notwithstanding the skeptics who said it couldn't be done, the auction was a huge success and the post-auction transition of nearly 1,000 television stations to new frequencies to accommodate the 84 megahertz of spectrum made available to wireless carriers for new mobile broadband services is now underway. The auction generated gross revenue of nearly $20 billion, providing more than $10 billion in capital for the broadcast television industry and more than $7 billion for federal deficit reduction.

Confidence of bidders in the FCC's auction processes is critical to our success in using auctions as a tool to make precious spectrum available. The Edelman Award confirmed to the world at large just what kind of groundbreaking science it took to achieve the Incentive Auction and, even more importantly, that the FCC is able to marshal the expert resources necessary to develop breakthrough auction-design approaches previously considered computationally infeasible. The Incentive Auction will have a lasting effect on future FCC auctions and the Federal Communication Commission's overall approach to integrating data analytics and operations research into its policymaking.

To illustrate just a few:

- **The FCC is continuing to use incentive auctions for other frequency spectrum bands.** On November 20, 2018, FCC Chairman Ajit Pai announced that "[t]oday, I'm circulating an order that would enable the Commission to move forward with an auction of the Upper 37 GHz, 39 GHz, and 47 GHz bands by the end of 2019. In combination, the Upper 37 GHz and the 39 GHz bands offer the largest amount of contiguous spectrum in the millimeter-wave bands for flexible-use wireless services—a total of 2,400 megahertz—and the 47 GHz band will provide an additional 1,000 megahertz of millimeter-wave spectrum for such services. Notably, this would be the second time the Commission uses an incentive auction format. And combined, all of these auctions will free up more spectrum than is currently used to provide terrestrial mobile broadband by all providers combined."

- **The FCC has created an Office of Economics and Analytics (OEA).** On December 11, 2018, Chairman Pai announced the official opening of the FCC's Office of Economics and Analytics and stated that this new office will help consistently and thoroughly incorporate economic and data analysis into the policymaking work of the agency. He also stated that the "FCC's Chief Economist and Chief Technology Officer (CTO), who traditionally have served on term assignments (e.g., one year), also would be based in OEA and report to the Chairman while working on a day-to-day basis with OEA staff."

- **The FCC is continuing the work on the phased-transition.** The operations research team continues to be involved in the phased-transition plan for moving television stations from their current channel assignments to new assignments. In a public notice dated February 11, 2019, the FCC announced: "Significant progress has been made, and the transition is ahead of schedule both in terms of the number of stations that have already vacated their pre-auction channels and the amount of 600 MHz spectrum that has been cleared and therefore made available for use by wireless auction winners."

Operations research and data analytics have become an integral part of the Federal Communications Commission's approach to policymaking and problem solving, and we deeply appreciate the Edelman Award affirmation of the extraordinary caliber of our Incentive Auction team.

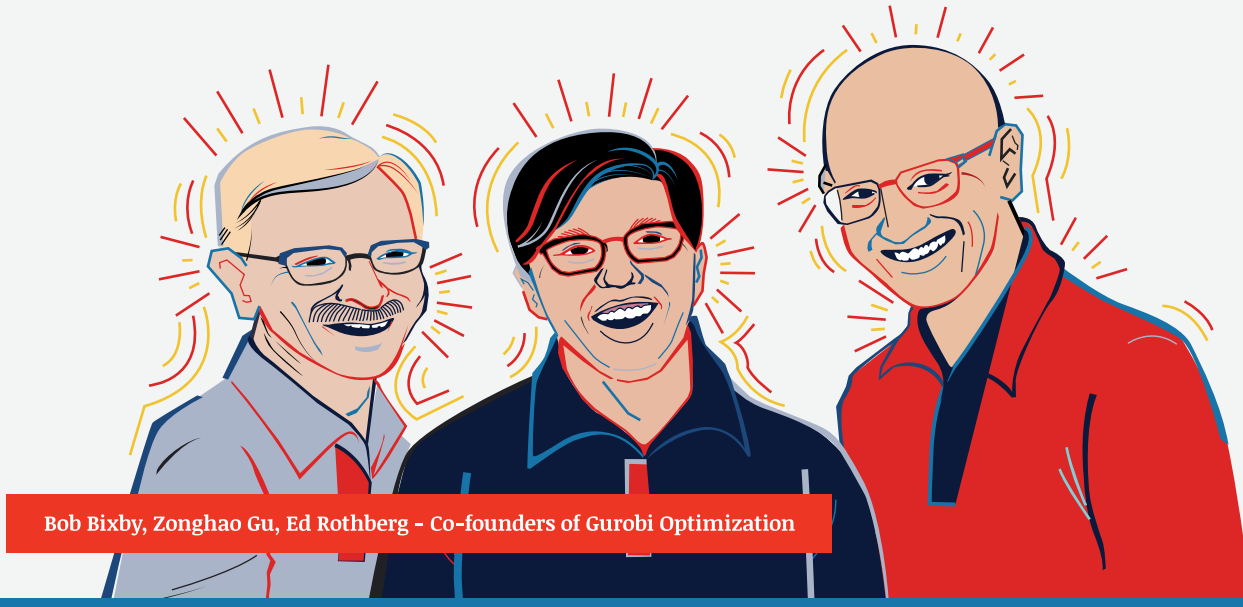
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OPERATIONS RESEARCH: BILLIONS AND BILLIONS OF BENEFITS!

By Jeffrey M. Alden, GM Analytics Research

Over 292 billion U.S. dollars of impact! That's impressive! How were they estimated? How broad is the impact? Is there more?

Since 1974, the Edelman finalists publish their project accomplishments in the *INFORMS Journal on Applied Analytics* (formerly *Interfaces*). While reviewing the 278 articles, their cumulative monetary impact was estimated under the following guidelines:

- Be objective and make conservative assumptions.
- Include reported impact plus at most two more years of anticipated impact.
- Include only one year of enormous impact (10s of billions) to downplay the huge size and budget of some organizations.
- Ignore relative impact even though saving $10 million for a small company may be more impressive than saving $100 million for a large company.

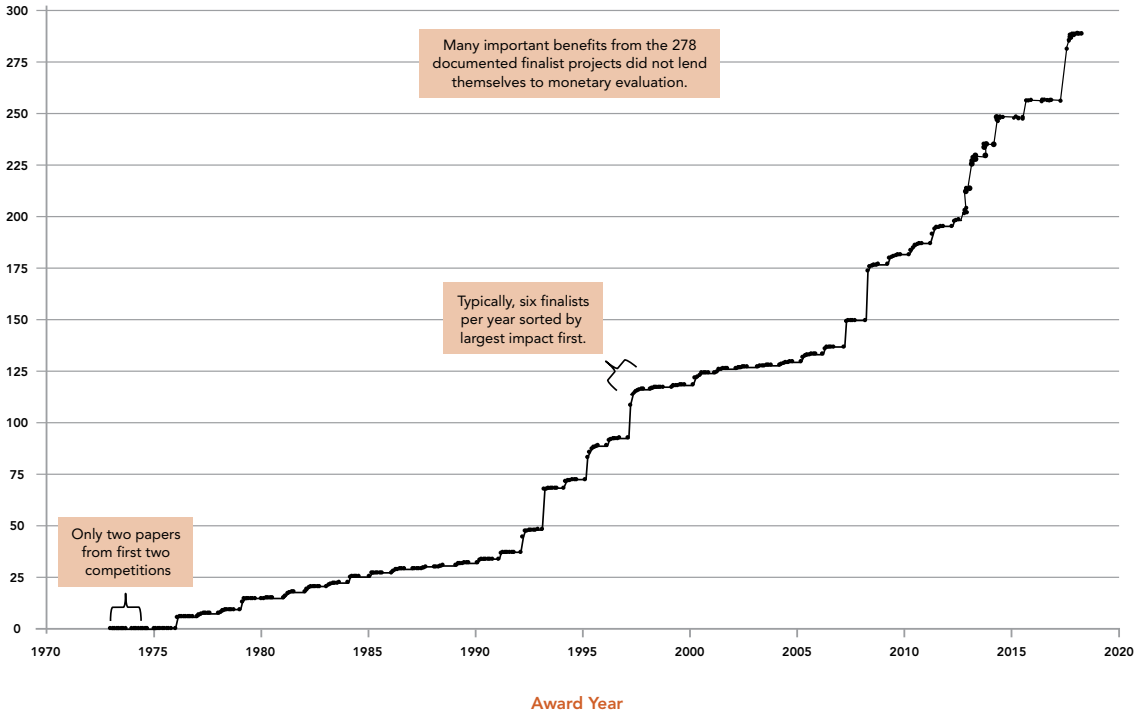
These conservative guidelines do not include many important yet difficult-to-quantify reported benefits like better legal dispute resolution, cancer treatments, airline security, epidemic disease control, organizational structure, on-time railway performance, and space shuttle heat shielding. For example, there are more than 20 finalist papers with significant life and health benefits. Most are difficult to quantify, however, a CDC project on (future) U.S. epidemics expects annual savings of 6,000 lives valued at $12B[1] and one U.S. Army project estimates 4,500 avoided casualties by reducing requirements for helicopter and ground-convoy movements[2]. Almost all finalist papers report nonmonetary benefits and frequently tout them as most important and longer lasting by establishing, for example, ongoing practices and organizational changes that improve health, safety, cooperation, decision making, and job satisfaction. Great! Clearly, reported monetary benefits greatly understate the full impact of the Edelman finalist projects.

Another important indication of the influence of operations research (O.R.) is the impressive breadth of applications. The Edelman finalists represent over 138 different application areas including air traffic, banking, canal operations, communications (broadband, broadcasting, radio spectrum), consumer products, crowd control, delivery (express, truck), defense (Air Force, Army), education, financial (pension, investment, credit card, settlement, fraud), fire protection, forestry, healthcare (blood collection, cancer, diagnosis, disease control, elderly, hospital, medical displays, pharmaceutical, surgery), hotel management, energy production and distribution (coal, gas, electric, oil, nuclear), land use, manufacturing (electronics, food, paper, seeds, steel, tires, vehicles, wood), marketing, mining, printing, sanitation, security (airport, police), senior housing, social networks, sports, tax collection, transportation (airline, highway, railway, rental, outer space), treasure hunting, waste management, water (resources, quality, flow, flood), and weapons dismantlement. The list goes on and on! In fact, 721 organizations[3] from business, government, and academia are recognized and honored as supporting or benefiting from finalist projects.

Finally, the O.R. impact reported here is just the "tip of the iceberg" because the Edelman

Benefits over $292 Billion from Edelman Finalist Projects 1972 through 2018

(Conservatively quantified benefits, realized plus at most two years anticipated, in 2019 U.S. dollars)



competition only captures those O.R. professionals choosing to compete! Just think, the more than 1,300 Edelman finalist authors[4] represent only 10% of the current INFORMS membership. Undoubtedly, there is a vast number of O.R. projects with significant impact that did not compete due to confidentiality, lack of internal support to compete (e.g., no one thought of it, too busy, no management support, inadequate documentation), or the team was simply unaware of the competition.

The impact is immense! O.R. professionals should be proud of their profession—you can say "billions and billions" when asked about the value of O.R.!

---

1 For CDC: 6000 lives/year ≈ 314M U.S. population * 5% epidemic penetration * 10% die under current practices * (1-80% fatality reduction under improved practices) * 1 epidemic per 200 years. Value of quality year of life in U.S. is $2M / average life ≈ $50K/year (a standard value) * 78 years life expectancy * 50% average life lived. Total expected annual impact is $12B = 6,000 * $2M. See "Advancing Public Health and Medical Preparedness with Operations Research," *Interfaces*, Vol. 43, No. 1 (note Figure 6). Numbers are reasonable values offered by the author.

2 "Bayesian Networks for Combat Equipment Diagnostics," *Interfaces*, Vol. 47, No. 1.

3 Some organizations and contestants have competed multiple times and are counted more than once.

4 Interesting how the average number of authors per paper has grown from 1.8 over first 10 award years (1974–1982) to 8.2 over last 10 award years (2009–2018). Linear regression gives 0.16 annual growth in average authors per paper with $R^2 = 0.80$.

FRANZ EDELMAN AWARD







RECOGNIZING AND REWARDING REAL ACHIEVEMENT IN O.R. AND ANALYTICS

The Franz Edelman Award competition is administered by the Practice Section of INFORMS

For more than 45 years, the international Franz Edelman competition award has shined a spotlight on the most outstanding real-world applications of operations research (O.R.) and analytics that are transforming our approach to some of the world's most complex problems.

Every year, organizations from around the world, both large and small, profit and nonprofit, business and governmental, private and public, compete for the Edelman Award. The common theme shared by all selected finalists is having realized substantial

benefits, from life-saving medical advancements to millions in cost savings and efficiency gains, from the practical application of advanced methods of operations research and analytics.

Rich with insightful research, the abstracts from Edelman finalist papers are shared online through the *INFORMS Journal on Applied Analytics* (formerly *Interfaces*) and full-text versions of some of these papers are available in an online archive. In addition, video of past competition presentations can be found in the INFORMS Video Learning Center, and serve as valuable tools for teaching, marketing, or publicizing O.R. practice successes.

The history of the Edelman Award predates that of INFORMS. In 1972, The Institute of Management Sciences (TIMS), together with its College on the Practice of Management Science (CPMS), created the competition. In 1986, the award was renamed in honor of one of the earliest industry practitioners of O.R. in North America, Franz Edelman. When TIMS merged with the Operations Research Society of America to create INFORMS in 1995, the Edelman Award became the flagship event in a growing awards program.

Born in Germany not long before Hitler came to power, Franz Edelman encountered much adversity at a young age. After fleeing the Nazi regime in the late 1930s, a teenage Franz Edelman found himself in England, where his alien status resulted in internment and he was sent to Canada for an interlude of lumberjacking. After overcoming these obstacles, he received his undergraduate education at McGill University, and later earned a PhD in applied mathematics from Brown University. He then joined the RCA Corporation as an engineer concentrating on computational topics. While his earlier efforts focused on physical science problem solving, he rapidly began to envision the extreme value of computer systems that could assist with management and business operations. By the early 1950s, this insight led him to establish RCA's legendary Operations Research Group, one of the first such groups in a North American corporation.

As he continued to advance the O.R. profession, Franz Edelman advocated that success in operations research requires IT excellence in computer software, computer hardware, and communications. His passion for IT ultimately led him to his new role as vice president of Business Systems and Analysis for RCA, responsible for IT as well as O.R. These ideals are still very much present in our current focus on "analytics" and "business intelligence," where strong analysis combines with strong IT.

After 30 years of service to RCA, Franz Edelman retired and formed Edelman Associates, an O.R. consulting firm. Throughout his career, Franz's commitment to advancing O.R. and his positive influence on others enhanced his legacy as a leader in the field of O.R. practice. Shortly after his death, the Franz Edelman Award was named in his memory and today continues to advance the operations research practice to which he contributed so much.



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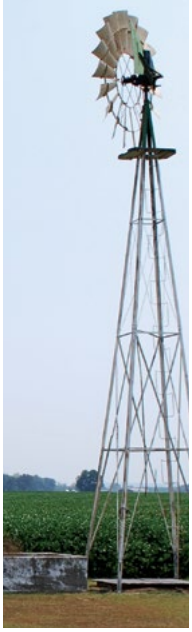
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EDELMAN FIRST-PLACE AWARD RECIPIENTS

2018 **Federal Communications Commission**
"Unlocking the Beachfront: Using Operations Research to Repurpose Wireless Spectrum"

2017 **Holiday Retirement**
"Revenue Management Provides Double Digit Revenue Lift for Holiday Retirement"

2016 **UPS**
"UPS On-Road Integrated Optimization and Navigation (ORION) Project"

2015 **Syngenta**
"Good Growth through Advanced Analytics"

2014 **U.S. Centers for Disease Control**
"Eradicating Polio Using Better Decision Models"

2013 **Delta Programme Commissioner**
"Economically Efficient Flood Standards to Protect the Netherlands Against Flooding"

2012 **TNT Express**
"Supply Chain-Wide Optimization at TNT Express"

2011 **MISO**
"MISO Applies Operations Research to Energy Ancillary Services Markets, Unlocking Billions in Savings"

2010 **Indeval**
"Mexican Financial Markets Benefit from Novel Application of Operations Research"

2009 **Hewlett-Packard**
"HP Transforms Product Portfolio Management with Operations Research"

2008 **Netherlands Railways**
"The New Dutch Timetable: The O.R. Revolution"

2007 **Memorial Sloan-Kettering Cancer Center**
"Operations Research Advances Cancer Therapeutics"

2006 **Warner Robins Air Logistics Center**
"Warner Robins Air Logistics Center Streamlines Aircraft Repair and Overhaul"










2005 **General Motors**
"Increasing Production Throughput at General Motors"

2004 **Motorola, Inc.**
"Reinventing the Supplier Negotiation Process at Motorola"

2003 **Canadian Pacific Railway**
"Perfecting the Scheduled Railroad: Mode Driven Operating Plan Development"

2002 **Continental Airlines**
"A New Era for Crew Recovery at Continental Airlines"

2001 **Merrill Lynch, Inc.**
"Pricing Analysis for Merrill Lynch Integrated Choice"

2000 **Jeppesen Sanderson, Inc.**
"Flexible Planning and Technology Management at Jeppesen Sanderson, Inc."

1999 **IBM**
"Extended Enterprise Supply Chain Management at IBM Personal Systems Group and Other Divisions"

1998 **Bosques Arauco, S.A.**
"Use of O.R. Systems in the Chilean Forest Industries"

1997 **Societé Nationale des Chemins de Fer Français and Sabre Decision Technologies**
"Schedule Optimization at SNCF: From Conception to Day of Departure"

1996 **South African National Defense Force**
"Guns or Butter: Decision Support for Determining the Size and Shape of the South African National Defense Force"

1995 **Harris Corporation/ Semiconductor Sector IMPReSS**
"IMPReSS: An Automated Production Planning and Delivery-Quotation System at Harris Corporation—Semiconductor Sector"

1994 **Tata Iron & Steel Company, Ltd.**
"Strategic and Operational Management with Optimization at Tata Steel"

1993 **AT&T**
"AT&T's Telemarketing Site Selection System Offers Customer Support"

1992 **New Haven Health Department**
"Let the Needles Do the Talking! Evaluating the New Haven Needle Exchange"

1991 **American Airlines**
"Yield Management at American Airlines"

1990 **Health Care Financing Administration**
"Diagnosis Related Groups: Understanding Hospital Performance"

1989 **ABB Electric, Inc.**
"A Choice-Modeling Market Information System That Enabled ABB Electric to Expand Its Market Share"

1988 **City of San Francisco Police Department**
"A Break from Tradition for the San Francisco Police: Patrol Officer Scheduling Using an Optimization-Based Decision Support System"

1987 **Syntex Laboratories, Inc.**
"Sales Force Sizing and Deployment Using a Decision Calculus Model at Syntex Laboratories"

1986 **Southland Corporation (CITGO Petroleum Corporation Subsidiary)**
"The Successful Deployment of Management Science throughout CITGO Petroleum Corportation"

1985 **Weyerhaeuser Company**
"Weyerhaeuser Decision Simulator Improves Timber Profits"

1984 **Blue Bell, Inc. (dual)**
"Blue Bell Trims its Inventory"













1984 **The Netherlands Rijkswaterstaat & the RAND Corporation (dual)**
"Planning the Netherlands' Water Resources"

1983 **Air Products and Chemicals, Inc.**
"Improving the Distribution of Industrial Gases with an On-Line Computerized Routing and Scheduling Optimizer"

1982 **Arizona Department of Transportation**
"A Statewide Pavement Management System"

1981 **ANR Freight System**
"From Freight Flow and Cost Patterns to Greater Profitability and Better Service for a Motor Carrier"

1980 **Kelly-Springfield Tire Company**
"Coordinating Decisions for Increased Profits"

1979 **The Greater New York Blood Program**
"The Long Island Blood Distribution System as a Prototype for Regional Blood Management"

1978 **Cahill May Roberts, Ltd.**
"A Planning System for Facilities and Resources in Distribution Networks"

1977 **Syncrude Canada, Ltd.**
"Simulation of Tar Sands Mining Operations"

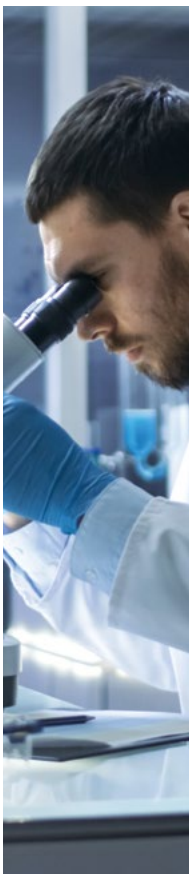
1976 **American Telephone & Telegraph**
"The Use of Management Science in Making a Corporate Policy Decision–Charging for Directory Assistance Service"

1975 **Xerox Corporation**
"Management Science's Impact on Service Strategy"

1974 **Canadian National Energy Board**
"Management Science in Energy Policy: The Trans Canada-Great Lakes Transmission Case"

1973 **The Babcock & Wilcox Company**
"Planning Nuclear Equipment Manufacturing"

1972 **The Pillsbury Corporation**






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THE FINEST STEP FORWARD: THE JOURNEY TO THE FRANZ EDELMAN AWARD



Each spring, the Franz Edelman Award for Achievement in Advanced Analytics, Operations Research, and Management Science is presented to just one remarkable candidate selected from a pool of incredibly accomplished finalists, in a culmination of what may represent years of research and hard work for that organization. For INFORMS too, the selection process begins long before the award is ever presented.

Each September, INFORMS issues a call for entries, and ultimately nearly two dozen organizations from around the world provide a brief summary illustrating a practical operations research (O.R.) application in which the results had significant, verifiable, and quantifiable impact for the organization.

The Franz Edelman Award Committee is composed of nearly four dozen O.R. practitioners and academics from leading O.R. programs, including BNSF Railway, Hewlett-Packard, Boeing, General Electric, General Motors, New York City Police Department, SAS, University of Maryland, UPS, and the Ivey School of Business. By November, this committee will have narrowed the applicant field to a group of semifinalists, and by the end of the year, six will be recognized as Edelman Award finalists.

Prior to being named finalists, each entry will be carefully reviewed by a team of verifiers, who work with the relevant stakeholders to validate the details of their award entry. The verifiers will thoroughly examine the O.R. work presented in the assigned entry summary, as well as its potential impact, and convey this information to the rest of the selection committee. The verifiers communicate directly with the entrant's O.R. team, the users of the work, and client management. Verification is a crucial step in the competition as it ensures that only the highest-quality O.R. will be represented in the Edelman Award competition. All verifiers follow detailed written guidelines and sample verification reports, to ensure a thorough process that is identical for each award entry.

Once the Edelman Award Committee has announced the six entries that will advance to the finals, each finalist will prepare a journal-quality paper and a 40-minute presentation that will be conducted during the INFORMS Conference on Business Analytics and Operations Research in April. A team of experienced coaches is assigned





to each finalist team to guide them throughout each step of the process, and help ensure the team's paper and presentation will convey the significance and monumental impact of the work to the panel of judges.

Two months prior to the INFORMS Conference on Business Analytics and Operations Research, during which the final stage of the competition will be held and the winner announced, the finalist papers are presented to the judges, who will begin the long review process. Each judge studies the papers independently, and provides input to a group discussion. The finalists are each assigned a focal point judge who conveys valuable feedback from the judging committee to the finalist's coaches. This feedback helps each team identify areas with potential for clarification or improvement prior to the final presentation.

On the day of the competition, each team will conduct a 40-minute presentation, followed by a 10-minute period of questioning by the judges. As they assess each presentation, the judges will follow a strict set of guidelines, including the importance of the application, the novelty and portability of the technical solution, the quality and effectiveness of the implementation, and the total impact of the project in both quantitative and qualitative terms. Once the final presentation is complete, the judges sequester themselves to carefully review all they have heard and seen, until they agree on which finalist team best exemplifies the ideals and standards of the Franz Edelman Award and its legacy that represents more than 45 years of O.R. and analytics excellence.

Following the competition, the incredible achievements of all the finalists will be showcased in the January/February issue of the *INFORMS Journal on Applied Analytics* (formerly *Interfaces*) which is dedicated to improving the practical application of O.R. to decisions and policies in today's organizations and industries. In addition, the competition is filmed and all presentations are made available via streaming video shortly after the end of the meeting. All finalists will again be invited to reprise their work at a session of the INFORMS Annual Meeting in the fall, which attracts more than 6,000 analytics professionals and academics from around the world. The first-place team will also conduct a keynote address during that meeting.

THE 2019 SELECTION COMMITTEE & VERIFIERS

We wish to thank the following individuals for their dedication and service as Selection Committee members and as verifiers for this year's Edelman Award.



Each of the semifinalists is assigned a verifier who works behind the scenes, often with an associate verifier, to validate the claims made by their entry. A verifier's primary role is to understand an applicant's O.R. work and its impact in detail, and then convey this to the rest of the committee, both orally and in a written report. Verification is a crucial element of the competition because it ensures that only the highest-quality O.R. and analytics work with verified impact makes it to the Edelman Award finals.

- Layek Abdel-Malek, *New Jersey Institute of Technology, v*
- Susan Albin, *Rutgers University*
- Jeffrey M. Alden, *General Motors, v*
- Sudharshana Apte, *Altria Client Services, v*
- Sharon Arroyo, *The Boeing Company*
- Carrie Beam, *University of Arkansas, v*
- Peter C. Bell, *Ivey Business School at Western University, v*
- Sudip Bhattacharjee, *University of Connecticut, v*
- John R. Birge, *University of Chicago*
- Ann Bixby, *Aspen Technology, v*
- Srinivas Bollapragada, *General Electric, v*
- J. Antonio Carbajal, CAP, *iHeartMedia*
- Manoj Chari, *SAS Institute, v*
- Pallav Chhaochhria, *McKinsey & Company, v*
- Walt DeGrange, CAP, *CANA Advisors, v*
- Pooja Dewan, *Otis Elevator*
- Howard Finkelberg, *Principal*
- Kenneth Fordyce, *Arkieva, v*
- Arnold Greenland, CAP, *University of Maryland, v*
- Sidney Hess
- Yoshiro Ikura, *SAITECH, Inc, v*
- Ananth Iyer, *Purdue University*
- Shailendra Jain, *Hewlett Packard Enterprise, v*
- Burcu Keskin, *University of Alabama, v*
- Russell P. Labe, CAP, *RPL Analytics Consulting*
- Evan Levine, *New York City Police Department*
- Grace Lin, *Asia University, v*
- Irvin Lustig, CAP, *Princeton Consultants, v*
- Douglas Matty, *U.S. Army*
- R. John Milne, *Clarkson University*
- Sven Müller, *European University Viadrina, Frankfurt (Oder), v*
- Patricia Neri, *SAS Institute, Inc.*
- Ranganath Nuggehalli, CAP, *UPS*
- Pelin Pekgun, *University of South Carolina, v*
- Graham Rand, *Lancaster University*
- Olga Raskina, *Juno Therapeutics, v*
- Anne G. Robinson, *Kinaxis*
- Maytal Saar-Tsechansky, *University of Texas at Austin*
- Harrison Schramm, CAP, *CSBA, v*
- Kendra Taylor, *KEYfficiencies, Inc.*
- Michael Trick, *Carnegie Mellon University in Qatar*
- Rajesh Tyagi, *GE Global Research, v*
- Andres Weintrab, *University of Chile, v*
- Peiling Wu-Smith, *General Motors*

"v" Indicates Verifiers





THE 2019 COACHES & JUDGES

We wish to thank the following individuals for their dedication and service as coaches and judges for this year's Edelman Award.

The role of the coach is to ensure each team's paper and presentation conveys the work in a manner that may be well understood by a general operations research audience. Often a coach is paired with an associate coach who lends another perspective to the process.

The judges must work together, evaluating the evidence to determine which finalist is most deserving of the Franz Edelman Award for Achievement in Advanced Analytics, Operations Research, and Management Science. The award is for implemented work that has had significant, verified, and preferably quantified impact.

Coaches

- Layek Abdel-Malek, *New Jersey Institute of Technology*
- Jeffrey M. Alden, *General Motors*
- Sudharshana Apte, *Altria Client Services*
- Carrie Beam, *University of Arkansas*
- Sudip Bhattacharjee, *University of Connecticut*
- John R. Birge, *University of Chicago*
- Ann Bixby, *Aspen Technology*
- Walt DeGrange, CAP, *CANA Advisors*
- Irvin Lustig, CAP, *Princeton Consultants*
- Sven Müller, *European University Viadrina, Frankfurt (Oder)*
- Harrison Schramm, CAP, *CSBA*
- Rajesh Tyagi, *GE Global Research Center*

Judges

- Pooja Dewan, Chair; *Otis Elevator*
- J. Antonio Carbajal, CAP, *iHeartMedia*
- Manoj Chari, *SAS Institute*
- Michael F. Gorman, *University of Dayton*
- Arnold Greenland, CAP, *University of Maryland*
- Patricia Neri, *SAS Institute*
- Pelin Pekgun, *University of South Carolina*
- Julie Swann, *North Carolina State University*
- Michael Trick, *Carnegie Mellon University in Qatar*

University of CINCINNATI
CENTER FOR BUSINESS ANALYTICS

The Center for Business Analytics congratulates the

2019

Franz Edelman Award Finalists

- Boston Public Schools
- IBM
- Louisville Metropolitan Sewer District and Tetra Tech
- Microsoft
- Spanish Aviation Safety & Security Agency
- Vattenfall

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THE EDELMAN LAUREATES

The men and women who author Edelman finalist papers are deemed Franz Edelman Laureates.

Authors of finalist papers to be published in *INFORMS Journal on Applied Analytics*, (formerly *Interfaces)*, are recognized as laureates and formally presented with the Franz Edelman Medal.

Laureates are recognized for their significant contributions to work that was selected to represent the best applications in the world of analytical support for decision making. Laureates are expected to serve as role models and exemplify that challenges can be met and innovative applications of analytics can help every organization.

The Laureate recognition is distinct and separate from membership in the Franz Edelman Academy.

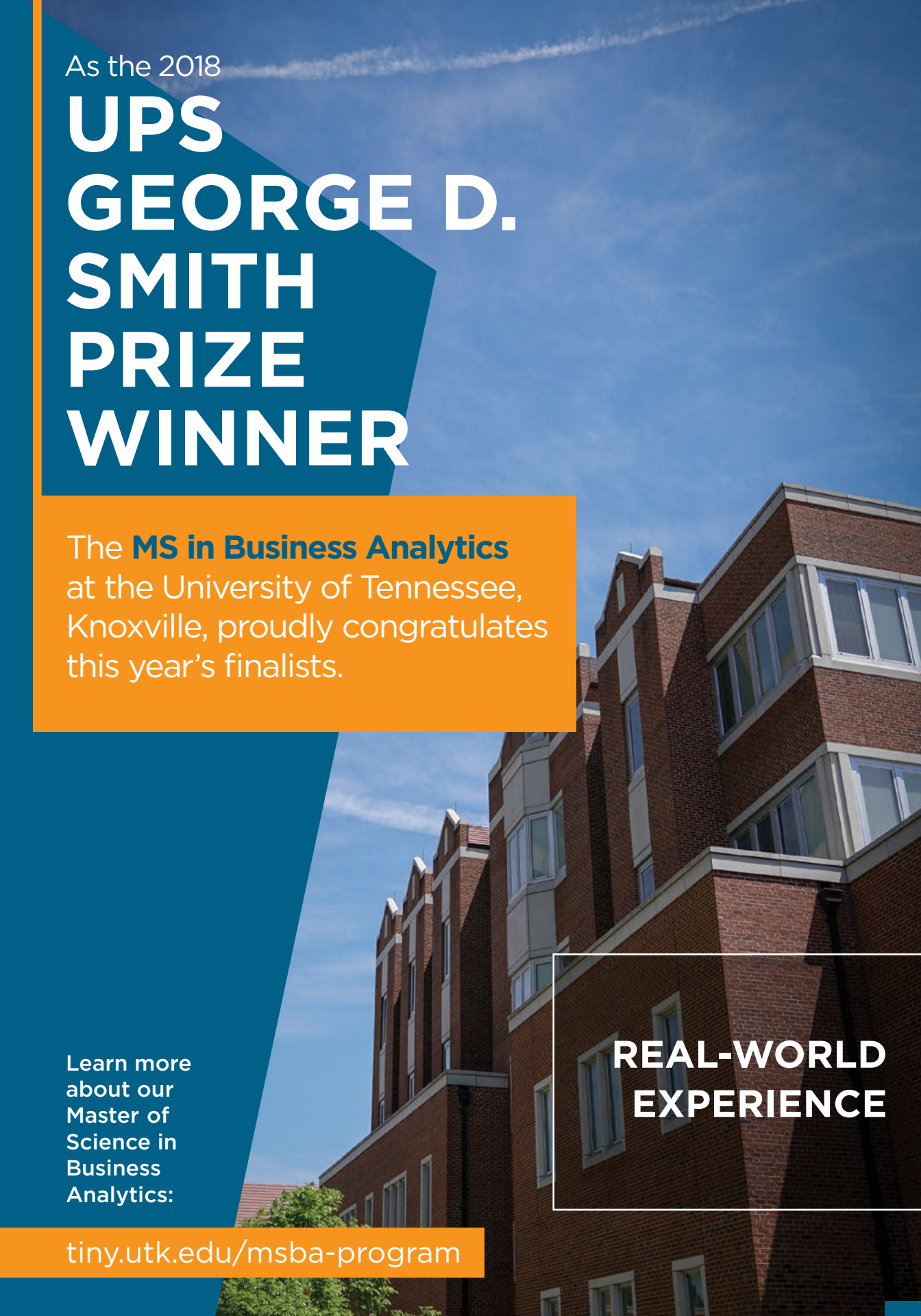
THE EDELMAN ACADEMY

Each year, participating organizations are inducted as members of the Franz Edelman Academy.

The primary client organization, or beneficiary of the finalist work, is inducted into the Academy at the annual Edelman Gala.

In addition, organizations that played a major role in the work, and therefore deserve academy membership, may also be inducted. The most common example would be an organization that provided the professionals who did the majority of the analytical work.

The membership of the Franz Edelman Academy represents 48 years of extraordinary contributions to society through the innovative application of operations research and advanced analytics.


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Congratulations!

AIMMS is proud to support INFORMS and the Edelman Gala. Congratulations to all of the outstanding finalists!

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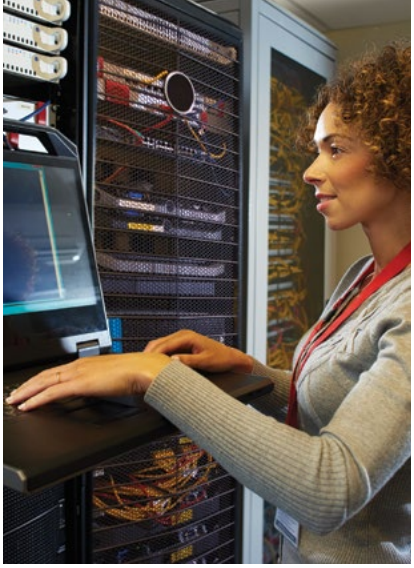
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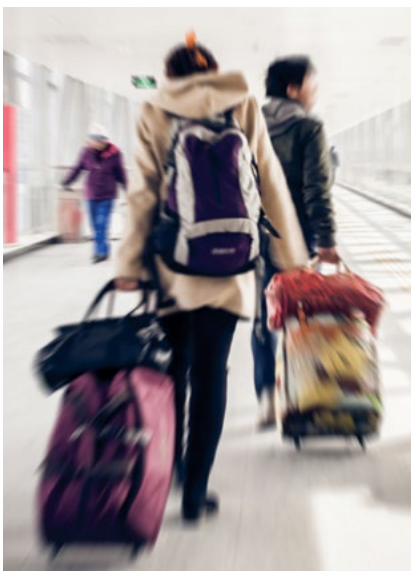
THE 2019 FRANZ EDELMAN AWARD FINALISTS

- **Boston Public Schools**
- **IBM**
- **Louisville Metropolitan Sewer District and Tetra Tech**
- **Microsoft**
- **Spanish Aviation Safety & Security Agency (AESA)**
- **Vattenfall**

Introduced in the pages that follow are the six finalists for the 2019 Franz Edelman Award. Over the past several months these teams have demonstrated to the selection committee that their work is among the finest examples of operations research practice in the world. One of these organizations will be recognized as the best in class, the first-place recipient of the 2019 Franz Edelman Award.

Each finalist's work is described here in a shortened summary. Full papers will be published in the January/February 2020 issue of *INFORMS Journal on Applied Analytics* (formerly *Interfaces*). This INFORMS journal is dedicated to improving the practical application of operations research and advanced analytics in today's organizations and industries.











BOSTON PUBLIC SCHOOLS

Optimized School Bus Routing Helps School Districts Design Better Policies

Boston Public Schools (BPS) is responsible for the education of over 54,000 mostly low-income and minority students. Boston's narrow streets and traffic combined with the district's generous levels of school choice, legally mandated transportation services for non-district schools, and other factors result in the country's most expensive public school transportation system. Within this system, constructing and managing school bus schedules is complicated and time-intensive, typically requiring a team of 10 working overtime for two months. The result of that process, even when using the best bus routing systems available, was invariably an inefficient set of bus routes and unnecessary costs.

To address this problem, BPS took the unusual step in April 2017 of hosting a "transportation challenge." With support from Google, Microsoft, and private

donors, BPS published a list of routing constraints and approximations of students' addresses, and asked for a system of routes. The winning team from the MIT Operations Research Center proposed a creative algorithm that could route 25,000 students in 30 minutes, compared to 3,000 hours for human experts. Its solutions promised potential savings of up to 20 percent, and outperformed current state-of-the-art algorithms by 10 percent.

BPS used this algorithm for the first time in the summer of 2017, resulting in a 7 percent reduction in the BPS bus fleet (50 buses), representing an estimated $5 million in annual transportation savings without increasing the average student's home-to-stop walking distance or ride time. This was the single largest bus fleet reduction in BPS history – larger than when BPS shifted 8,000 7th and 8th graders from bus service to public transportation. The algorithm has now been implemented for two years running and continues to be improved as BPS and MIT work toward refining time performance and generating savings to reinvest into classrooms.

In addition to creating more efficient bus operations, automated routing gave BPS the ability to evaluate the transportation costs of previously untested policy ideas, including shifting school locations, adjusting rider eligibility rules, or changing school start and end times. Like most other districts, BPS staggers the start and end times of different schools to allow buses to serve multiple schools during the day. Because of this, the system is so interconnected that small tweaks often have significant transportation implications. In 2016, a change to one school's start time caused an unexpected cost increase of more than $1 million. Being able to understand the implications of proposed changes can help BPS and other districts avoid unintended costs by giving them the ability to easily run accurate simulations – something that to date no school district transportation system can reliably do.

Adjusting schools' start times is a challenge for school districts across the country. A growing body of research has found that too-early school starts have been linked to teen health issues including obesity, depression, and traffic accidents. The American Academy of Pediatrics issued a public report calling for teenagers to start their school day after 8:30am, while a 2015 CDC report found that just 17.7 percent of U.S. high schools comply, a reality that could cost the U.S. economy more than $80 billion over the next decade. Yet an inability to quickly and easily run simulations to understand transportation implications from a new set of start times has hindered districts in finding and moving to an optimal set of bell times.

Exploring adjustments to BPS' current start and end times had vexed the BPS Transportation Department and multiple outside partners for years: no one, in academia or industry, had ever jointly solved school bus routing and bell time selection. However, working with BPS, the MIT team created an innovative optimization tool that could handle the task. Specifically, the tool could find and evaluate bell time assignments on the efficiency frontier of several criteria determined by community feedback. These new bell times ultimately did not become a reality for a number of reasons, but the effort showed the potential for using an algorithm to solve a seemingly intractable public policy dilemma.

Since developing these new operations research tools, the MIT team has contributed to a growing national conversation about school start times. In September 2018, they provided data for the *Boston Globe's* top-trending interactive article "The Equity Machine," which allowed readers to visualize the policy tradeoffs of different bell time scenarios. In solving a problem widely considered impossible, operations research has surged to the front of the national debate about school start times. Though bell times in Boston have not changed, the Boston School Committee approved a new policy that explicitly outlines quantifiable objectives that future bell time assignments should seek to optimize. Buoyed by media coverage (*Wall Street Journal*, NPR, *The Boston Globe*), the MIT team has been solicited by dozens of policymakers at the state and local levels, leading to the development of a new software system for school transportation and policy by Dynamic Ideas, a company started by

Dimitris Bertsimas. Dynamic Ideas is currently in talks with almost 30 districts (and directly partnering with three) across 17 states to implement routing and/or bell time solutions.

By producing innovative solutions to one of the field's oldest and most difficult problems (vehicle routing) and one of its newest (start time selection), BPS and MIT have created a blueprint for the role of operations research in addressing complex and important public policy problems.



ORGANIZATIONS

Boston Public Schools

Boston Public Schools (BPS), the first school district in the United States, currently serves approximately 55,000 students across 124 schools making it the largest school district in New England and one of the 100 largest school districts nationally. BPS students are predominantly Hispanic (42 percent) and Black (34 percent). Two-thirds of BPS students receive some form of state aid, one-third is currently English learners, and one-fifth has a disability. A total of 25,000 of these students rely on a fleet of over 600 buses, traveling 45,000 miles across Boston, to get to and from school each day. BPS Transportation runs this fleet, which represents 10 percent of BPS' $1.3 billion annual budget.



Massachusetts Institute of Technology (MIT)

The Massachusetts Institute of Technology (MIT) is one of the world's leading research universities, enrolling over 10,000 graduate and undergraduate students in top-ranked programs in science and engineering, as well as in architecture, management, humanities, and social sciences. MIT's primary purpose is teaching and research – with relevance to the practical world and transforming society for the better as guiding principles. The Operations Research Center (ORC) is the oldest graduate program in operations research in the United States. The ORC is home to over 130 graduate students and 50 affiliated faculty, with a focus on impacting society via research by solving some of the world's most significant problems.







IBM

Analytics and O.R. for IBM's IT Service Deals

IBM Services designs, builds, and runs the foundational systems and services that is the backbone of the world's economy. In part of their business, IBM Services competes in a tender kind of process to win complex multimillion-dollar IT service contracts. In response to clients' requests for proposals (RFPs) for IT services, IBM Services and other service providers prepare and submit solution proposals to the client. Clients short-list a number of providers and engage with them through due diligence and intense negotiations (that could last up to a year) to select a final winner for the bid.

Given the business value at stake, the conventional approach to prepare a proposal and negotiate it involves resource-intensive complex activities and decision-making. This calls for a strong demand to bring in data-driven analytics and operations research (O.R.). The team at IBM Research (the innovation engine of the IBM Corporation and the largest industrial research organization in the

world) has partnered with stakeholders in IBM Services and developed an innovative analytical ecosystem that transforms subjective, time-consuming business judgments into informed decisions based on data-driven insights.

The tools in the built ecosystem start with one that aims at automatically and cognitively processing the RFP drafted by the client using customized text analytics and natural language processing techniques to extract client requirements. Therefore, instead of relying on experts manually processing an RFP (which could be hundreds of pages) for a few days or weeks, the developed tools can now accurately do this in a matter of minutes. The extracted requirements are then mapped to IBM's service offerings to fulfill them, via some optimization techniques. Then, instead of relying on human subjective estimation of the costing and pricing of the determined services, the second tool uses data analytics to mine historical and market data to accurately estimate the costs.

O.R. revenue management techniques are then used to come up with the optimal pricing. The developed costing and pricing tools allow for fast re-pricing and re-costing accounting for the continuous changes that occur during the negotiation process with clients. Market benchmarking is also done via analytical techniques mining market data, allowing the business to ensure competitiveness of the bids.

Since IBM Services manages a pipeline of multiple deals simultaneously, predicting the status and outcome of each deal is vital to effectively manage that pipeline and align sales force resources. Instead of subjectively indicating such status, a win prediction tool is developed. The tool performs data analytics on both structured attributes of deals and the unstructured data of the seller comments (meeting minutes with clients) during the negotiation process.

All tools were developed, implemented, and deployed for the business. There were challenges related to data collection, resistance to change, and adoption. The team was able to overcome all of these challenges and the tool ecosystem has resulted in significant business usage and both quantitative and qualitative impacts. IBM has calculated the quantifiable impact as follows: First, we compared the win rates vertically and horizontally to determine if there was an increase in win propensity through use of the tools.

Vertically, we compared average win rates of transactions that used our tools compared to historical average win rates before the tools were deployed, for the same geography (and other fixed factors). IBM realized a significant average percentage increase of double digits in win rate of latter transactions relative to former ones [i.e., ((average latter win rates - average former win rates) / average former win rates) is a double-digit percentage].

Horizontally, we compared the win rates for transactions that used the developed tools to those that did not, for the same geography (and other fixed factors) for each year among the years in which the tools were deployed. Similar to the vertical analysis, there was an average percentage increase of a double digit in win rate of latter transactions relative to former ones. IBM then applied this win rate differential to the value of transactions that used the tools, determining the benefit of the higher win rate to be about $350 million. Other qualitative benefits include the significant productivity gains resulting from the higher speed IBM Services now processes RFPs.

IBM considers the developed tools to be highly innovative as evidenced by filing with the United States Patent and Trademark Office over a dozen patent applications, as well as the publication of 19 academic papers and articles in top venues. The tools also have a high potential for being reused in similar contexts for tender-like kind of businesses such as the construction industry, medical service contracts, and financial service outsourcing contracts.

ORGANIZATIONS

IBM Research

IBM Research is the innovation engine of the IBM corporation. It is the largest industrial research

organization in the world with more than 3,000 researchers in 12 labs across six continents. IBM Research plays the long game, investing now in tomorrow's breakthroughs. Watson, the world's first cognitive system, is the fruit of over 50 years of IBM research in artificial intelligence (AI). Today, it forms a core part of IBM's business. IBM's scientists are charting the future of AI, breakthroughs like quantum computing, how blockchain will reshape the enterprise and much more. IBM is dedicated to applying AI, analytics, and science to industry challenges, whether it's discovering a new way for doctors to help patients, teaming with environmentalists to clean up our waterways or enabling retailers to personalize customer service.



Scientists from IBM Research have produced six Nobel Laureates, 10 U.S. National Medals of Technology, five U.S. National Medals of Science, six Turing Awards, 19 inductees in the National Academy of Sciences, and 20 inductees into the U.S. National Inventors Hall of Fame.



IBM Services

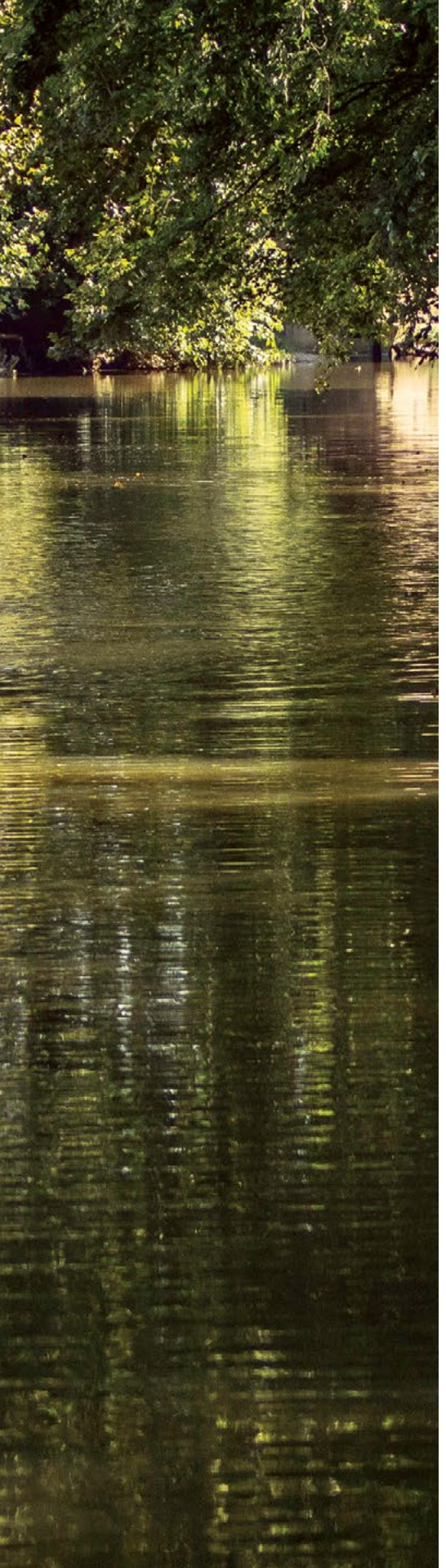
IBM Services designs, builds, and runs the foundational systems and services that is the backbone of the world's economy. IBM Services partners with the world's leading companies to build smarter business by reimagining and reinventing through technology, with its business insights, industry-leading portfolio and world class research and operations expertise leading to results-driven innovation and enduring execution.

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IBM Services' clients represent the cornerstones of their industries and include 4 of the top 5 airlines by revenue, 8 of the 10 leading mobile operators, 8 of the 10 largest automobile manufacturers, 4 of the 10 largest global retailers, 7 of the 10 biggest insurance companies, and the world's 10 largest banks are among IBM's assets.





LOUISVILLE METROPOLITAN SEWER DISTRICT AND TETRA TECH

Protecting Community Waterways: Applying Analytics, Optimization, and Real Time Control for the Efficient Operation of Sewer Networks

Louisville and Jefferson County Metropolitan Sewer District (MSD) in Kentucky uses operations research and analytics to optimize its sewer management. This smart approach allows MSD to have fewer overflows during rainfalls while reducing the storage facilities required and saving the community over $200 million to date. MSD protects the community's overall health and safety by providing clean waterways and managing flood and drainage issues across the 376 square miles of the Louisville Metro area. MSD operates and maintains extensive and very complex sewer, storm and floodwall systems,

with more than 3,200 miles of sewer lines, five regional wastewater treatment plants, over 280 pump stations, 27 long-term stream water quality monitoring stations, as well as the Ohio River Flood Protection System.

With increasingly intense and more frequent rainfall, urban wastewater collection and treatment systems are often inundated during large rainfall events and generate overflows of untreated sewerage and stormwater. To address the many challenges of reducing overflows to improve water quality and considering the financial limitations of a nonprofit regional utility service, MSD has a progressive vision for total wastewater system optimization that requires innovative operation approach and analytics.

Louisville MSD was one of the early adopters of real time control (RTC) in the nation, applying inline storage since the 1990s. In partnership with Tetra Tech, MSD pioneered the application of model predictive RTC using Csoft®, Tetra Tech's innovative software solution to provide system-wide optimization, which has been in operation since 2006. Initial RTC feasibility studies identified a relatively low unit cost for overflow reduction that is 4–10 times lower than the cost of constructing traditional storage solution alternatives.

Tetra Tech started the development of the RTC software solution in the mid-1990s, to efficiently manage sewer networks in real time based on rain forecasts, model predictions, and sensor readings. It is applied as a more adaptable and robust solution complementary to the traditional engineering methods to address the various challenges in urban water management, such as sewer overflows, stormwater runoff, water quality, flooding, and drought, exacerbated by climate change in recent years.

The solution uses a hydrologic and hydraulic model and mixed-integer linear programming, allowing the full use of system capacity, while reducing additional infrastructures required to achieve multiple operational and environmental objectives. This unique solution has been successfully implemented in other communities in the United States, Canada, and France, saving each client between 25 and 75 percent in capital expenditures to address pollution and flood control objectives.

The Louisville RTC system with Csoft® to automate decisions for storing or routing flows in the sewer has been implemented in phases. Current reductions show it stores or mitigates more than two billion gallons per 2001 Typical Year of combined sewer overflows. Incorporating RTC into the MSD's Integrated Overflow Abatement Plan has resulted in approximately $200 million in savings to date, compared to traditional methods.

Once all planned storage projects are constructed, RTC will allow MSD to eliminate or capture and treat 98 percent of combined system flow, up from approximately 60 percent prior to RTC and the implementation of the overflow abatement plan. RTC is an important component of Louisville MSD's long-term plan to mitigate untreated



combined sewer overflows into Beargrass Creek and the Ohio River. It provides an innovative, cost-effective, and sustainable management strategy that helps to satisfy regulatory requirements while also improving overall sewer system operability.

ORGANIZATIONS

Louisville MSD

Louisville MSD manages wastewater, drainage, and flood protection for the Louisville Metro-area—24 hours a day, every day of the year—to achieve safe, clean waterways for the community. The Louisville/Jefferson County Metropolitan Sewer District (Louisville MSD) works to achieve and maintain clean, environmentally safe waterways for a healthy and vibrant community.

The organization's more than 650 employees provide wastewater management, drainage, and food protection services across the 376 square miles of Louisville Metro. In addition to operating and maintaining Louisville Metro's sewer system, floodwall system, water quality treatment centers, and flood pumping stations, MSD invests in hundreds of infrastructure improvement projects each year. It also plants more than 1,000 trees and other vegetation annually to enhance water filtration and reduce runoff, and provides numerous outreach programs to inform and educate the community about protecting our waterways.

Tetra Tech, Inc.

Tetra Tech is a leading global provider of consulting and engineering services. It is differentiated by *Leading with Science*® to provide innovative technical solutions to clients. Tetra Tech supports commercial & government clients focused on water, environment, infrastructure, resource management, energy, and international development. With over 17,000 associates worldwide, Tetra Tech provides clear solutions to complex problems.







MICROSOFT

Prospective Dynamic Fraud Control for Optimal Profitability in e-Commerce

Today's digitally transformed enterprise conducts most of its business online and in real time, with little human intervention. This reduces costs, improves the customer experience, and drives increased revenue. In particular, e-commerce has caused a tectonic shift in the retail landscape, with sales estimated to reach $3.9 trillion worldwide by 2020 at a compound annual growth rate (CAGR) of 19.2 percent. Agile merchants who embrace the new world of omnichannel customer experience survive and thrive, while those who are slow to adapt face existential difficulties.

However, it is also true that e-commerce exposes the merchant to serious threats from sophisticated bad actors who take advantage of the relative anonymity and ease of the online channel to defraud and abuse it, such as using compromised accounts and stolen payment instruments to commit payment fraud. As one of the largest e-commerce merchants in the

world, Microsoft derives a significant portion of its $100+ billion revenue from online sales. Over the years, Microsoft has faced, and successfully controlled, these e-commerce fraud challenges by implementing a fraud protection system with high availability and low latency that enables the organization to securely process millions of transactions every day.

The challenges faced by e-commerce merchants from fraudsters are numerous and continually changing as fraudsters adapt to existing fraud deterrent methods. Fraudsters actively attempt to stay below the radar of fraud detection systems and change their attack vectors as soon as those systems start getting good at thwarting them. Hence, merchants are under constant threat from innovation by fraudsters. One critical challenge stems from dynamic fraud patterns, a consequence of the changing behavior of fraudsters as well as legitimate shoppers. This leads to a deterioration of the performance of the fraud detection models because of feature staleness and model droop.

A second major challenge comes from the drawbacks of locally optimal decisions. First-generation fraud detection systems focused on keeping fraud loss at small levels and did not pay much attention to the opportunity loss due to false positives. Second-generation systems did somewhat better. They optimized the choice of the static decision thresholds applied on the fraud probability assessed by the fraud models, with a view to achieve a balance between fraud loss and opportunity loss, thus maximizing total instantaneous profitability. However, the underlying assumption remained that the environment was quasi-static and described by long-term average measures. These locally optimal decision policies belied the dynamic nature of the fraud environment and ignored the multiple feedback interaction loops involved between the decision of the risk model and the follow-up decisions made by other associated parties such as issuing banks and manual reviewers.

Microsoft developed Prospective Dynamic Fraud Control, a next-generation fraud detection system, to combat the multiple challenges associated with fraud prevention. Microsoft addressed dynamic fraud patterns by taking a self-adaptive approach to modeling and mitigated feature staleness by developing an innovative feature-generation system that incorporated multiple features. These include real-time archiving, dynamic risk features with fraud feedback, and fraud island linkage features from a knowledge graph. To address the problem of model droop, Microsoft developed customized long-term and short-term sequential machine learning (ML) models. The long-term model is used to catch the general trend of fraud and is trained biweekly on at least one year of data with confirmed fraud labels, giving greatest accuracy, stability, and seasonal coverage. This long-term model score is then passed as a feature into the short-term model, which, in contrast, is optimized to quickly react to emerging fraud patterns without impacting overall performance (learning new patterns without forgetting old ones). It is trained on the most recent data with both confirmed and unconfirmed fraud labels.

Microsoft solved the problem of locally optimal decisions in a systematic way by taking an operations research approach. Rather than viewing the decision thresholds for the risk score as semi-static parameters, Microsoft treated them as knobs of a multistage decision-making system with feedback that they could control dynamically. This novel framework quantifies the interactions between the decisions made by different parties in the decision flow and can adjust fraud control strategies based on the availability of data attributes and labels. It applies data analytics and dynamic optimization techniques, called Prospective Control Modeling, to make automated decisions (approval, rejection, manual review) for each individual transaction. The current decision is based not only on the features of the current transaction (such as its risk score, cost, and margin) but also on the expected profit of the transactions in a future period of interest that will be impacted by the current decision. The Prospective Control Model is trained using fully matured data of past transactions, partially matured data of recent transactions, and the predicted future outcomes. The gold function, which gives the joint probability of risk decisions of various parties and fraud outcomes conditioned

on the ML fraud score, is then used to estimate the expected total profit of each decision. Microsoft uses real-time greedy heuristics to update the estimation of the gold functions, thus making the system purely data-driven and self-adaptive.

The impact of these innovations on Microsoft's business has been very significant. Over a two-year period (end of 2016 to end of 2018), Microsoft dramatically reduced the company's fraud loss rate resulting in $75 million in savings. Over the same period, Microsoft also reduced the false positive rate by 138 basis points and increased the bank acceptance rate of legitimate purchases by 770 basis points, generating significant additional revenue by avoiding wrongful rejection of transactions. Microsoft selectively employs manual reviews on transactions that involved physical goods or products with high cost of goods/high-risk, and even in that category, the review rate has been driven down from 5.3 to 1.26 percent.

With such strong success in fraud protection in our own e-commerce systems, and because the new cloud-based system is very portable, Microsoft has been encouraged to make it available to its enterprise customers, to help other digitally transformed enterprises to fight fraud while keeping their doors open for legitimate transactions. Microsoft is currently involved in a private beta program with select merchants and banks, with plans to launch a preview product called Microsoft Dynamics 365 Fraud Protection in April 2019.

ORGANIZATION

Microsoft

Microsoft is a technology company whose mission is to empower every person and every organization on the planet to achieve more. We strive to create local opportunity, growth, and impact in every country around the world. Our strategy is to build best-in-class platforms and productivity services for an intelligent cloud and an intelligent edge infused with artificial intelligence (AI). We develop, license, and support a wide range of software products, services, and devices that deliver new opportunities, greater convenience, and enhanced value to people's lives. Our platforms and tools help drive small business productivity, large business competitiveness, and public-sector efficiency. They also support new startups, improve educational and health outcomes, and empower human ingenuity.









SPANISH AVIATION SAFETY & SECURITY AGENCY (AESA)

RIMAS – Safer Skies in Spain

Aviation is a key transportation means in modern societies. Safety is the main property for its sustainable growth and development. Organizations involved in aviation have been dealing with the prevention of accidents from the early days of this industry. Since its creation in 1945, the International Civil Aviation Organization (ICAO) has centered interests in making aviation the safest transportation mode. In particular, the ICAO mandates its signatory countries to develop their own State Safety Programme (SSP) for aviation. In Spain, AESA (Agencia Estatal de Seguridad Aérea), the Spanish Aviation Safety and Security Agency, is in charge of the coordination and impulse of the SSP and its related Safety Action Plan. Aviation service providers like airlines, aerodromes, or air navigation providers are required to have their

own Safety Management System (SMS). These SMSs are integrated in the SSP and aligned with SSP objectives.

The AESA Safety Analysis division in charge of SSP activities assigned to AESA, wanted to go beyond the available risk management standards based on risk matrices and decided to partner with the Spanish Royal Academy of Sciences to improve state-of-the-art approaches. As a consequence, a rigorous methodology for risk management in aviation safety at state level was required, facilitating decision support to make civil aerial operations in Spain safer.

The final aim of RIMAS, the methodology and decision support system developed, is to facilitate optimal safety resource allocation of inspection resources to make accidents and incidents of various types less likely and less harmful should they happen in civil aviation operations in Spain. This is a very complex system entailing the coordination of more than 2.5 million operations and 250 million passengers per year, about 50 airports, 44 airlines, 213 aerial works companies, 4,000 aircrafts, and more. Even though there have been no fatal accidents involving commercial passenger airlines, annually there are about 30,000 safety occurrences with roughly 0.1 percent of accidents. Spain considers 88 types of occurrences (bird strike, motor failure, runway excursion, etc.) of five severity levels, considering four classes of aircrafts. Aviation safety management in Spain is based on trying to minimize fatalities, injuries (severe and minor), induced delays and cancellations, repairs and destructions of aircrafts, and image costs.

RIMAS is a truly groundbreaking approach to aviation safety at state level, based on the application of numerous advanced–some innovative–O.R. techniques from decision and data sciences. It transcends the simplistic risk management tools, which are standard in the industry. RIMAS entailed the use of numerous advanced analytics methods to: forecast incidents, their severities and (multiple) impacts; assess such impacts; track and monitor aviation safety, launching alarms as required; screen the most worrisome occurrences; support safety resource allocation; and last, but not least, better support safety reporting.

Because of the complexity of the methodology, the R-based RIMAS decision support system was developed to facilitate its implementation within the agency with the corresponding training courses. RIMAS covers all the stages of the approach, from web scrape and data load, to exploratory analysis, to forecasting, going through optimization, visualization, and reporting.

Through the application of advanced O.R. and analytics, AESA is now capable of better supporting and documenting their decisions and discussing them more convincingly with the numerous stakeholders involved (air carriers, airport service providers, other national aviation safety agencies, etc.). RIMAS has led to changes in aviation procedures and practice and, through



them, to outstanding improvements in lives and aircrafts saved, accidents avoided, and cost reductions.

ORGANIZATIONS

Agencia Estatal de Seguridad Aérea (AESA)

AESA is the state agency that ensures compliance with Civil Aviation Regulations in the aeronautical sector of Spain and it has the mission of supervision and inspection of air transport, air navigation, and airport security. In addition, it assesses air transport safety through the detection of threats, the analysis and evaluation of risks, and a continuous process of risk control and mitigation. It is also empowered to sanction violations of civil aviation regulations. AESA works to implement a safety culture, to promote the development, establishment and application of national and international aviation safety legislation and protect passenger rights, all with the aim of achieving a safe, efficient, quality, respectful with the environment, accessible, and fluid air transport. AESA wants to be a model institution for society, providing security, quality, and sustainability to the national and international civil aviation system and serve as a reference for Europe.

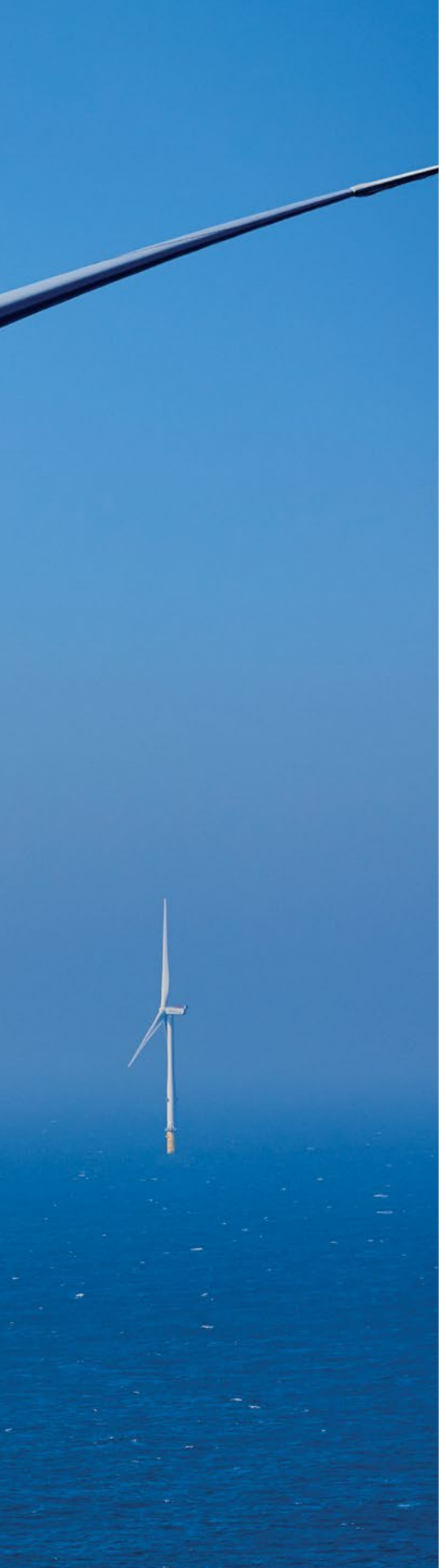
Real Academia de Ciencias Exactas, Físicas y Naturales

The Spanish Royal Academy of Sciences is the most distinguished scientific institution in Spain, covering the areas of mathematical sciences, physics, chemistry, biology, and geology. It includes 54 national members, 108 national corresponding members, and about 100 foreign members. It provides scientific advice on policymaking as well as on science policy to the Spanish national and regional governments. It also maintains the national scientific terminology.






VATTENFALL



VATTENFALL

Operations Research Optimizes Offshore Wind Farm Design and Enables a Fossil-Free Future

Wind energy is a fast-evolving field that has attracted a lot of attention and investments over the past decades. The development into a more mature and competitive market makes reduction of costs and maximization of power production imperative already in the design phase of new wind farms.

Vattenfall is one of Europe's major producers of electricity and heating with strong presence in Denmark, Finland, the Netherlands, Germany, United Kingdom, and Sweden. The energy company is among the leading developers of offshore wind energy.

Vattenfall has introduced operations research (O.R.) methods to identify the optimal location of wind turbines in a given site in order to maximize performance and ultimately profits, while reducing costs.

By focusing on two complex components of offshore wind farm design, namely wind turbine location and routing for offshore electrical cables, Vattenfall is able to maximize its power output, expand its pipeline, and is on track to reach its target of enabling fossil-free living within one generation.

Until a few years ago, O.R. had never been used in the wind farm design process. However, the results obtained are extremely successful: Savings between $11.3 million to nearly $16 million have been achieved when designing each individual wind farm. If the new O.R. tool is applied to the 6.5 GW production capacity of offshore wind farms in Vattenfall's pipeline, the savings add up to more than $169 million.

Previously, wind farm design at Vattenfall was a multistep process depending heavily on standard tools and the experience of the engineers. A preliminary layout was generated, checked for certain factors, adapted, passed to another team for checking and adaptation of other factors, and so on. This manual process was time consuming and might even cancel out the previous work done on optimization of other factors.

With the new tool the process is streamlined, as all factors are coded into the optimizers, which delivers optimized layout and cable routing to be evaluated by experts in the final business case. The developed O.R. models and algorithms are now fully integrated within Vattenfall's wind farm design process, allowing not only for large gains, but also for a more agile overall design process. The optimizer has been used on a number of real-world farms, such as Kriegers Flak in Denmark and Hollandse Kust Zuid in the Netherlands, among others.

The use of the O.R. tools for what-if analyses led to the establishment of a new "scenario" team, where different layout options for future farms are quickly evaluated and more informed decisions are made. The optimizer also gave momentum to Vattenfall's experts, allowing them to think out of the box, testing entirely new ideas and solutions by running the optimizer with various design factors as input.

The availability of such comprehensive optimization tools helps Vattenfall to test new ideas and alternative options straight away, and to quantify the impact of new design choices from the very first stages, which would not be possible in the more manual process.

In addition, Vattenfall can now identify which new components create the most value for



the company, and feed that information to the suppliers, which indirectly has a significantly high value. Thanks to this newly gained understanding, Vattenfall can now engage with suppliers in a novel way and drive innovation in a structured and value-oriented way, supporting the overall offshore wind business.

ORGANIZATIONS

Vattenfall

Vattenfall is a leading European energy company and among the largest electricity and heat producers on the continent with 6,450,000 electrical customers. For more than 100 years, Vattenfall has electrified industries, supplied energy to people's homes, and modernized energy use through innovation and cooperation. Vattenfall is a leading offshore wind energy developer with major offshore wind farms in operation and under construction. Vattenfall is passionate about driving the transformation of the energy sector and has an ambition to enable fossil-free living within one generation. Offshore wind energy is a cornerstone in realizing this ambition. The company has approximately 20,000 employees in Sweden, Germany, the Netherlands, Denmark, the United Kingdom, and Finland.

DTU Management Engineering

The Department of Management Engineering at Technical University of Denmark (DTU) is one of the leading operations groups in Europe. The group has a holistic approach to operations research by covering all phases from problem analysis to algorithm development. DTU has a fruitful collaboration with the industry on developing solutions for the green transition, and optimization techniques play a central role in reaching these goals.

Department of Electrical, Electronic, and Information Engineering (DEI), University of Bologna, Italy

The Alma Mater Studiorum – Università di Bologna (UNIBO) was founded in 1088 and is, thus, the oldest university in the Western world. UNIBO is one of the most important institutions of higher education in EU with more than 87,000 enrolled students, and is extremely active in research and technology transfer. The Operations Research group of the Department of Electrical, Electronic, and Information Engineering (DEI) at UNIBO has an internationally recognized visibility in the design and implementation of solution algorithms for combinatorial optimization problems, with special emphasis on real-world applications, like cutting and packing, routing, energy systems, telecommunications, and transportation.



THE WAGNER PRIZE





DANIEL H. WAGNER PRIZE HISTORY

For Excellence in Operations Research Practice

The Wagner Prize is awarded annually in honor of the late Dr. Daniel H. Wagner. During his years as president and principal owner of Daniel H. Wagner Associates, Dr. Wagner brought many high-quality mathematicians into the operations research community. This led to significant advances in the firm's fields of endeavor and delivery of significant applications to the Navy, Coast Guard, and other clients. Many of the applications are still in service today.

Dr. Wagner earned his PhD in mathematics from Brown University in 1951. His dissertation, "On Free Products of Groups," was published in 1957 in the *Transactions of the American Mathematical Society*. Dr. Wagner joined the Navy's Operations Evaluation Group at the Pentagon, working on operations research for naval warfare. He worked there until 1956, with a one-year leave of absence for postdoctoral research on free algebras at MIT. Dr. Wagner then joined the Burroughs Research Center, where he directed a group of mathematicians performing analysis for the development of digital computers.

In 1957, Dr. Wagner and John D. Kettelle formed the partnership of Kettelle and Wagner, which was dissolved in 1963. That same year, he formed a new company, Daniel H. Wagner Associates, Inc. This company applied itself to cutting edge work in the mathematics of naval tactics, especially antisubmarine warfare, detection theory, and search planning.

After retirement from the firm he founded, Dr. Wagner held various teaching and research positions with the U.S. Naval Postgraduate School and the U.S. Naval Academy.

Dr. Daniel H. Wagner was a member of INFORMS/ORSA for more than 40 years. He passed away in March 1997.

2018 Wagner Prize Committee

- Patricia Neri, Chair; *SAS Institute, Inc.*
- William J. Browning, *Applied Mathematics Associates*
- C. Allen Butler, *Daniel H. Wagner Associates*
- Arnold Greenland, CAP, *University of Maryland*
- Mary Helander, *IBM Research, Retired*
- Mustafa Kabul, *Augmentir*
- Pelin Pekgun, *University of South Carolina*
- Lawrence D. Stone, *Metron, Inc.*
- Aurelie Thiele, *Southern Methodist University*

2018 WAGNER PRIZE FINALISTS

The 2018 Wagner Prize competition took place at the INFORMS Annual Meeting in Phoenix. Six teams gave presentations to the INFORMS Practice Section judging committee seeking to demonstrate that the quality of their analysis in a real-world application qualifies them to win this award for outstanding practice of operations research and advanced analytics.

All finalists' presentations can be viewed at the INFORMS Video Library. A special issue of *INFORMS Journal on Applied Analytics*, (formerly *Interfaces*), will publish the winning paper along with those of the other five finalists listed here.

Centralized Admissions for Engineering Colleges in India

- Surender Baswana, *IIT Kanpur*
- Partha Pratim Chakrabarti, *IIT Kharagpur*
- Sharat Chandran, *IIT Bombay*
- Yash Kanoria, *Columbia Business School*
- Utkarsh Patange, *Alphagrep Securities*

Collaborative Human-UAV Search & Rescue for Missing Tourists in Nature Reserves

- Yu-Jun Zheng, *Hangzhou Normal University*
- Wei-Guo Sheng & Yi-Chen Du, *Zhejiang University of Technology*
- Hai-Feng Ling, *Army Engineering University*

Combinatorial Exchanges for Trading Fishery Access Rights

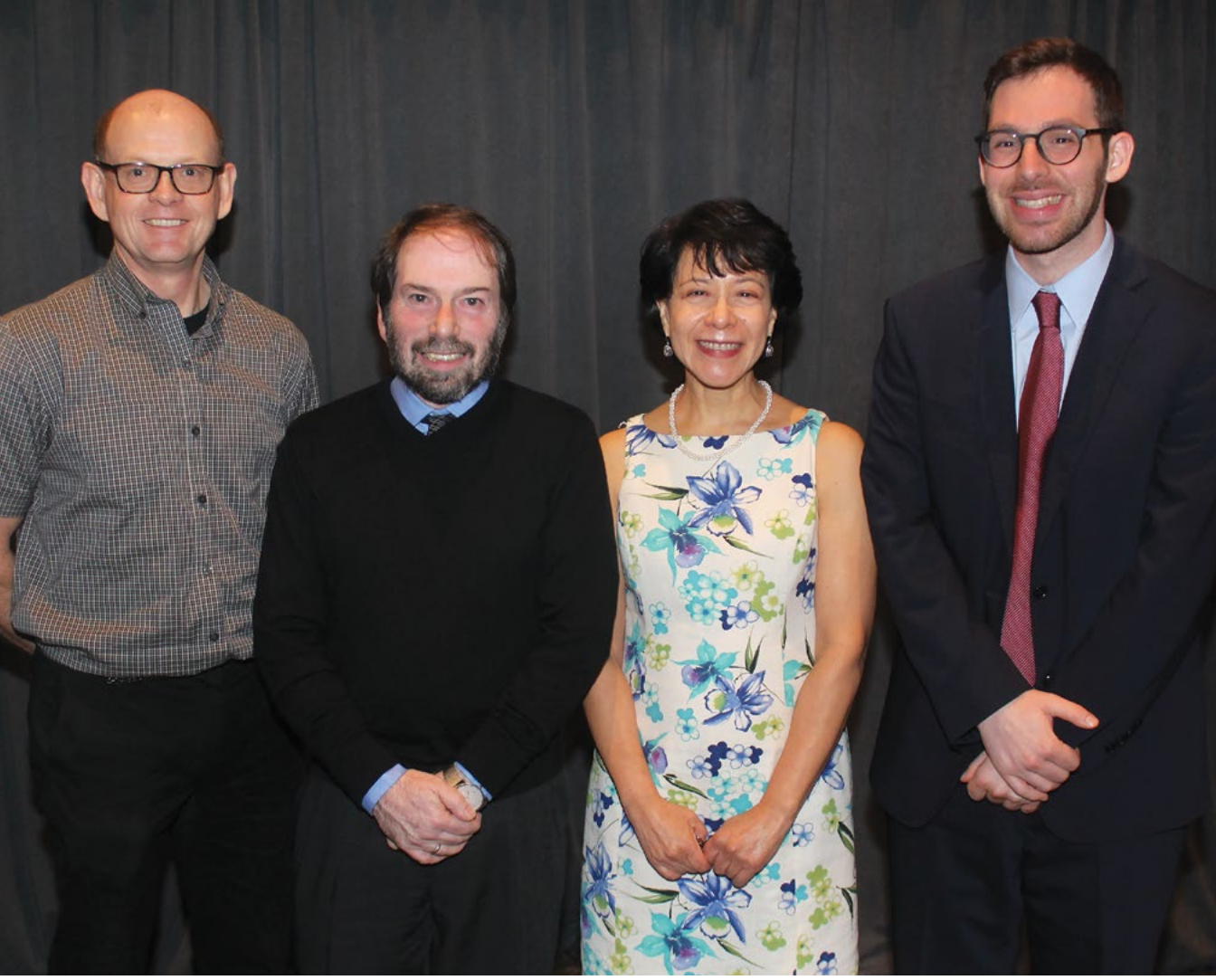
- Martin Bichler & Vladimir Fux, *Technische Universität München*
- Douglas Ferrell, *Department of Primary Industries, Fisheries Analysis*
- Jacob K. Goeree, *University of New South Wales*

Primal-Dual Algorithms for Order Fulfillment at Urban Outfitters, Inc.

- Vivek Farias, *MIT*
- John M. Andrews, Aryan Khojandi, & Chad Yan, *Celect Inc.*

What's Wrong with My Dishwasher: Advanced Analytics Improve the Diagnostic Process for Miele Technicians

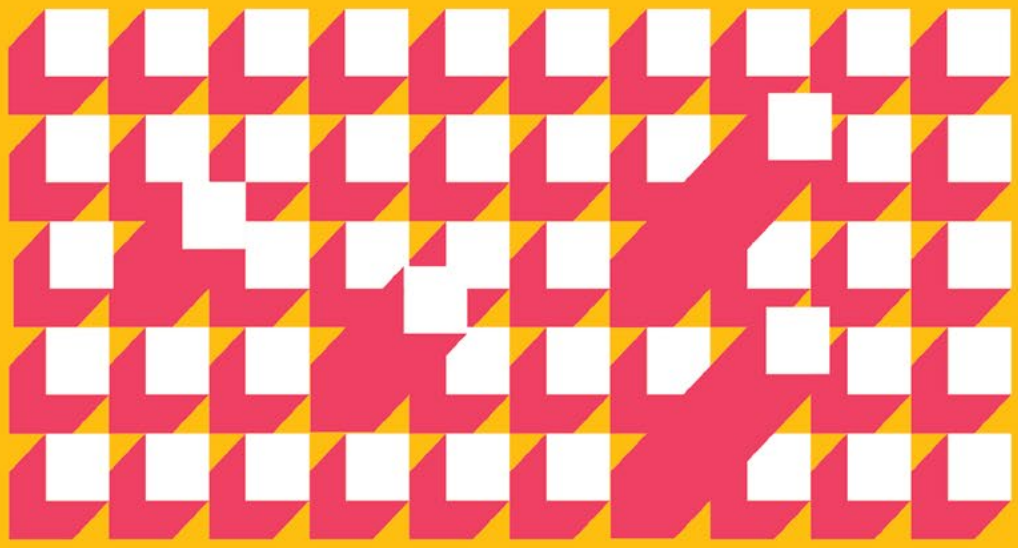
- Segev Wasserkrug, *IBM Haifa Research Lab*
- Evgeny Shindin, *University of Haifa*
- Sergey Zeltyn, *IBM Haifa Labs*
- Martin Krueger, *Miele*
- Yishai Feldman, *IBM Research Lab*



2018 WAGNER PRIZE WINNER

The 2018 Daniel H. Wagner Prize first place winners are Daniel Freund, Shane G. Henderson, Eoin O'Mahony, and David B. Shmoys, Cornell University.

The paper, "Analytics and Bikes: Riding Tandem with Motivate to Improve Mobility," describes how the team worked with Motivate, the operator of the systems in, for example, New York City, Chicago, and San Francisco, to innovate a data-driven approach to manage both their day-to-day operations and several central issues in the design of their systems. This work required the development of a number of new optimization models, characterizing their mathematical structure, and using this insight in designing algorithms to solve them. The team's submission focuses on two particularly impactful projects—an initiative to improve the allocation of docks to stations, and the creation of an incentive scheme to crowdsource rebalancing. Both of these have been fully implemented to improve the performance of Motivate's systems across the country; for example, the Bike Angels program in NYC yields a system-wide improvement comparable to that obtained through Motivate's traditional rebalancing efforts, at far less financial and environmental costs.



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UPS GEORGE D. SMITH PRIZE





UPS GEORGE D. SMITH PRIZE HISTORY

The UPS George D. Smith Prize is awarded to an academic department or program for effective and innovative preparation of students to be good practitioners of operations research, management science, or analytics. It is accompanied by a $10,000 cash award.

The prize committee is pleased to announce the 2019 finalists:

- Department of Operations, Business Analytics, and Information Systems, **University of Cincinnati**
- Department of Decision, Operations & Information Technologies, **University of Maryland**
- Operations and Supply Chain Management Program - Management Science Department, **University of South Carolina**

The UPS George D. Smith Prize is an exciting award created in the spirit of strengthening ties between industry and the schools of higher education that graduate young practitioners of operations research.

This prize has been named in honor of the late UPS chief executive officer who was a patron of operations researchers at the leading Fortune 500 corporation. George D. Smith was the second CEO of UPS, holding the position from 1962 to 1972. He joined UPS as an accountant in 1925 and at some point in his long and illustrious career held almost every functional title within the company.

While his background was steeped in finance, George Smith had a keen engineering mind. In the late 1940s, after learning about operations research, George Smith realized that intuition alone would not be enough to help UPS master the many issues it faced as it grew in size from a regional to nationwide carrier.

George Smith recognized O.R. as an engineering approach to making decisions, and started advocating the use of operations research concepts at UPS. Quantitative analysis became the bedrock on which the UPS engineering function was built. Because of George's vision, UPS now employs thousands of engineers whose focus is efficiency, sustainability, and service.

He was a strong believer in investing in our younger generation. For him, nurturing them was the key to sustained prosperity. This prize embodies George Smith's beliefs: to recognize the importance of operations research in practice, and ensure that members of our younger generation get proper exposure to its value, and in turn benefit society.

2019 UPS George D. Smith Prize Committee

- Rina Schneur, Chair; *ARCKS Productions*
- Hai D. Chu, *Disney*
- Rob Dell, *Naval Postgraduate School*
- Pooja Dewan, *Otis Elevator*
- Harish Krishnan, *University of British Columbia*
- Andy Wasser, *Carnegie Mellon University*
- Haining Yu, *Amazon.com*



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UPS Congratulates the 2019 INFORMS UPS George D. Smith Prize Finalists

For their leadership in strengthening the ties between academia and industry.

Operations, Business Analytics and Information Systems Department, University of Cincinnati

Decision, Operations & Information Technologies Department, University of Maryland

Operations and Supply Chain Program - Management Science Department, University of South Carolina

2019 SMITH PRIZE COMPETITION

Since the earliest days of operations research (O.R.) and analytics, to support the developing technology and research, it became increasingly important to prepare young O.R. and analytics professionals to further the growing impact of these fields. The UPS George D. Smith Prize recognizes the importance of a strong partnership between industry and academia in preparing students to be effective practitioners.

The diversity, quality, and innovation of this year's finalists presented the committee with an encouraging and exciting glimpse of the future of the profession. Tonight, we will not only celebrate the 2019 Smith Prize winner, but also the next generation of O.R. and analytics professionals.

SMITH PRIZE PAST WINNERS

2018 Haslam College of Business MSBA
University of Tennessee

2017 Operations Research Program
United States Air Force Academy

2016 H. John Heinz III College of Information Systems and Public Policy
Carnegie Mellon University

2015 Sauder School of Business
University of British Columbia - Center for Operations Excellence

2014 MIT
Leaders for Global Operations

2013 Department of Operations Research
Naval Postgraduate School

2012 Tauber Institute for Global Operations
University of Michigan

DEPARTMENT OF

Operations, Business Analytics, and Information Systems



The Carl H. Lindner College of Business offers nationally recognized educational programs in operations, business analytics and information systems (OBAIS).

University of Cincinnati Center for Business Analytics

business.uc.edu/analytics-center

The department also houses the industry-supported UC Center for Business Analytics that brings business organizations together with a world-class, multidisciplinary groups of faculty and students, to educate and exchange ideas and best practices on how to apply analytical methods for enhancing business and organizational performance. Center member organizations include more than 25 leading companies, such as Ameritas, Cincinnati Children's Hospital, GE Aviation, Principal Financial, Kroger, P&G, US Bank, Macy's, Cincinnati Reds, Western & Southern, and others.

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  - Operations Management
- Bachelor of Science:
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  - Industrial Management

Undergraduate Minors

- Business Analytics
- Information Systems

Graduate Programs

- Business Analytics
- Information Systems

Graduate Certificates

- Data Analytics
- Data Science
- Enterprise Resource Planning
- Operations Excellence

PhD Concentrations

- Business Analytics
- Information Systems
- Operations Management

MORE INFORMATION:

Michael Fry, PhD
Professor of Operations, Business Analytics and Information Systems
mike.fry@uc.edu
513-556-0404

ROBERT H. SMITH SCHOOL OF BUSINESS

DEPARTMENT OF DECISION, OPERATIONS & INFORMATION TECHNOLOGIES (DO&IT)



The Department of Decision, Operations & Information Technologies (DO&IT) is the largest of six academic departments in the Robert H. Smith School of Business, University of Maryland, College Park, with over 40 full-time faculty in the areas of operations research (OR), operations management (OM), business analytics (BA), and information systems (IS). The roots of the department go back to 1975, when an early OR pioneer, Saul Gass (author of the very first textbook on linear programming, president of the Operations Research Society of America in 1976, and recipient of the Kimball Medal in 1991) was hired to chair what was then known as the Management Science & Statistics department.

PROGRAMS

There are eight programs administered in DO&IT, at the undergraduate, MS, and PhD levels. A common theme running through our programs is to graduate students who are prepared to be successful in the business world through experiential, reality-based learning. Our programs are designed to provide our students with comprehensive training in statistical and quantitative modeling techniques and computational skills needed to become effective practitioners of business analytics and operations research in today's data-driven decision-making environment. Currently, the total number of majors in our undergraduate programs is close to 500 in IS and 300 in OM & BA, and over 200 students entered the two MS programs (combined) in 2018.

FACULTY QUALITY

The strength of the programs relies mainly on the quality of the faculty, and DO&IT faculty cover the entire spectrum of OR/MS, analytics, and information systems. The Smith School faculty were ranked #1 in the category of "faculty quality" by The Economist in 2016 and 2017, and DO&IT has had 5 INFORMS Fellows (including 3 current), two recipients of the INFORMS Prize for the Teaching of OR/MS Practice, and an INFORMS Franz Edelman Laureate.

CENTERS

DO&IT houses two major centers whose missions connect students to OR & analytics practice: the National Center of Excellence for Aviation Operations Research (NEXTOR) and the Center for Health Information and Decision Systems (CHIDS). DO&IT faculty also serve as co-directors of the Center for Digital Technology, Analytics, and Data Science (CTADS), an umbrella center that incudes the Smith Business Analytics Consortium, which hosts an annual conference and a student Datathon.



SELECTED UNDERGRADUATE AND MS PLACEMENTS: POSITIONS & EMPLOYERS



Producing Analytics-Savvy Supply Chain Graduates

In the **University of South Carolina – Operations and Supply Chain Management (USC-OSC) Program at Darla Moore School of Business,** we have carefully designed our curriculum to provide end-to-end operations and supply chain integrating a "business process perspective." We don't produce tools experts, but we produce expert users of tools to improve operations and supply chains.

The USC-OSC program entails OSC domain courses in operations management, strategic sourcing, supply chain management, supply chain planning and control, and service operations management. The pillar of the program is the "business process excellence" course that creates the process world-view of OSC strategies and tactics. It provides a broad and deep understanding of complementary process improvement approaches including Lean and Six-Sigma. And we have implemented a matrix approach to operations research – management science – statistical analytics integration into teaching design and improvement of internal operations and inter-organizational supply chain processes across the domain OSC courses.

Our program has executed an industry-validated companion initiative that has engrained experiential, hands-on OSC capabilities in our students. **There are two industry-facing practical components to this initiative:**

USC-OSC Center: The Center's industry partners participate in USC-OSC Program's Capstone Consulting Projects. The highly competitive course pairs teams of 4-6 seniors with a faculty expert to solve a front-burner live project for the Center partner. To date, the USC-OSC Center has executed 240+ consulting projects in more than 30 partners resulting in client-validated savings approaching $250 million.

Sonoco-USC Lean Six-Sigma Green Belt: We have worked with Sonoco Products Company to jointly certify our Capstone graduates with an industry-validated LSS GB certificate with rigorous project and exam requirements. To date we have certified more than 1,000 graduates.

The 10-year old program has produced several national R. Gene Richter SCM scholarship winners, a consistent Top 15 Gartner Research Ranking, and career placements for graduates into leading global employers *(with premium compensations).*

PROGRAM PARTNERS / EMPLOYERS

3M • Accenture • adidas • Amazon
Atrium Health • Audi • Bank of America
Boeing • BMW • Bosch • Coca-Cola
Collins Aerospace • Continental Tire
Cummins • Deloitte • Daimler
Delta Airlines • Eastman Chemical
Electrolux • E&Y • GE
Goldman Sachs • Honda • Honeywell
IBM • Intel • Ingersoll Rand
International Paper • Johnson & Johnson
JP Morgan • Lockheed Martin • L'Oréal
Manhattan Associates • McKinsey
McLeod Health • Michelin
Nephron Pharmaceuticals • Pfizer
PwC • Rolls Royce • Raytheon
Schneider Electric • Siemens • Sonoco
Smith & Nephew • Tesla • Textron
Walmart • UPS • UTC

moore.sc.edu **#MooreSchool**

UNIVERSITY OF SOUTH CAROLINA
Darla Moore School of Business



Congratulations to all **2019 Edelman Award finalists.**

Kinaxis. Empowering confident supply chain planning decisions.

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INFORMS PRIZE





INFORMS PRIZE HISTORY

This is the 12th year in which the INFORMS Prize has been honored during the Edelman Gala. While the Edelman Award and the Wagner Prize recognize single projects that demonstrate outstanding accomplishments in O.R. practice, the INFORMS Prize complements them by recognizing long-term, multiproject achievements.

The INFORMS Prize is awarded annually to recognize effective integration of operations research into organizational decision making. The award is given to an organization that has repeatedly applied the principles of advanced analytics in ways that were beneficial, novel, varied, and lasting.



2019 INFORMS Prize Committee

- Mark Gallagher, CAP, Chair; *Air Force Institute of Technology*
- Margery Connor, CAP, *Chevron*
- Dayana Cope, *Disney*
- Pooja Dewan, *Otis Elevator*
- Tarun Mohan Lal, *Mayo Clinic*
- Sanjay Saigal, *University of California, Davis*

INFORMS PRIZE CRITERIA

Variety of Advanced Analytics and O.R. Applications.
Implementations in diverse applications, using a wide set of methods, led to greater opportunities to improve organizational performance.

Strategic Advantage for the Organization.
Analytics and O.R. permeate the parent organization's operations and are considered integral and a source of strategic advantage.

Large Impact.
Over the years the total amount of beneficial impact on the organization has been substantial. This impact was delivered through some one-time and some recurring projects; its amount could be described sometimes by numerical measures and sometimes by statements without numbers.

Model for Success.
The organization provides an excellent example of successful analytics and O.R. practice for others to follow. An important reason for success has been to contribute in a variety of basic functions; for instance, in a business organization these functions likely will include finance, marketing, production, and planning.

Top-Management Endorsements.
Strong submissions include personally written endorsements from top-level executives.

High-Quality Application.
The best applications are well written. And they |are complete, with all supporting references and endorsements included.

INFORMS PRIZE WINNERS

2019 Booz Allen Hamilton

2018 BNSF Railway

2017 The Walt Disney Company & U.S. Air Force

2016 General Motors

2015 Chevron

2014 Mayo Clinic

2013 Ford Motor Company

2012 Memorial Sloan-Kettering Cancer Center

2011 Sasol

2010 Jeppesen

2009 Intel Decision Technologies Group

2008 GE Global Research Risk & Value Management Laboratory

2006 Schneider National, Inc.

2005 Air Products & Chemicals, Inc.

2004 Procter & Gamble

2003 UPS

2002 Hewlett-Packard

1999 IBM

1998 Lucent Technologies

1997 Merrill Lynch Private Client Group

1996 Pfizer Inc

1995 Bellcore

1994 AT&T and US West Technologies

1993 New York City Office of Management and Budget and United Airlines

1992 San Miguel Corporation

1991 American Airlines and Federal Express

Notes: Prior to 1995, the award was called the ORSA Prize. No prize recipients were chosen in 2000 and 2001. To adjust to the new INFORMS Prize presentation schedule, no award was given in 2007.

2019 INFORMS PRIZE WINNER

Booz | Allen | Hamilton®

Booz Allen Hamilton

The 2019 INFORMS Prize is awarded to Booz Allen Hamilton (Booz Allen) for extensively deploying operations research and advanced analytics solutions across all facets of its business. Booz Allen Hamilton is a management and information technology consulting firm headquartered in McLean, Virginia, with more than 25,000 employees and $6.3B in 2018 annual revenue. Founded in 1914, Booz Allen provides a broad range of services and solutions for a diverse base of federal government agencies and top-tier commercial and international organizations. Our business model differs from the past INFORMS Prize awardees in that we predominantly provide operations research (O.R.) externally as a service in addition to using it internally to improve our own business.

In 2013, Booz Allen saw that O.R. talent and solutions, specifically in the areas of data science and machine learning, were becoming increasingly essential to the future of our clients' missions. Recognizing a need, we took the bold step of consolidating our firmwide O.R. talent into a single, centralized organization to enhance cross-disciplinary exchanges and accelerate internal research and development projects. This new practice, Booz Allen's Analytics Practice, integrated traditional O.R practitioners from our Defense business with experts in high-performance computing from our National Security business and solution architects from our Civil and Commercial businesses. Together, this group of 600+ practitioners authored influential publications and pioneered the application of data science to such use cases as minimizing vaccine production variability, detecting pharmaceutical safety issues, preventing entitlement fraud, and disrupting threat networks. This transformative effort received the 2015 Booz Allen Excellence Award for Innovation, our institution's highest honor selected from over 1,000 ongoing client and internal programs.

Internally, Booz Allen has repeatedly incorporated O.R. into its culture and operations to achieve efficiencies and enhance employee and customer experiences. In 2015, in partnership with Kaggle, Booz Allen launched the annual Data Science Bowl, which today is the largest data science-for-social-good competition in the world. From 2015 to 2018, the event attracted more than 114,000 challenge submissions and more than 50,000 participants who logged close to 628,000 hours of work, giving an estimated $30M of in-kind labor. In 2017, Booz Allen launched the Data Science 5K, an ambitious internal workforce development program aimed at rapidly growing our data science talent. This program, the recipient of *Chief Learning Officer* magazine's 2018 Trailblazer Award, has successfully trained over 1,600 data scientists in the past three years. Lastly, beginning in 2018, Booz Allen integrated the use of predictive modeling and machine learning into firmwide workforce management and employee engagement efforts, positively impacting employee attrition and increasing staffing optimization across our portfolio.

At Booz Allen, we view O.R. as an integral component of our corporate strategy to meet the challenges of today and the future. Thus, our O.R. journey continues in earnest. We thank INFORMS for recognizing the extraordinary effort and passion of our 4,000 O.R. practitioners, whose story is further shared at www.boozallen.com.

WE HAVE

28 MILLION REASONS

YOU NEED JUST

ONE TAUBER TEAM



Tauber sponsoring companies saved an average of $28 million per project in 2018, but that was just one of many benefits they received from working with a Tauber Team. Learn how our graduate-level engineering and business student teams help business sponsors with high-impact, high ROI projects such as:

- Machine learning and advanced analytics
- Lean process design and implementation
- Manufacturing site strategic assessment
- Supply chain implementation plan
- New product/process development strategy
- Product complexity analysis
- Manufacturing process design

We Solve Industry's Toughest Problems

Tauber Team Projects find innovative solutions for industry's toughest problems. Student teams work on site for sponsoring companies on highly visible operations-related challenges with both engineering and business components. Tauber Team Projects have historically delivered significant financial savings, as well as improvements in areas such as CO_2 emissions, energy consumption, throughput time, and supply chain.

Award-Winning University of Michigan Faculty and Curriculum

The Tauber Institute develops and delivers superior talent utilizing the strengths of Michigan's top-ranked business and engineering schools. Award-winning faculty from both the College of Engineering and the Stephen M. Ross School of Business work closely with students on each team project. Input from the Tauber Institute Industry Advisory Board ensures that our curriculum constantly adapts to prepare our students to be leaders in the evolving world of operations.

The Results? Millions Saved and Earned

In 2018, student teams worked on 30 projects submitted by 20 companies, and averaged $28 million/per project savings over 3 years. The total savings projected according to sponsoring company calculations, was $564.4 million.



The Tauber Institute for Global Operations congratulates the **2019 UPS George D. Smith finalists.**

Many thanks to INFORMS and UPS for their unwavering support of innovations in operations research, management science, and analytics.

As an inaugural recipient of the UPS George D. Smith prize, **we proudly welcome this year's winner.**

Learn more at **tauber.umich.edu**

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Tauber Institute for Global Operations Industry Advisory Board

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INFORMS





ABOUT INFORMS

The Institute for Operations Research and the Management Sciences

From increased efficiency in business processes that leads to millions in savings, to lifesaving advancements in medical treatments, to revolutionized transportation and delivery systems, analytics and operations research (O.R.) are truly saving lives, saving money, and solving problems. And the world is beginning to take notice. *U.S. News & World Report* listed operations research analyst as one of the top seven business jobs for 2019. At the heart of this growing field is INFORMS, the leading professional society for a vibrant community of more than 12,500 operations research and analytics professionals, academics, and students, representing more than 86 countries around the world, whose impact on the economy and society has been and continues to be nothing short of remarkable.

INFORMS promotes best practices and advances in analytics and O.R. We are dedicated to encouraging, facilitating, and awarding excellence in our membership. Formed in 1995 when the Operations Research Society of America (ORSA) and The Institute of Management Sciences (TIMS) merged, INFORMS strives to provide opportunities of inspiration and collaboration among our members, fostering the life-changing ideas of the O.R. and analytics leaders of the future.

Each year, INFORMS hosts a number of events across the country and worldwide, including our Annual Meeting and Analytics Conference, that provide unique forums for thousands of attendees to interact and collaborate as well as celebrate those individuals and organizations who are making the biggest impact on the world around them.

INFORMS also publishes 16 scholarly, peer-reviewed journals, more than one-third of which are featured on the *Financial Times* list of 50 top academic journals, highlighting the latest methods and applications on a full spectrum of analytics and O.R. fields. In addition, our continuing education and Certified Analytics Professional (CAP®) and Associate CAP (aCAP™) certification programs provide opportunities for professional advancement at every career stage. With 20 percent of *Fortune 100* companies now employing CAP certified analytics and O.R. professionals, these certifications also enable industry leaders to identify and employ top talent.

INFORMS provides many resources to organizations of all sizes seeking information on the benefits of analytics, connecting them with the latest research and discoveries, as well as analytic and operational research professionals with the expertise they require. In addition, within our membership are smaller specialized subdivisions that are dedicated to a common theme or technical interest, many of which directly pertain to analytics and operations research applications for industry. Our members are embracing complex problems and unlocking the valuable data needed to enhance decision-making processes and improve day-to-day operations in almost every type of organization.

INFORMS would like to congratulate and thank the project members and organizations honored at our 2019 Edelman Gala, both for their incredible contributions today, as well as inspiring the great discoveries and advancements of tomorrow.



WAKE FOREST
UNIVERSITY

SCHOOL *of* BUSINESS

Center for Analytics Impact

Congratulations to the
2019 Franz Edelman Award Finalists!

About the Center for Analytics Impact

The Wake Forest University Center for Analytics Impact (CAI) goes beyond methodology to emphasize the non-technical aspects of the effective use of analytics. The goals of the Center are to be the leading authority on empirical research in the success or failure of analytics and its impact on organizations and society, and to be the premier provider for continuing education in the areas that promote the successful implementation of analytics.



Shaping the Future of Agriculture with Data Analytics

Syngenta is proud to support the talent and ideals that embody the INFORMS membership and the class of 2019 Franz Edelman Award finalists.

With a growing population and heightened pressure on the natural resources necessary for food production, cross-industry collaboration has never been more important. That's why we launched the **Syngenta Crop Challenge in Analytics**, hosted by the Analytics Society of INFORMS. The open innovation competition brings together experts in mathematics, agriculture and big data to discover new ways to feed a growing population with limited natural resources.

Now in its fourth year, this contest continues to foster the development of unique data-driven models that can ultimately help us breed better seeds so that farmers can grow more from less.

The Crop Challenge aligns with our goal to make crops more efficient, one of the six commitments that comprise **The Good Growth Plan**, our global sustainability program. Learn more at www.GoodGrowthPlan.com.

Congratulations to the 2019 Franz Edelman Award finalists!

Learn more about the 2019 Syngenta Crop Challenge in Analytics at ***www.ideaconnection.com/syngenta-crop-challenge***.

@SyngentaUS @INFORMS #CropChallenge

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syngenta®





ADVANCING THE PRACTICE OF O.R. & ADVANCED ANALYTICS

By Ranganath Nuggehalli, CAP
President, INFORMS Section on Practice

Tonight we celebrate outstanding achievements in operations research and advanced analytics. This gala and the competitions for the Edelman Award, Wagner Prize, and UPS George D. Smith Prize are all conducted by volunteers of the INFORMS Section on Practice. Details on these competitions are described in this program book.

The focus of our section is on promoting the practice of operations research and advanced analytics through the stewardship of competitions dedicated to highlighting the best practices of our profession. And, we organize a set of practice-related presentations at the INFORMS Annual Meeting in the fall and publish biannual newsletters for section members.

We invite you to join our exceptional group of volunteers who are dedicated to bettering our world by using operations research. Volunteering is a good way to work with like-minded colleagues to advance the practice of operations research, management science, and analytics. I have found these activities to be mind-opening and stimulating. I have repeatedly applied insights from this volunteer work at my job at UPS. People who volunteer with our Practice Section are highly capable, and are enthusiastic about promoting the profession. It's a pleasure to collaborate and network with them. Because we work in so many different organizations, both academic and nonacademic, we have different perspectives to share and from which to learn. It is gratifying to contribute to the advancement of our profession by helping promote and celebrate the best applied work of our profession.

If you are interested in volunteering with the INFORMS Section on Practice, please send an email to me at: rnuggehalli@ups.com. It would be great if you could join us.





CALL FOR 2019 NOMINATIONS

DANIEL H. WAGNER PRIZE

Excellence in Operations Research Practice

The Daniel H. Wagner Prize emphasizes the quality and coherence of the analysis used in practice. This prize recognizes those principles by emphasizing good writing, strong analytical content, and verifiable practice successes.

2019 Submission Deadline:
Wednesday, May 1, 2019

UPS GEORGE D. SMITH PRIZE

Strengthening Ties Between Academia & Industry

The UPS George D. Smith Prize is awarded to an academic department or program for effective and innovative preparation of students to be good practitioners of operations research, management science, or analytics.

2020 Submission Deadline:
Thursday, October 31, 2019

FRANZ EDELMAN AWARD

Achievement in Advanced Analytics, Operations Research, & Management Science

The purpose of the Franz Edelman competition is to bring forward, recognize, and reward outstanding examples of operations research, management science, and advanced analytics practice in the world, with $15,000 in awards. First prize is accompanied by a $10,000 honorarium.

2020 Submission Deadline:
Wednesday, October 16, 2019

INFORMS PRIZE

Sustained Integration of Operations Research

The INFORMS Prize is awarded for effective integration of advanced analytics and OR/MS in an organization. The award is to be given to an organization that has repeatedly applied the principles of advanced analytics and OR/MS in pioneering, varied, novel, and lasting ways.

2020 Submission Deadline:
Sunday, December 1, 2019

ACCOLADES

PAST EDELMAN LAUREATES

2018

Diane Bryant
José Antonio Carbajal, CAP
Wes Chaar
Steven Charbonneau*
James Andrew Costa*
Anthony Coudert*
Umberto Dellepiane
Tianhu Deng
Melissa Dunford*
Gary Epstein*
Alexandre Fréchette*
Michael Gaies
Julien Guillen
Jingkuan Han
Karla Hoffman*
Sasha Javid*
Karl Kempf
Jean L. Kiddoo*
Evan Kwerel*
Eva K. Lee
Kevin Leyton-Brown*
Dingzhi Liu
Raffaele Maccioni
William Mahle
Matthew Manary
Charles E. Meisch, Jr.*
Dinesh Menon*
Neil Newman*
Susan C. Nicolson
Richard G. Ohye
Gail D. Pearson
Alessandro Pinzuti
Andreea Popescu
Enrico Procacci
Anthony Romero
Pierre Ruiz
Paul Salasznyk*
Ilya Segal*
Lara S. Shekerdemian
Zuo-Jun (Max) Shen
Brian Smith*
Rudy Sultana*
Michael Trick*
Brian Wieland
Sean Willems
Peter Williams
Madolin K. Witte
Mengying Xue
Junchi Ye
Yanfang Zhao
Zhongde Zhao
Shuhui Zhou

2017

Brandon Allen
Johanna Amaya
Felipe Aros-Vera
Turgay Ayer
Jeff Ban
Jerod Bieringer
Peter Boggis
Srinivas Bollapragada
Robert Boute
Sylvie Bouffard
Jay Brantley
Matthew Brom
Shama Campbell
Mary Deck
Kristof Deneire
Sheila Donahoe*
Fred Ehlers
Sandra Fleming
Marc Garbiras
Carlos A. Gonzalez-Calderon
Stacey Hodge
José Holguín-Veras
Kai Hsiao*
Amber Hyde*
Miguel Jaller
Loskesh Kalahsthi
Alain Kornhauser
Ahmet Kuyumcu*
Kevin Lee
Randy Markley
Michael Marsico
Susan McSherry
Bryan Monk
Heath Morgan
Melanie Murray*
Kaan Ozbay
Zeynep Ozkaynak
Giampaolo Orrigo
Marianela Pereira
Asheque Rahman
Michael Replogle
Keith Quan
Mason Samuels
Iván Sanchez-Diaz
Mark Simon
Michael A. Silas
Caesar Singh
Erdem Telatar
Charlie Turnipseed
Maud Van den Broeke
Roshan J. Vengazhiyil
Cara Wang
Andrew Weeks
Chelsea C. White III
Scott Wills
Jeffrey Wojtowicz
Shamim Wu*
Xia Yang
Utku Yildirim*
Chenxi Zeng
Can Zhang

2016

David Aebischer
Fernando Alarcón
William Aldrich
Bradford Alex Baker
Brian Blank
Stefan Conrady
Guillermo Duran
Michael Kevin Geraghty
Gnanadeeban Gnanapandithan
Michael Grimes
Mario Guajardo
Song He
Amanda B. Hepler
Chuck Holland*
Michael Johnson
Roderick Jordan
Captain Michael Joy
Boris Kats
Katherine Lajoie
Prasad Lakshminarasimhiah
Evan Levine
Jack Levis*
Erika Lunceford
Suzanne M. Mahoney
Matthew Maron
Jaime Miranda
John Morik
Hugo Muñoz
Christopher Myers
Ranganath Nuggehalli, CAP*
Victor O'Laughlen
Pavithran Rajendran
Luis Ramirez
Mario Ramirez
Madhusudan Rana
Carlos Reinoso
Luis Reinoso
Madangopal Revoor
Daniel Ruble
Gary Salomon
Bob Santilli*
Denis Sauré
Matias Siebert
Eric Sonmezer
Sebastian Souyris
Anthony Tasso
Joseph A. Tatman
Jessica Tisch
Andrew Vatterott
John Vatterott
Rodolfo Villalba
Andrés Weintraub
Jeff Winters*
Darrin L. Whaley
Rodrigo Wolf-Yadlin
Gonzalo Zamorano

2015

Habib Z. Al Abideen
Brian Alford
Tovey Bachman
David Basset
Aaron K. Baughman
Richard Bogdany
Joseph Byrum*
Robert W. Carroll
Kristen M. Cheman
David Culhane*
Jeffrey Curtis
Craig Davis*
Scott Davis
Greg Doonan
Tracy Doubler*
Shatiel Edwards

** Indicates Member of Winning Team*

David Foster*
Brandon Frankel
Ferrari Griarte
Meggen Gullo
Knut Haase
Benjie Harrison
Andrew Hazlewood
Dirk Helbing
Stephen Henry
Scott Johnson
Matthew Hoffman
Mathias Kaspe
Jack M. Kloeber, Jr. *
Matthes Koch
Craig Lawton
Ni Li
Bruce Luzzi*
Stephen Mack*
Jim Martineau
Cameron McAvoy
Michael McCarthy
Darryl Melander
Reeto Mookherjee
Ronald Mowers*
Frank Muldoon
Jeet Mukherjee
Sven Müller
Brian O'Connell
Herbie Pearthree
Roy Rice
Liliana Shelton
Sandy Sun
Gerald Teper
Clay Upton
Pamela J. Williams
Liang Xu
Xiaochuan Zhang
Kailai Zhou
Chris Zinselmeier*

2014

Ross Anderson
Itai Ashlagi
Hany Atallah
Kristen Baker
Abel Chan
Stephen Cochi*
Radboud Duintjer Tebbens*
Peter Ferris
Chris Forbes
Joseph Forbes
Michael Forbes
David Gamarnik
Ashish Goel
Pankaj Gupta
Siva Gurumurthy
Leon Haley
John Haupert
Zengjian Hu
Paul Kennedy
Eva K. Lee
Joshua Morrison
Edmond Mount
Mark Pallansch*
Eleanor Post
John Putz
Michael Rees
Alvin Roth
Aneesh Sharma
John Sirois
Tayfun Sönmez
Yohan Sutjandra
Calvin Thomas
Kimberly Thompson*
Utku Ünver
Dong Wang
Steven Wassilak*
Michael Wright
Daniel Wu

2013

Carlijin Bak*
Tejinder Kaur Bimbraw
Brett Bonner
Ruud Brekelmans*
Graeme Case
K. Chandrasekhar
Lijun Chen
Zhi-Long Chen
Parag Chitalia
Pawan Chowdhary
Margery Connor, CAP
Robert Creek
Mark Davis
Dick den Hertog*
Youssef Drissi
Matthijs Duits*
Carel Eijgenraam*
Bob Gooby
Randhir Hebbar
Ganesh Hegde
Mary Helander
Guofen Hu
Matt Johnson
James Kalina
Kaan Katircioglu
Nick Kenaston
Jarl Kind*
Mahesh Krishnan
Wim Kuijken*
Rahul Kumar
Ted Kutz
Lin Li
Lebin Lin
Jiyin Liu
Yan Liu
Sudeep Maity
Karl Martin
Doug Meiser
Ying Meng
Nathan Mott
Murugan Pugalenthi
K. Raghava Rau
Kees Roos*
Rohit Saksena
Howard Smith
Karthik Sourirajan
Craig Stenstrom
Karthik Subbian
Sumathi Subramanian
Lixin Tang
Pieter Vermeer*
David Wagnon
Gongshu Wang
Takashi Yonezawa
Bo Zhang
Xinhui Zhang

2012

Ahmar Abdullah
Suresh Acharya
Sofia Archontaki
Bernard A. Benecke
Greg Burel
Arnab Chakraborty
Kyle Christianson
Frederic Deschamps
John Dimotikalis
Prasanna Dhore
Feryal Erhun
Phillip Finch
Hein Fleuren*
James Fuller
Chris Goossens*
Marco Hendriks*
Erik F. Hertzler
David W. Hill
Karl G. Kempf
Iraklis Lazakis
Eva K. Lee
Marie-Christine Lombard*
Kathleen Mallery
Jacquelyn Mason
Ronald P. Menich
Ineke Meuffels*
Pelin Pekgün
Chen Peng
Ferdinand H. Pietz
John Poppelaars, CAP*
Timothy R. Rosenberg
Bharathan R. Shamasundar
Manav Shroff
Ritwik Sinha
Girish Srinivasan
Suresh Subramanian
Rohit Tandon
Osman Turan
James Van Sistine
Orestis Varelas
Takis Varelas

2011

Naoki Abe
Fernando Alarcon
Gary F. Anderson
Gustavo Angulo
Alex Beiza
James J. Bennett
Cristian Berner
Brian Carlson*
Jaime Catalan
Yonghong Chen*
Brent R. Cooley
Kenneth Cooper
Jin Dong
Xing Dong Zhang
Craig Eister
Rafael Epstein
Timothy Gardinier
Edward Godlewski
Cristian Gonzalez
Guillermo Gonzalez
Jon A. Higbie
Mingguo Hong*
Liu Xiao Hu
Sergio Hurtado
Florencio Infante
David L. Jensen
Roy Jones*
Dev Koushik
Kevin Larson*
Gregory Lee
Guo Li Jie
Xingwang Ma*
Prem Melville
Gerard Miller









Mauricio Naveas
Andres Neely
Peter Nieuwesteeg*
Cezar Pendus
Xi Quan Wang
Chandan K. Reddy
Haili Song*
Kimberly Sperry*
Matthew Tackett*
Doug Taylor*
Li Thomas
Vince P. Thomas
Fernando Valenzuela
Jie Wan
Melissa Weatherwax
Andres Weintraub
Ming Xie
Jun Yin Wen*
Daniel Yung
Eugene Zak*
Bin Zhang

2010

Gerkotze Bonthuys
Ebert Cawood
Jay Cunningham
Miguel de Lascurain*
Luis de los Santos*
Esmi Dreyer
Ingrid Farasyn
Andrea Feunekes
Ugo Feunekes
Marc Fischer
Michele Fisher, CAP
Tjark Freundt
Wolfgang Giehl
Francisco J. Herrería*
Salal Humair
Johan Janse van Rensburg
Jaco Joubert
Joel I. Kahn
Peter Kolesar
Willem Louw
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IBM **Analytics**

Make optimal decisions with IBM Watson Studio and help achieve business goals

Data science has become a strategic imperative for gaining competitive advantage. Data Science teams need access to tools and techniques to drive innovation and empower business decision-makers with the right insights at the right time to make reliable decisions.

Data science teams rely on a combination of techniques like machine learning and decision optimization to develop unique solutions that help drive operational efficiency.

IBM® Watson Studio is now ready for prescriptive analytics through integration of optimization capabilities. Data science teams can combine optimization techniques with coding and non-coding tools, model management and deployment, and other data science capabilities to easily operationalize data science projects.



Figure 1. Powerful visualization features help compare multiple scenarios

"Ultimately, the IBM solution is helping us to gain the most from our resources, and make smarter decisions about investments in our manufacturing network—driving higher revenues and profits."

– Niklas Steding, IT Project Lead, Continental Tires

Create innovative solutions: Integration with IBM® Watson Studio enables solving complex decision-making problems by combining optimization technology with data science techniques like machine learning.

Improve productivity: Validate optimization models more quickly and easily using visual dashboards. Explore trade-offs between different action plans in a single view using what-if analysis capabilities.

Experience fast time to value: Solve a wide range of optimization models at speed using exceptional IBM CPLEX® solver performance.

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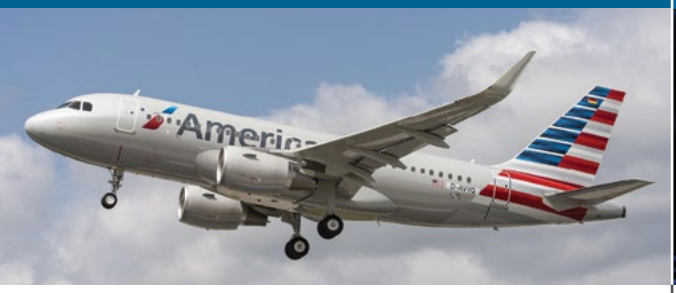
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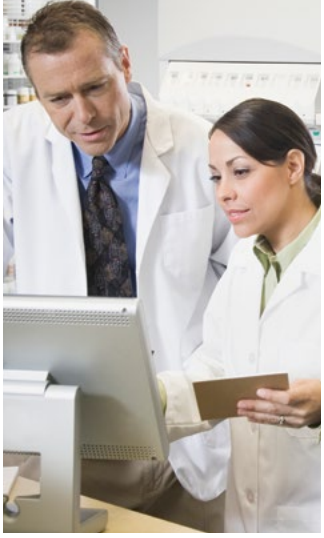





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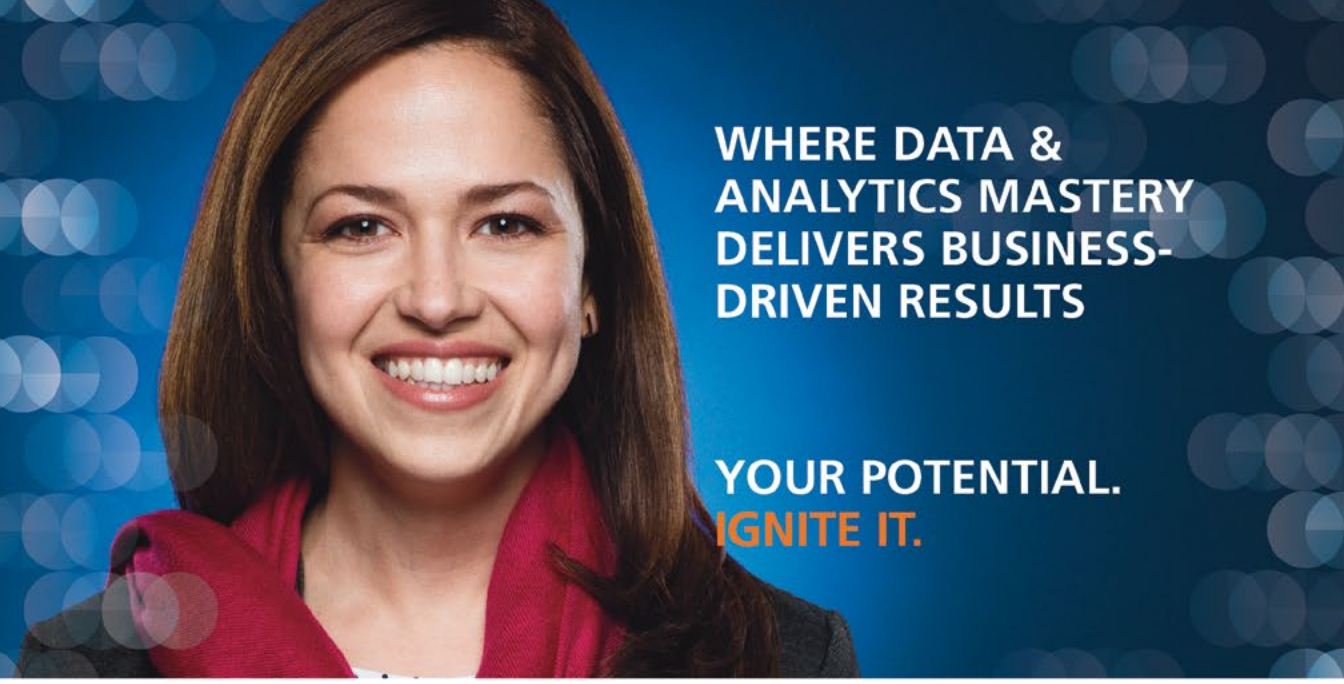








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