2018 Edelman Gala

For Distinction In Practice

THE FRANZ EDELMAN AWARD

Achievement in Operations Research

Emphasizing Beneficial Impact

THE DANIEL H. WAGNER PRIZE

Excellence in Operations Research Practice

Emphasizing Innovative Methods and Clear Exposition

UPS George D. Smith Prize

Strengthening Ties Between Academia & Industry

Emphasizing Effective Academic Preparation

THE INFORMS PRIZE

Sustained Integration of Operations Research

Emphasizing Long-Term, Multiproject Success

April 16, 2018

Baltimore, Maryland

The Edelman Gala

Master of Ceremonies: Don Kleinmuntz ____ 6

Analytics and Operations Research Today

Introduction—Nicholas G. Hall ____ 9
A Pricing Revolution—Ahmet Kuyumcu ____ 12
Operations Research: Billions and Billions of Benefits—Jeffrey M. Alden ____ 16

Franz Edelman Award

Recognizing and Rewarding Real Achievement in O.R. and Analytics ____ 19
Edelman First-Place Award Recipients ____ 22
The Finest Step Forward: The Journey to the Franz Edelman Award ____ 28
The 2018 Selection Committee & Verifiers ____ 31
The Coaching and Judging Process & The 2018 Coaches and Judges ____ 32
The Edelman Laureates and The Edelman Academy ____ 33
China National Petroleum Corporation ____ 38
Europcar ____ 42
Federal Communications Commission ____ 46
Intel ____ 50
Pediatric Heart Network ____ 54
Turner Broadcasting System, Inc. ____ 58

Wagner Prize

A History ____ 63
2017 Finalists ____ 64
2017 Wagner Prize Winner ____ 65

UPS George D. Smith Prize

A History ____ 69
2018 Competition ____ 71

INFORMS Prize

A History ____ 77
Criteria ____ 78
2018 INFORMS Prize Winner ____ 79

INFORMS

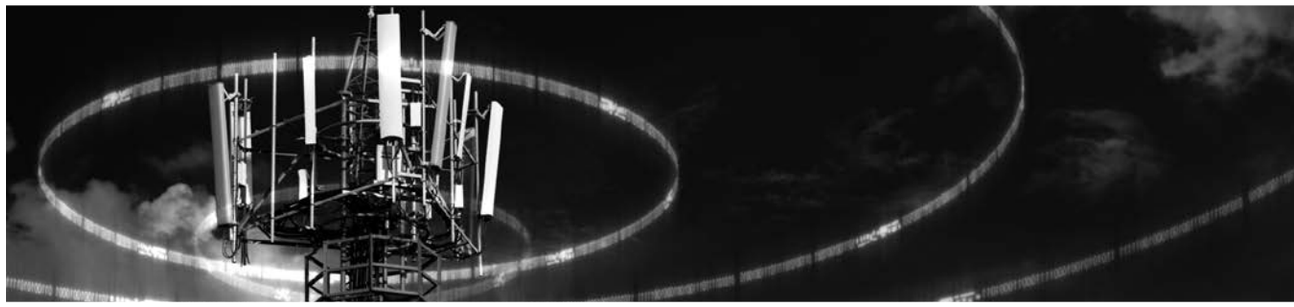
About INFORMS ____ 83
Advancing the Practice of O.R. and Advanced Analytics—Ranganath Nuggehalli, CAP ____ 86
Calls For Nominations ____ 87

Acknowledgments

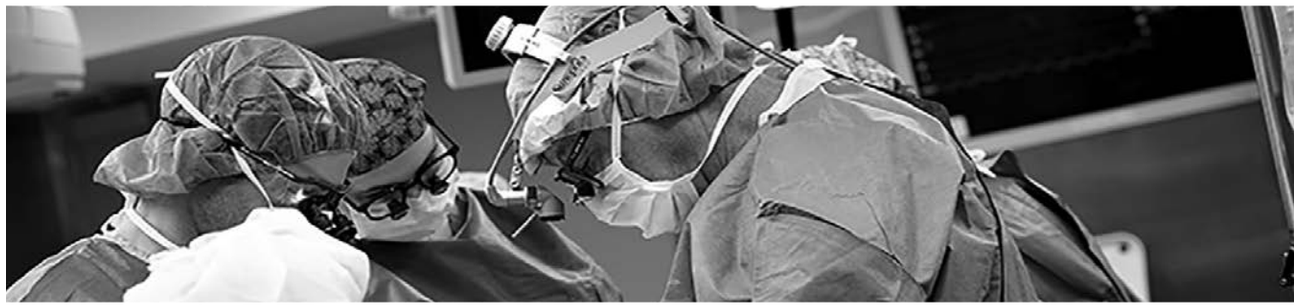
The Edelman Laureates, 1972-2017 ____ 91
The Edelman Academy Members, 1972-2017 ____ 100
Acknowledgments ____ 106





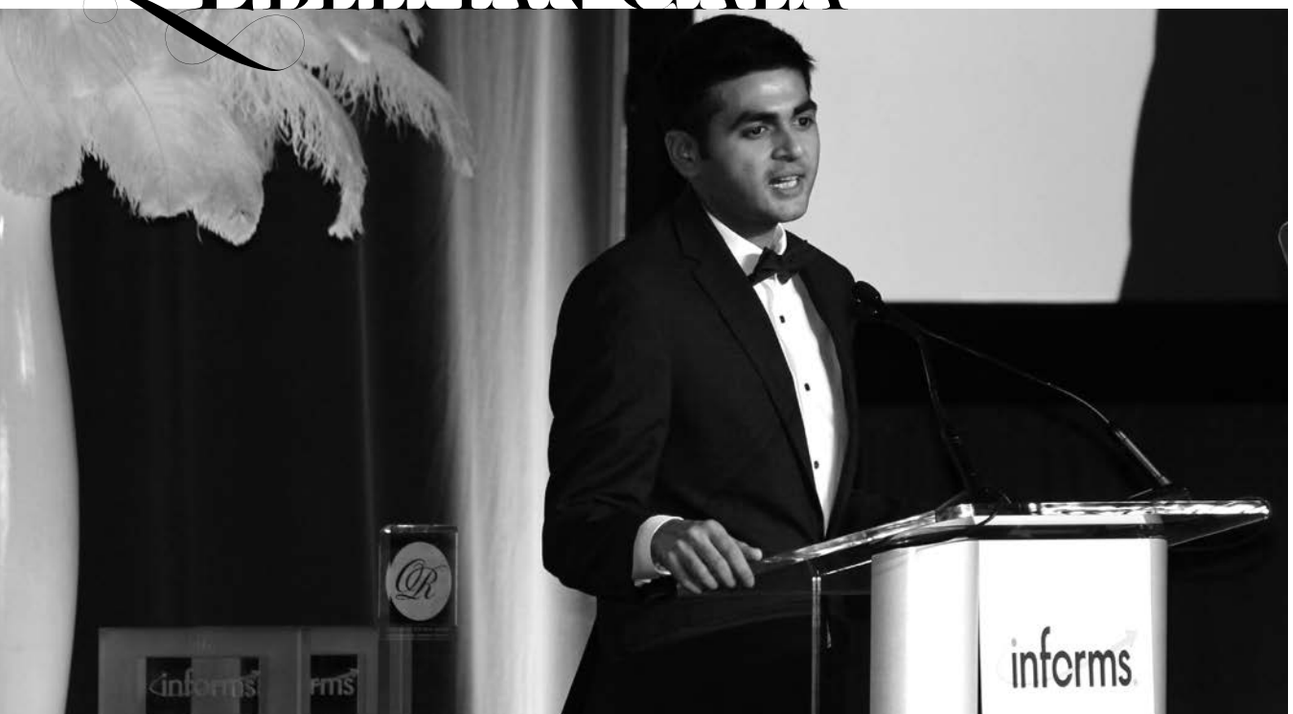








The Edelman Gala



2018 Edelman Gala

Welcome, Acknowledgments, and Awards to be Presented
Don Kleinmuntz
Master of Ceremonies

Summaries of 2018 Edelman Finalist Work
China National Petroleum Corporation
Europcar

Presentation of the Wagner Prize
Lawrence D. Stone
2017 Wagner Prize Committee

Summaries of 2018 Edelman Finalist Work
Federal Communications Commission
Intel

Presentation of the UPS George D. Smith Prize
Rina Schneur
Chair, 2018 UPS George D. Smith Prize

Summaries of 2018 Edelman Finalist Work
Pediatric Heart Network
Turner Broadcasting System, Inc.

Presentation of the INFORMS Prize
Tarun Mohan Lal
Chair, 2018 INFORMS Prize

Recognizing Members of the Franz Edelman Academy
Don Kleinmuntz
Master of Ceremonies

Announcement of the 2018 Franz Edelman Award Winner
Ramayya Krishnan, INFORMS President-Elect
Anne G. Robinson, Chair, 2018 Edelman Award

Master of Ceremonies

Don Kleinmuntz



Dr. Don Kleinmuntz is an expert on decision and risk analysis and business analytics, with significant contributions to both academia and industry. He is Principal at Kleinmuntz Associates, an analytics consultancy, and Adjunct Professor of IT, Analytics, and Operations Research at the University of Notre Dame's Mendoza College of Business. From 2014 to 2017, Don was founding Academic Director of Notre Dame's Chicago-based MS in Business Analytics, an innovative and intense 12-month degree for experienced business professionals.

After receiving a PhD from the University of Chicago's Booth School of Business with dual specialization in decision research and statistics, Don held faculty positions for more than 30 years. In addition to Notre Dame, he held faculty positions at the University of Texas at Austin, MIT, the University of Illinois at Urbana-Champaign, and the University of Southern California. His research and teaching focus on methods and approaches for improving decision making, including applications in accounting, healthcare management, resource allocation, and homeland security risk management.

In 1996, Don and his wife, Dr. Catherine Kleinmuntz, founded Strata Decision Technology. Starting in the basement of their home in Champaign, Illinois, they grew the company into a leading provider of financial analytics software solutions for the healthcare industry. Over a period of 17 years, Don held a variety of executive positions including CEO, CFO, and CIO. By the time he left in 2014, the company had grown to more than 100 employees and implemented solutions at nearly one-third of large U.S. hospitals. Strata is a subsidiary of Roper Technologies, a publicly held corporation.

As a consultant, Don has collaborated with hospitals, academic medical centers, and multihospital healthcare systems, primarily on financial decision support, strategic financial planning, and resource allocation. He has also consulted on similar problems in other industries, and with several government agencies, including the U.S. Department of Homeland Security.

Don is an active and committed member of INFORMS and served as INFORMS President in 2009. He has also served as INFORMS Treasurer, President of the INFORMS Analytics Society, founding Editor-in-Chief of the INFORMS journal *Decision Analysis*, and far too many INFORMS committees to reasonably list in a single-page bio (but highlights include serving as judge for both the Edelman Award and the UPS Smith Prize).

Don's professional recognitions include INFORMS Fellow (2007), the INFORMS Decision Analysis Society Frank P. Ramsey Medal for distinguished contributions to decision analysis (2011), and the INFORMS George E. Kimball Medal for distinguished service to the field of operations research and management science (2012).

Don lives in Chicago's Lincoln Park neighborhood with his wife Catherine, their three-year-old twins, Alex and Mika, and their dog Molly, a five-year-old wheaten terrier who is firmly convinced that she is the family's eldest daughter.

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MONSANTO

Analytics and Operations Research Today



Edelman Program Notes from INFORMS President Nicholas G. Hall

Thank you for joining us tonight as we recognize the recipients of four of INFORMS' most prestigious awards.



These awards celebrate excellence in the application of operations research (O.R.), management science (M.S.), and analytics: *Daniel H. Wagner Prize for Excellence in Operations Research in Practice; UPS George D. Smith Prize; INFORMS Prize;* and *The Franz Edelman Award for Achievement in Advanced Analytics, Operations Research, and Management Science.*

As INFORMS works to promote the profound global impact of O.R., M.S., and analytics, the work recognized in these four awards provides clear and convincing evidence of the value these fields deliver every day.

Daniel H. Wagner Prize for Excellence in Operations Research in Practice

For nearly 20 years, the Daniel H. Wagner Prize has been awarded to teams who have demonstrated not only clear intelligent writing and strong analytical content, but a verifiable practice success.

The winner of the 2017 Wagner Prize, recognized for their unique new application of O.R., is a team of students and professors from Lehigh University, who partnered with the Pennsylvania Department of Corrections to revolutionize the approach to inmate assignment. The team created an algorithm that considers the nearly 100 unique factors that impact the task of assigning inmates to prison facilities, and transformed a process that initially took seven employees a full week to accomplish into one that can now be completed in less than 10 minutes.

This project represents the first time that O.R. methodologies have been implemented within the correctional system, and has generated an expected savings of nearly $3 million.

UPS George D. Smith Prize

The INFORMS UPS George D. Smith Prize is awarded in recognition of universities that foster strong relationships between industry partners and young O.R. and analytics students and practitioners. Finalists are selected from among the leading university O.R. and analytics programs from around the world.

This year's finalists are the School of Operations Research and Information Engineering, MEng Programs, Cornell University; and the Haslam College of Business MSBA, University of Tennessee.

INFORMS Prize

Since 1991, the INFORMS Prize has recognized organizations around the world that have effectively integrated O.R. and analytics programs. INFORMS is pleased to announce that the 2018 award will be presented to BNSF Railway, whose growing O.R. and analytics team has provided strategic analytics support to BNSF Railway leadership for 25 years.

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

The 2018 finalists for the Franz Edelman Award, the world's most prestigious recognition for achievement in the practice of advanced analytics and O.R., represent a remarkable cross section of industry: from broadcasting, healthcare, and communication, to inventory management, vehicle fleet management, and alternative energy industries.

This year's finalists are the China National Petroleum Corporation, Europcar, Federal Communications Commission, Intel, Pediatric Heart Network, and Turner Broadcasting System, Inc.

In response to China's rapidly growing demand for natural gas, the ***China National Petroleum Corporation (CNPC)*** replaced an outdated manual planning system with new software that optimized the country's natural gas pipeline network. Since implementing this software, CNPC has realized approximately $330 million in direct savings. Also, the pipeline's increased efficiency has delayed the need for further pipeline expansions, thereby generating additional savings of more than $18 billion dollars.

To serve its more than five million drivers each year more efficiently, ***Europcar*** created an advanced logistics management solution, Opticar. This system not only enabled the company to consider the many factors impacting the car rental industry every day, but also to anticipate future vehicle demand up to six months in advance.

To meet the rapidly increasing demand for the electromagnetic spectrum utilized by the growing wireless service industry, the ***Federal Communications Commission (FCC)*** conducted the world's first major two-sided auction, during which the FCC purchased spectrum from TV broadcasters to sell to wireless providers. In addition to raising nearly $20 billion in revenue, the FCC contributed $7 billion toward reducing the federal deficit.

Intel has revolutionized the management of its inventory of finished goods by implementing the fully automated Multi-Echelon Inventory Optimization (MEIO) inventory target-setting system. MEIO has enabled Intel to lower inventory levels, resulting in $1.3 billion in gross profit since 2014. In addition, Intel's customer service satisfaction ratings have achieved an all-time high since implementing MEIO.

More than 2.5 million children and adults in the United States are impacted by congenital heart defects (CHDs). There has been no standardized protocol for surgical care of patients with CHDs, which resulted in inconsistent surgical outcomes. ***The Pediatric Heart Network*** worked with the nine leading U.S. pediatric centers to create clinical practice guidelines to improve the surgical outcome of patients with CHDs. These guidelines effectively decreased the time for which a patient must remain in intensive care, while achieving a cost savings of 27 percent, or $13,500 per patient.

Turner Broadcasting System, Inc. developed two television audience targeting solutions that simultaneously created advertiser and sales efficiencies for popular television networks including CNN, TBS, and the Cartoon Network. These solutions, TargetingNOW and AudienceNOW, use integrated forecasting and optimization models to revolutionize media industry standards and processes. This has enabled Turner to expand its advertising reach to engage entirely new audiences and realize ad revenue in the billions of dollars.

Thank you again for joining me, and the rest of the INFORMS Board of Directors and staff to celebrate the winners and finalists. Their impressive contributions not only advance the fields of analytics and O.R., but serve as convincing evidence of how these fields save lives, save money, and solve problems.

Principal®

We're proud to congratulate the **2018 Edelman Award finalists**.

Best of luck.

China National Petroleum Corporation

Europcar

Federal Communications Commission

Intel

Pediatric Heart Network

Turner Broadcasting System, Inc.

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A Pricing Revolution

By Ahmet Kuyumcu, Co-Founder & CEO, Prorize LLC

Reflections on Winning the 2017 Franz Edelman Award

"There are two fools in every market; one who asks too much and one who asks too little!" *Old Russian proverb*

In 2011, we received a call from Holiday Retirement (Holiday) to create a revolution in pricing for senior living housing. Holiday is the second-largest senior-housing operator in the United States with more than 300 facilities and annual revenue of approximately $1 billion. Holiday's then CEO, Kai Hsiao, had a vision to implement a data-driven pricing approach to benefit Holiday, its residents, and the growing senior living industry. Hsiao and several members of the Holiday executive team were familiar with the impacts of implementing revenue management (RM) techniques from their past experiences in the hospitality industry and were questioning whether they could be applied to the senior living industry.

After significant exploration, Holiday selected Prorize, then a two-man pricing-consultancy shop, to create software that would analyze available data and make pricing recommendations for their senior housing apartments. Even though we were a small company, both my partner and I had extensive experience pioneering RM solutions for multiple businesses, including the apartment rental industry.

The key challenge to achieving a cogent solution for senior living, as opposed to the apartment rental industry, is that senior living is a care business. The decision to move into a senior-living facility is a very emotional process and many believed that scientific pricing would simply not work for this situation.

However, Hsiao believed the opposite and considered pricing optimization a strategic imperative for Holiday. Understanding the often-poignant sales situation, the requirement was to use data and facts to generate right prices so that Holiday could shift the sales conversation away from bargaining to finding well-suited homes for real people in which to spend the rest of their lives. Our goal was to develop a practical RM solution to consistently recommend the optimal price for each apartment, allow Holiday to remain profitable, and enable them to continue providing services that residents enjoy and value most.

We were thrilled with the challenge and readily agreed to the initial proof-of-concept study. During an intense eight months, Prorize developed an initial prototype of the RM system called Senior Living Rent Optimizer™ (SLRO™). The SLRO performance was tested with scientifically selected pilot-control pairs (much like clinical trials) and revenue lift differentials were observed from actual rent deployments. The average revenue lift exceeded nine percent.

As a result, Holiday decided to rollout the SLRO across all its communities in August 2014. The revenue lift estimates were later confirmed by the company's same-community revenue growth. Revenue lifts were primarily due to lower rents and higher occupancy rates; a win-win for both Holiday and their residents.

Prior to implementation, Holiday's market rents were artificially high, and it was virtually wishful thinking that units would sell. Unable to move units, the sales force historically gave many on-the-spot discounts. Instead, we recommended starting with the calculated, right rent and allow only a two-week promotional allowance. This reduced the gap between asking and actual rent from 11 percent to less than 2 percent. In the process, we significantly raised occupancy levels and kept them high for extended periods.

The RM system was championed by the entire executive team. The initiative streamlined pricing practices and fostered back-and-forth communication between operations, sales, and pricing teams, and resulted in considerable improvements in Holiday's operations and sales processes. Culturally, it was a "mind shift" away from discounts and incentives to a value-based approach, which ultimately created a more focused and informed sales force, and improved the industry's talent level.

Armed with our success in senior living, we adapted our model for the self-storage industry as both businesses share many of the same challenges. Prorize partnered with CubeSmart, the third-largest owner and operator of self-storage facilities in the United States with approximately $500 million annual revenue, and tested our solution with a pilot program using approximately a quarter of its portfolio. Again, results were impressive, with our RM system showing a four-percent revenue increase as compared to their legacy RM system.

Knowing we achieved something big with these results, on a hunch, I scrolled the INFORMS website to see if we should apply for the Edelman competition to share our story with the analytics community. Competing for the Edelman Award was a lifelong dream, and this seemed like an optimum time to apply. We satisfied all criteria for the competition: implementation in an important industry (senior living), significant revenue and cultural impact, advanced technical solution, difficulty, and even achieved transportability (self-storage industry).









When I contacted Edelman Committee Chair Anne Robinson, she said that I had three hours left before the application deadline (yikes!). My partner, Utku Yildirim, and I quickly wrote the key messages, and our editor-in-chief, Ray Wheeler, added the final touches. We finished on time and submitted the abstract.

Being named a finalist was a great honor and winning the award from among an outstanding group of finalists was both humbling and gratifying. Our Edelman coaches, Jeff Alden of General Motors and Arnie Greenland of the University of Maryland, offered amazing guidance and helped us prepare for the competition by putting together a "laser-focused" story. Winning the award served as the highest form of recognition for the long hours and hard work put in by the Prorize and Holiday teams.

Winning the 2017 Edelman Competition has enhanced our company's image in the business community. It has yielded inquiries from many firms in multiple industries. Each prospective partner presents a new set of challenges and an opportunity to transform the way they do business. In the self-storage industry alone, we partnered with seven additional clients with repeated success. An additional unintended benefit of winning the Edelman Award is that we can more easily attract top talent for our growing company.

At Prorize, we are fascinated by the complexity and the many dimensions of pricing. We know there is one right price and many wrong prices. Reflecting on the Russian proverb, it is easier to be a fool if your price is based on guesswork. We understand the price a customer is willing to pay; therefore, the price a company can achieve depends on the customer's perceived value of a product or service. We are driven to find the right price so that both buyers and sellers are content. After all, better pricing creates a better economy, which in turn, creates a better society and ultimately a better world.

Despite our amazing results, the revolution is far from complete. We continue to encounter pushback from the "business-as-usual" crowd, which I imagine every operations research (O.R.) professional faces from time to time. Pricing optimization techniques are new for many industries including senior-living. When staff turnover occurs, new team members tend to bring with them traditional practices.

The pricing process involves the most sensitive profit decisions as it directly influences sales-purchase transactions. It is transformational and very difficult to implement half-heartedly. One lesson we learned is that changing the way companies price is an ongoing process. Many people feel that they give up their pricing authority when a computer program produces price recommendations. Overcoming this perception has been a challenge, and we know the only way to succeed in the long-term is through persistence and synergistic collaboration with our customers.

The O.R. field is at the intersection of data and technology, providing value and meaning to data, and is positioned to revolutionize the world in ways we've never imagined. At Prorize, we feel fortunate to be part of this movement and hope that our example of a two-man shop, which ultimately won the Edelman Award, can serve as an inspiration to others in the field.

While we have come a long way, we still have a long way to go. The revolution continues.









IT - DATA & ANALYTICS

Data & Analytics (D&A) at Procter & Gamble is where business, data and technology come together to create competitive advantage. Our mission is to deliver insights to help P&G win with consumers. Our D&A professionals are diverse business leaders who apply D&A mastery to deliver game-changing business models and capabilities. Whether your role is to analyze market performance for one of our billion dollar brands, optimize our supply chain operations, or deliver breakthrough analysis as part of the corporate data science team, your technical mastery will be recognized and rewarded. Your passion for the industry will be further cultivated by our culture of continued learning and growth. A career in D&A builds change leadership and influence skills, breadth of experience across multiple businesses, and depth of expertise in Data and Analytics.

WHO IS ELIGIBLE?

Graduates or students pursuing BS or MS or PhD in Applied Math, Operations Research, Statistics, Analytics (or like degrees).

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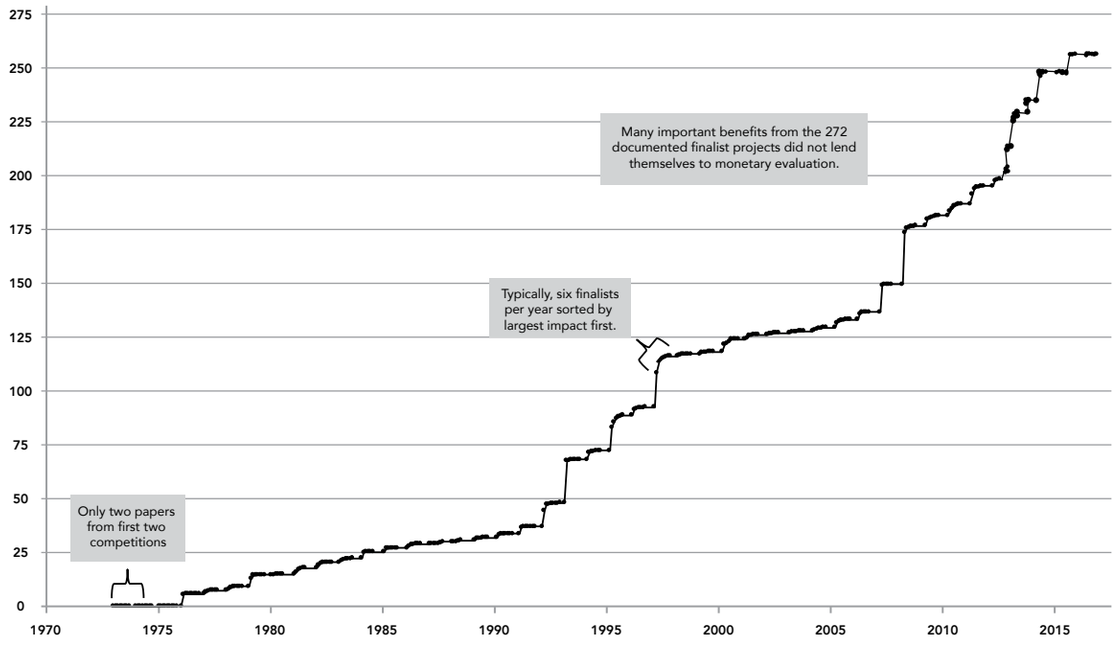
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Operations Research: Billions and Billions of Benefits!

By Jeffrey M. Alden,
Technical Fellow, GM, R&D Operations Research

Benefits over 250 Billion from Edelman Finalist Projects 1972 through 2017

(Conservatively quantified benefits, realized plus at most two years anticipated, in 2018 U.S. dollars)



Over 257 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 published their project accomplishments in the INFORMS journal *Interfaces*. Reviewing all 272 articles, their monetary impact was estimated under these guidelines:

- Be objective and conservative.
- Include only one year of enormous impact (10s of billions) to downplay the huge size and budget of some organizations.
- Include reported impact and at most two more years of anticipated impact.
- Ignore relative impacts 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 benefits like better legal dispute resolution, cancer treatments, airline security, hazardous material deposition, budget allocation, epidemic disease control, organizational structure, on-time railway performance, and space shuttle heat shielding performance. For example, there are more than 20 finalist papers with significant life and health benefits. Most are very difficult to quantify, however, a CDC project on (future) U.S. epidemics expects annual savings of 6,000 lives valued at $12B[1] and a U.S. Army project prevented 4,500 casualties by reducing requirements for helicopter and ground-convoy movements[2]. Almost all finalist papers report non-monetary 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, the 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 more than 130 different application areas including: air traffic, banking, canal operations, communications (broadband, broadcasting), consumer products, crowd control, delivery (express, truck), defense (air force, army), education, financial (pension, investment, credit card, settlement), fire protection, forestry, healthcare (blood collection, cancer, hospital, diagnosis, disease control, elderly, medical displays, pharmaceutical), 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, space), treasure hunting, waste management, water (resources, quality, flow, flood), and weapons dismantlement. The list goes on and on! In fact, 692 organizations (business, government, academic, etc.) are recognized and honored as supporting or benefiting from finalist projects (some counted more than once).

Finally, the O.R. impact reported here is just the "tip of the iceberg" because the Edelman competition only captures those O.R. professionals choosing to compete! Just think, the count of Edelman finalist authors (1,249 with some counted twice) represents about 10% of the current INFORMS membership[3]. 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 the United States is $2M/average life ≈ $50K/year (a standard value) *78 years life expectancy *50% average life lived. Total expected annual impact is $12B = 6000 x $2M. See "Advancing Public Health and Medical Preparedness with Operations Research," *Interfaces*, 2013, Vol. 43, No. 1, pp. 79–98 (note Figure 6). Numbers are reasonable values offered by the author.

[2] "Bayesian Networks for Combat Equipment Diagnostics," *Interfaces*, 2017, Vol. 47, No. 1, pp. 85–105.

[3] It is interesting how the average number of authors per paper has grown from 1.8 over first 10 award years (1974–1982) to 8.1 over the last 10 award years (2008–2017). Linear regression gives 0.16 annual growth in average authors per paper with $R^2 = 0.79$.

Franz Edelman Award





Recognizing and Rewarding Real Achievement in O.R. and Analytics

The Franz Edelman Award Competition is administered by
The INFORMS Section on Practice

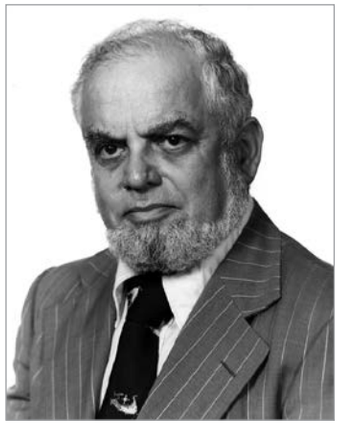
For nearly half a century, the international Franz Edelman competition has shined a spotlight on the most outstanding and inspiring real-world applications of operations research (O.R.) and analytics that are transforming our approach to some of the world's most complex problems.

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 through *Interfaces* online, 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 on the INFORMS website in the Video Library, 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



Franz Edelman

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 excellence in information technology (IT) – 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 share his legacy while advancing the operations research practice to which he contributed so much.





Using data analytics to feed the world

As data analytics increasingly shapes our lives and ushers in a new era in innovation, Syngenta is proud to support the talent and ideals that embody the INFORMS membership and the class of 2018 Franz Edelman Award finalists.

With a growing global population and heightened pressure on the natural resources necessary for food production, the time for cross-industry collaboration has never been more important in the quest for global food security. That's why we launched the Syngenta Crop Challenge in Analytics, hosted by the Analytics Society of INFORMS. Now in its third year, this contest continues to foster the development of unique data-driven models that can improve seed selection and decision-making.

The use of data analytics in our plant breeding program is enabling us to breed better seeds, faster—ultimately helping farmers grow more from less, while delivering on our ambitious goal to make crops more efficient, one of the six commitments that comprise The Good Growth Plan, our global sustainability program.

Congratulations to the 2018 Franz Edelman Award finalists!

For more information about the Syngenta Crop Challenge in Analytics, visit ***www.ideaconnection.com/syngenta-crop-challenge***.

To learn more about our commitment to improving sustainability in agriculture, visit ***www.GoodGrowthPlan.com***.

Connect with us at ***www.Syngenta-US.com/social***.

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Edelman First-Place Award Recipients

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 and 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 OR 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 (SANDF)
"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"



Edelman First-Place Award Recipients

(Continued)

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

1984 (dual) The Netherlands Rijkswaterstaat and the RAND Corporation
"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

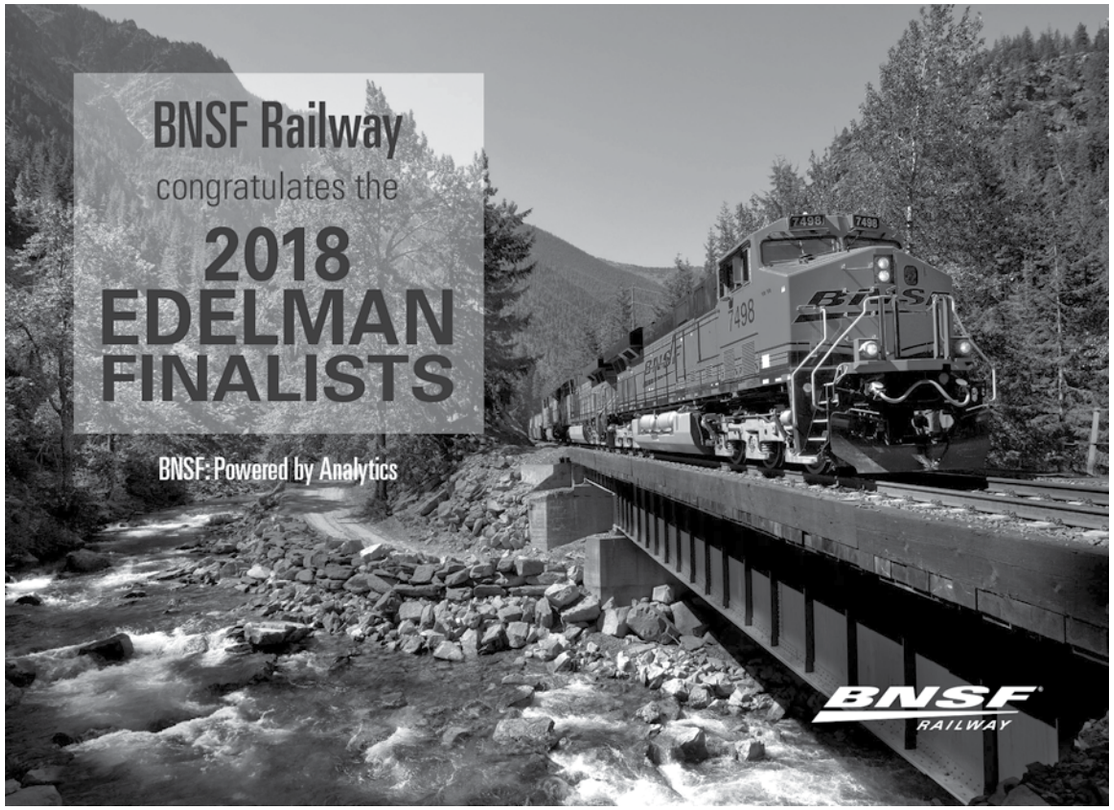
Congratulations to the Franz Edelman Award Finalists!

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The Finest Step Forward: The Journey to the Franz Edelman Award

Every year, 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 fall, INFORMS issues a call for entries, and, ultimately, nearly two dozen organizations from around the world provide a brief summary illustrating an analytics or 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 three dozen practitioners and academics from leading analyics and O.R. programs around the world, including Honeywell, SAS, Verizon, Chevron, UPS, Purdue University, NYPD, U.S. Air Force, BNSF Railway, MIT, Boeing, IBM, and General Motors. This committee spends many hours reviewing each entry, narrowing the applicant field to a group of semifinalists, and by the end of the year, six are recognized as Edelman Award finalists.

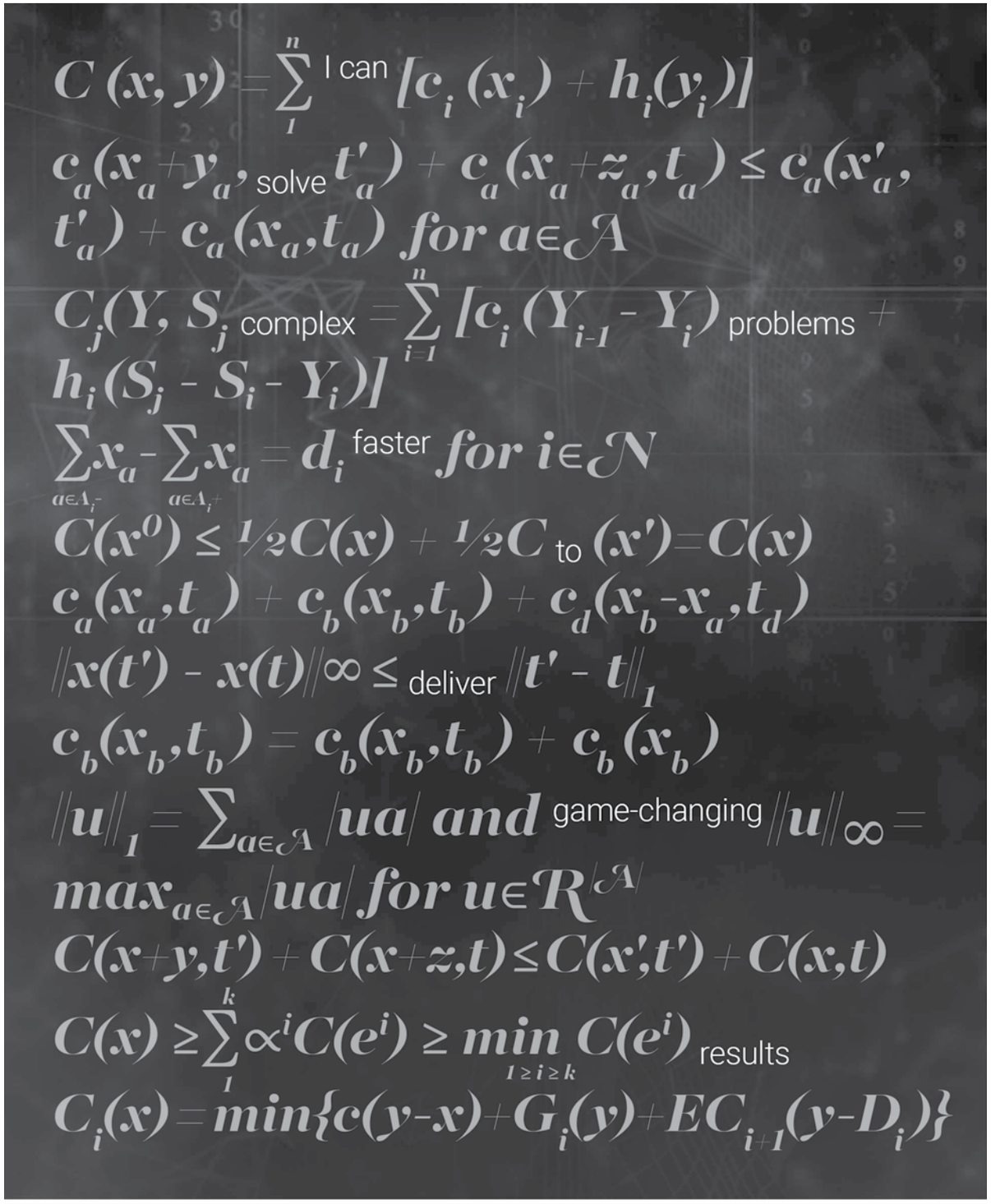
An important part of the review process, each entry is carefully evaluated by a team of verifiers, who work with the relevant stakeholders to validate the details of their award entry. The verifiers thoroughly examine the work presented in the assigned entry summary, as well as its potential impact, and convey this information to the rest of the selection committee. The verifiers directly communicate with the entrant's analytics and 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 analytics and O.R. will be represented in the Edelman Award competition. All verifiers adhere to detailed written guidelines and sample verification reports to ensure a thorough process that is identical for each award entry.

Once the Edelman Award Committee announces the six entries that they have selected to advance to the finals, each finalist will prepare a journal-quality paper and a 40-minute presentation that is conducted during the upcoming *INFORMS Conference on Business Analytics and Operations Research*. Each finalist is assigned a team of experienced coaches who guide them throughout each step of the process, and help ensure that the team's paper and presentation will clearly and concisely 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 independently studies the papers, 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, elaboration, or improvement prior to the final presentation.

On the day of the competition, each team conducts a 40-minute presentation, followed by a 10-minute period of questioning by the judges. As they assess each presentation, the judges will base their decision on 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 each finalist team has presented, the judges sequester themselves to carefully review all that they have heard and seen, until they unanimously agree on which finalist team best exemplifies the ideals and standards of the Franz Edelman Award and its legacy representing more than 47 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 *Interfaces*, which is dedicated to improving the practical application of O.R. and advanced anayltics 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 Analytics Conference. All finalists will again be invited to reprise their work in a session at the *INFORMS Annual Meeting* in the fall, which attracts nearly 6,000 analytics professionals and academics worldwide. The first-place team will also conduct a keynote address during the Annual Meeting.



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The 2018 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.

Selection Committee & Verifiers

- 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*
- Rob Benson, Spinnaker Management, *v*
- Sudip Bhattacharjee, University of Connecticut
- John R. Birge, University of Chicago, *v*
- Ann Bixby, Aspen Technology, *v*
- Srinivas Bollapragada, General Electric
- Anthony Brigandi
- Bruce Bukiet, New Jersey Institute of Technology
- C. Allen Butler, Daneil H. Wagner Associates
- Luz Adriana Caudillo Fuentes, Universidad Anáhuac, *v*
- Pooja Dewan, BNSF Railway
- Kenneth Fordyce, Arkieva
- Yanai Golany, Verizon
- Michael F. Gorman, University of Dayton, *v*
- Stephen Graves, Massachusetts Institute of Technology
- Arnold Greenland, CAP, University of Maryland, *v*
- Sidney Hess
- Yoshiro Ikura, SAITECH, Inc, *v*
- Ananth Iyer, Purdue University, *v*
- Shrikant Jarugumilli, Monsanto Company, *v*
- William Klimack, Chevron
- Russell P. Labe, CAP, RPL Analytics Consulting
- Evan Levine, New York City Police Department
- Yingdong Lu, IBM, *v*
- Irvin Lustig, CAP, Princeton Consultants, *v*
- Charles McCallum
- R. John Milne, Clarkson University, *v*
- Sven Müller, University of Applied Sciences Karlsruhe, *v*
- Patricia Neri, SAS Institute, Inc.
- Ranganath Nuggehalli, CAP, UPS, *v*
- Anna Olecka, Honeywell, *v*
- Pelin Pekgun, University of South Carolina, *v*
- Jesse Pietz, CAP, United States Air Force Academy, *v*
- Graham Rand, Lancaster University
- Olga Raskina, Juno Therapeutics, *v*
- Anne G. Robinson, Verizon
- Randall S. Robinson, *v*
- Harrison Schramm, CAP, CANA Advisors, *v*
- Leon Schwartz, Informed Decisions Group
- Peiling Wu-Smith, General Motors, *v*
- Kendra Taylor, KEYfficiencies, Inc., *v*
- Rajesh Tyagi, GE Global Research, *v*
- Andres Weintrab, University of Chile

"v" Indicates Verifiers

The Coaching and Judging Process & The 2018 Coaches and Judges

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

The major role of the coach is to ensure each team's paper and presentation convey 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, NJIT
- Jeffrey M. Alden, General Motors
- Carrie Beam, University of Arkansas
- Luz Adriana Caudillo Fuentes, Universidad Anáhuac
- Arnold Greenland, CAP, University of Maryland
- Yingdong Lu, IBM
- Irvin Lustig, CAP, Princeton Consultants
- Anna Olecka, Honeywell
- Pelin Pekgun, University of South Carolina
- Olga Raskina, Juno Therapeutics
- Randall S. Robinson
- Kendra Taylor, KEYfficiencies, Inc.

Judges

- Anne G. Robinson, Chair, Verizon
- Susan Albin, Rutgers University
- Sudharshana Apte, Altria Client Services
- Zhi-Long Chen, University of Maryland
- Pooja Dewan, BNSF Railway
- Michael F. Gorman, University of Dayton
- Ananth Iyer, Purdue University
- Evan Levine, NYC Police Department
- Harrison Schramm, CAP, CANA Advisors

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 *Interfaces* are recognized with this distinction, and each is formally presented with the Franz Edelman Medal.

Laureates are recognized for their significant contribution to work that is selected each year as a representative of the best applications in the world of analytical support for decision making.

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



The Edelman Academy

Each year, a limited number of organizations may be 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 47 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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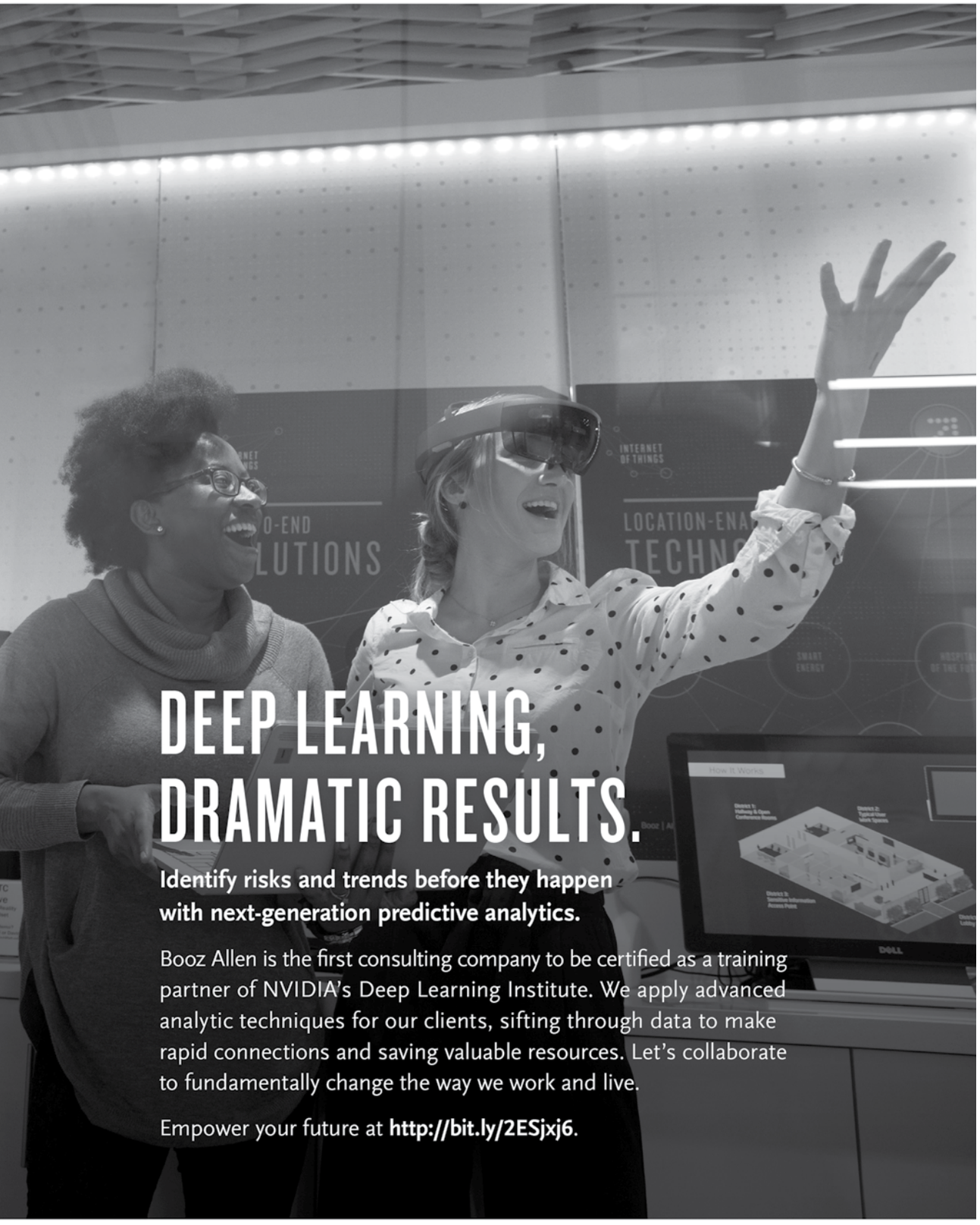
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Introduced in the pages that follow are the six finalists for the 2018 Franz Edelman Award.

Over the past several months these teams have demonstrated to the judges 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 2018 Franz Edelman Award.

Each finalist's work is described here in a shortened summary. Full papers will be published in the January/February 2019 issue of *Interfaces*, the INFORMS journal dedicated to improving the practical application of operations research and advanced analytics in today's organizations and industries.

The Finalists for the 2018 Franz Edelman Award are:

China National Petroleum Corporation

Europcar

Federal Communications Commission

Intel

Pediatric Heart Network

Turner Broadcasting System, Inc.

China National Petroleum Corporation

Operations Research Models Enable Better Planning of Natural Gas Pipelines Resulting in Reduced Costs, Lower Budgets, and Enhanced Revenues

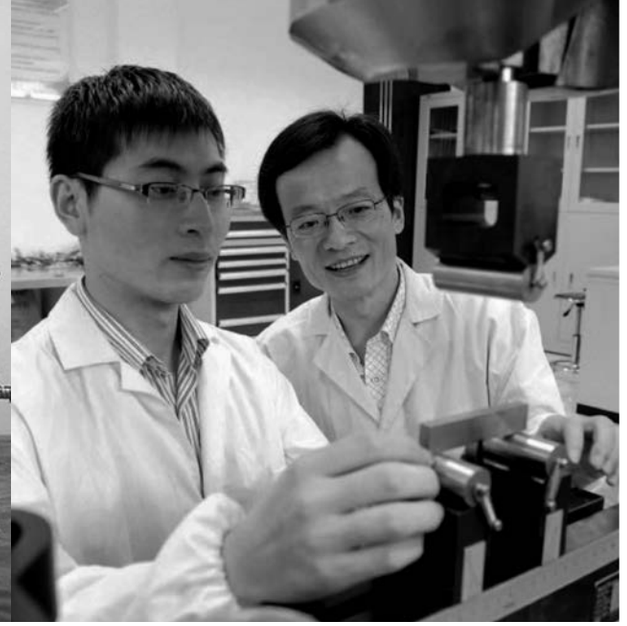
From 2010 to 2015, China's annual natural gas consumption increased from 107 to 193 billion cubic meters, while the total length of the pipeline network grew from 32,800 to 45,000 kilometers. With the demand for natural gas expected to continue rapidly increasing, and in view of the large scale, China recognized a need to be efficient in planning, constructing, and operating its pipeline network.

China National Petroleum Corporation (CNPC) is China's largest oil and natural gas producer and supplier and one of the world's top five players in the energy industry. CNPC now holds over 72 percent of China's natural gas resources plus approximately 70 percent of national pipelines. Since its establishment in 1988, CNPC has integrated a series of upstream and downstream oil and gas businesses. Prior to 2015, all annual planning for gas production, importing, transmission, storage, and sales for CNPC was conducted by traditional methods using spreadsheets. Increasing complexity caused this to become no longer feasible.

To pursue efficiency, and conquer complexity, CNPC turned to operations research. Researchers from CNPC, the University of California, Berkeley, and Tsinghua University (Beijing) partnered to develop and implement novel analytical models. CNPC's approach changed from making simple production-pushing or demand-pulling decisions to profit maximization. Optimization models were








developed to deal with the complex physical laws of natural gas pipeline transmission dynamics and to provide a unified way to handle different models. The research team worked to produce models that complete in seconds, generate solutions with satisfactory accuracy, are robust, and are user friendly.

The operations research team modeled the dynamic planning of natural gas transmission and usage as a nonconvex, deterministic optimization problem. They invented an innovative solution method to tackle both finding optimality and being sufficiently accurate. Specifically, they modeled the application as a nonconvex and nonlinear mixed-integer problem, then convexly relaxed and solved it. They proposed a three-stage framework to improve solution accuracy, and also developed implementing software.

Benefits of the operations research effort have been substantial. Implementation of the software saved more than $330 million for CNPC's natural gas transmission in post-implementation years 2015 and 2016. In addition, efficiencies discovered within the existing pipeline network postponed the need for new pipelines, resulting in a budget reduction of over $18 billion. CNPC realized greater revenue from selling more natural gas than would have been possible without the efficiencies. Furthermore, the importance of optimization has been recognized by the entire corporation, while the modeling methods and the optimization software system have become core techniques for reducing operational costs at CNPC.

This project also favorably impacts China's sustainable development. The new analytical software provides accurate evaluation of CNPC's current transmission capacity, helps to make well-informed new investment decisions for its transmission system, and thereby facilitates more efficient operation of the gas network that increases the percentage of natural gas in China's energy consumption, and thus has a positive impact on the sustainable development of China's economy.

Organization

China National Petroleum Corporation (CNPC) and China Petroleum Planning and Engineering Institute (CPPEI)
CNPC is a Chinese oil and gas corporation and one of the largest integrated energy groups in the world. CNPC was ranked third in the 2016 *Fortune Global 500*. CNPC is the largest oil and natural gas producer and supplier in China, and is one of the world's five major players in the energy industry. Since its establishment in 1988, CNPC has integrated a series of upstream and downstream oil and gas businesses and now holds approximately 72 percent of domestic natural gas resources and 70 percent of the domestic pipeline network.

CPPEI is the research and consulting division of CNPC. It is responsible for the technological and economic analysis of petroleum- and petrochemical-related construction projects. Since its foundation, CPPEI has played a key role in the design and technology development of many important projects, including the West-East natural gas transmission project, construction of gas transmission pipelines between China and Russia, and development of gas storage facilities in Kuwait.

Department of Industrial Engineering and Operations Research (IEOR), University of California, Berkeley
The Industrial Engineering and Operations Research Department (IEOR) at UC Berkeley invents, analyzes, and teaches tools and approaches for design, analysis, risk management, and decision making in complex real-world systems like supply chains, energy systems, healthcare systems, and financial systems.

Department of Civil and Environmental Engineering at UC Berkeley
The Department of Civil and Environmental Engineering (CEE) is a worldwide leader in developing engineering solutions to societal-scale challenges. The Department conducts cutting-edge research in evolving and vital areas that address societal needs for well-designed and well-operated buildings, energy, transportation, and water systems. These critical systems must be reliable and resilient in the face of hazards such as earthquakes and flooding. Extensive efforts will be needed to adapt civil infrastructure to withstand adverse changes in weather and climate.

Department of Industrial Engineering at Tsinghua University
The Department of Industrial Engineering is the leading industrial engineering program in China. The Department has three institutes—Operations Research & Logistics, Production Engineering, Human Factors and Ergonomics—and has established a series of laboratories. The research of the faculty covers major sub-specialties in industrial engineering including engineering management, operations research, logistics and supply chain management, and system engineering.

Europcar

Opticar–Forecasting, Simulation, and Optimization for Vehicle Rental

The car rental industry is one of the most complex businesses from a revenue and logistics management point of view. It is highly dynamic, operating in a competitive market, and associated with high financial risks because of the intensive requirement of asset investments.

Opticar is the decision support system used by Europcar, the leading European car rental company, to help revenue and capacity managers in their daily operations. Opticar features forecasts, discrete event simulations, and optimization techniques providing an integrated approach to demand forecasting, revenue management, and fleet and price optimization.

Opticar was designed with the collaboration of ACTOR, a math-based company with over 20 years of competence in discrete and continuous optimization, and predictive analytics, all applied in many different industries like retailers, fashion, transportation, and others.

The car rental business is a dynamic industry in a competitive market, impacted by several global and local factors such as: seasonality, weather, local events (like an expo, sporting event, and concerts), and the flow of airport passengers.

To govern such business on an international scale is a big challenge, mainly because each of the corporate countries can have a different context from the others. Furthermore, any action, relevant to the revenue and capacity management, exposes the decision makers to risks of creating a low fleet saturation (profit deterioration) or loss of business opportunity. Moreover, this challenge is also associated with high financial risks as this business requires intensive asset investment.



To face this demanding scenario, multiple decisions have to be made, impacting both the revenue management and customer satisfaction. For example, capacity managers plan for the next few months, the in-fleet and de-fleet of vehicles to/from the right geographical area. At the same time, they define long-term contracts with car vendors establishing the number of cars to be acquired and dismissed (returned) as well as the economic conditions including penalties in case cars exceed the maximum predefined mileage. Capacity managers also make decisions about the fleet allocation; in other words, they plan the shuttling of cars (transfers) between different geographical locations to match the demand. Revenue managers, on the other hand, define the price for each car (group) and station based on rental duration and the expected market conditions, such as number of competitors or their actions. They also define promotions and stop sales in case of expected excess-demand.

Opticar supports decision makers to make the best decisions, sharing a common view of the future, anticipating critical situations. It merges multiple predictive models, combining statistical models and artificial intelligence to provide the forecast of the demand. It also features a simulation model to evaluate the uncertainty of the demand on the business and two optimization models: the fleet composition and allocation and the vehicle pricing. The former, based on a large-scale linear programming problem, is solved through an ad-hoc genetic algorithm, while vehicle pricing considers the dynamics and the advance bookings. It is based on a black-box optimization problem and solved through a global optimization heuristic.

Opticar is used by nine Corporate Europcar countries (France, Great Britain, Belgium, Germany, Italy, Spain, Portugal, New Zealand, and Australia) and its adoption by the franchisee network is currently starting.

Despite widely different cultures and work logic, Opticar permitted a standardization of the processes, a higher level of corporate cooperation, and most importantly, higher quality of the decisions that improved the overall Europcar financial and customer service performances.

Organization

Europcar
Europcar is the European leader in vehicle rental service and is also a major player in mobility markets. Active in more than 130 countries and territories, including nine subsidiaries in Europe and two in Australia and New Zealand, Europcar serves customers through an extensive vehicle rental network composed of its wholly-owned subsidiaries as well as sites operated by franchisees and partners. The group operates mainly under the Europcar® InterRent® and Ubeeqo® brand. Customer satisfaction is at the heart of the group's mission and all of its employees; this commitment fuels the continuous development of new services. The Europcar Lab, based in Paris, was created to better grasp tomorrow's mobility challenges through innovation and strategic investments, such as Ubeeqo, E-Car Club, or Brunel.

ACT Operations Research
ACT Operations Research (ACTOR) is a math-engineering company specialized in providing corporate decision-making software and process control solutions. Offices are located in Charlotte, NC; London, UK; and Rome, Italy.

ACTOR's core business is to provide solutions based on: math-optimization, artificial intelligence (AI), discrete event simulators, and predictive models. Such software technologies, combined with corporate big data, support complex business decisions and systems control. ACTOR's decision-science software platform enables "what-if" analysis as well as real-time optimization.

ACTOR has gained over 20 years of competence in discrete and continuous optimization, predictive analytics, supply chain and logistics. Through this expertise, applied in many different industries like retailers, fashion, transportation and others, ACTOR offers optimized solutions and revenue management technology to help clients cut costs and improve profits.







Federal Communications Commission

Unlocking the Beachfront: Using Operations Research to Repurpose Wireless Spectrum

The U.S. Federal Communications Commission (FCC) authorizes and manages the use of the radio frequencies ("spectrum") that Americans use for communications purposes. The demand for spectrum has increased dramatically every year as myriads of new types of devices and uses for spectrum are being developed—and demanded by consumers and businesses. But spectrum is a finite natural resource that has become scarce as consumer, business, and governmental agency needs increase. Since new, unoccupied spectrum cannot be manufactured, one way to create supply to meet new demand is to repurpose spectrum from one use to another.

In 2012, based in part on the FCC's preliminary operations research studies demonstrating the feasibility of the concept, Congress passed a law directing the FCC to relieve the "spectrum crunch" by conducting the world's first two-sided "incentive auction" using market incentives to repurpose some over-the-air broadcast television spectrum to wireless communications services. The auction would offer television stations "incentive" payments to voluntarily relinquish their spectrum (i.e., TV channel assignments) and reassign the remaining television stations into the smaller segment of the spectrum allotted to television broadcasting after the auction. The vacated spectrum would then be converted from television broadcasting into expanded capacity for wireless communications services.

Conducting this auction required far more than the creation of a standard exchange for a largely homogeneous commodity. The television channels to be purchased in the









auction differ in terms of the population they cover based on their location, frequency, and other factors. Adding significantly to the auction design challenges, the wireless spectrum "products" to be sold in the auction would not be usable by wireless service providers unless reconfigured into contiguous blocks whose dimensions differ in both frequency and geographic scope from the broadcast licenses. This required the FCC to use innovative operations research techniques and analytics to create a successful auction.

The FCC was required to determine how much spectrum was available to be repurposed, how to determine channel availability for nearly 3,000 stations across the United States and Canada on as few as 28 channels, and what new channel assignments would be feasible substitutes for television broadcasters who would remain on the air after the auction. This required analyzing massive quantities of data, creating optimization and feasibility models, and determining appropriate policy objectives to serve American consumers, the wireless industry, and television broadcasters. Without the use of operations research, the auction would not have been possible.

To solve these challenging problems, the FCC created two tools: (i) a distributed optimization solver to address all optimization problems, using Gurobi, combined with a set of custom heuristics and decomposition approaches to determine optimal or near optimal solutions, for each problem; and (ii) a highly customized portfolio of satisfiability solvers that determine, usually within a fraction of a second, whether a given station repacking was feasible or infeasible.

This unique and unprecedented auction generated nearly $20 billion in revenue from wireless providers, of which over $10 billion was paid to winning television broadcasters, $1.75 billion to support television stations required to switch to a new channel, and $7.3 billion to the U.S. Treasury to reduce the federal deficit. The auction repurposed 14 channels (84 MHz) of valuable low-band spectrum; 70 MHz for licensed use to support technologies like next-generation 5G mobile broadband and the Internet of Things, and 14 MHz for unlicensed use to support technologies like Wi-Fi and wireless microphones. The FCC's use of optimization enabled the market to determine the maximum amount of spectrum to repurpose while giving all stations that remain on air a channel equivalent to their pre-auction channel. Importantly, these tools ultimately enabled the FCC to assign most of the remaining TV stations to their original channel, thereby significantly reducing transition costs and TV viewer inconvenience.

The FCC has continued to embrace operations research solutions, including using optimization to develop the post-auction transition schedule for broadcasters. This schedule helps broadcasters coordinate limited transition resources to enable all broadcasters to transition by the final deadline so that wireless providers can promptly use their newly acquired spectrum to provide expanded services to American consumers. The FCC also sees operations research as a pillar of its new Office of Economics and Analytics that will help to inform and improve future policy decisions. As the FCC's Chairman recently stated, "The success [of operations research to solve complicated design and implementation challenges of the incentive auction] speaks for itself, and the team's work is exemplary of the data-driven approach to policymaking that I believe should be this agency's hallmark." This groundbreaking auction has also created a new and powerful tool for managing spectrum use internationally.

Organization

Federal Communications Commission
The Federal Communications Commission regulates interstate and international communications by radio, television, wire, satellite, and cable in all 50 states, the District of Columbia, and U.S. territories. An independent U.S. government agency overseen by Congress, the commission is the United States' primary authority for communications law, regulation, and technological innovation. In its work facing economic opportunities and challenges associated with rapidly evolving advances in global communications, the agency capitalizes on its competencies in:

- Promoting competition, innovation, and investment in broadband services and facilities;
- Supporting the nation's economy by ensuring an appropriate competitive framework for the unfolding of the communications revolution;
- Encouraging the highest and best use of spectrum domestically and internationally;
- Revising media regulations so that new technologies flourish alongside diversity and localism; and
- Providing leadership in strengthening the defense of the nation's communications infrastructure.

Intel

Analytics Makes Inventory Planning a Lights-Out Activity at Intel Corporation

Intel, which employs more than 100,000 people in over 70 countries around the world and has annual revenues of over $60 billion, is a world leader in the design and manufacturing of essential products and technologies that power the cloud and an increasingly smart, connected world. With more than 4 million square feet of manufacturing clean room space, Intel ramps technologies to an enormous scale producing over 10 billion transistors every second.

Intel delivers a constantly evolving product portfolio consisting of computer, networking, and communications platforms to a broad set of customers including original equipment manufacturers (OEMs), original design manufacturers (ODMs), cloud and communications service providers, as well as industrial, communications, and automotive equipment manufacturers. To do so requires managing a complex, worldwide supply chain with approximately $1.5B in finished goods being managed at any moment.

Today, Intel is proud to be an Edelman Award finalist for our work in inventory management, an achievement almost unthinkable a decade ago. In the mid-2000s, Intel's supply chain was far from best-in-class. In response to customer concerns and the reality of needing world-class supply chain capabilities in increasingly global markets, Intel committed to updating its supply chain management capabilities, thus kicking off a 10-year journey spanning logistics, business units, and information technology, that has ended in a nearly complete process transformation and automation of inventory management at Intel.



Where product planner rule-of-thumb heuristics and spreadsheets were formerly the backbone of Intel's inventory management, today a fully automated Multi-Echelon Inventory Optimization (MEIO) inventory target-setting system manages over $1 billion in finished goods enabling daily replenishment to our customers. It took almost a decade of rolling out technical and organizational solutions to get MEIO from initial pilot to automatically generated algorithm-derived inventory targets accepted by planners +99.5 percent of the time; but taking the necessary time to perfect the process has been worth it.

Intel's journey began with its three-echelon distribution network for retail-packaged microprocessors. In 2005, the internal operations research (O.R.) team selected and applied an inventory optimization tool based on the guaranteed service model of safety stock optimization. Over the first few years of deployment, Intel developed several technical solutions to optimize MEIO algorithms to the reality of biased forecasts common across many industries. This initial pilot achieved success in reducing total inventory investment for its boxed CPU channel business line by 11 percent while raising service levels above 90 percent. In addition, Intel created a control group for comparison by not including all of its boxed CPU products and has demonstrated that the pilot SKUs (MEIO) continue to outperform the control group by 10 points of service on average.

Intel's boxed CPU channel business continued to experience decreased inventory levels and increased services levels over the next five years, accounting for a return of $400 million. This proved to be the ideal business unit upon which the internal O.R. team perfected its inventory processes—small enough that brute-force manual processes were feasible, but large enough that the savings, process improvements, and scale provided executive management the confidence to deploy MEIO on the largest and most critical part of Intel's supply chain—its vendor managed inventory (VMI) hubs, through which Intel distributes more than half its microprocessor volume. As a result, Intel's total finished goods inventory subsequently fell $321 million by the end of 2013, and an additional $289 million by the end of 2014, contributing to a 30 percent reduction, or a savings of $600 million, in total finished goods inventory for Intel within two years of implementation.

Over the past six years since fully-automated MEIO has been widely deployed at Intel, agreed upon and aggressive customer service levels have been sustained with our customers, we reduced the time to commit to customers from months to one day, our customer satisfaction supply chain scores have reached and sustained all-time highs, and we've received numerous customer awards and are perennially in the top 10 of Gartner's Supply Chain Top-25. And most importantly to our shareholders, the deployment of MEIO at Intel has been credited with over $1.3 billion in gross profit since 2014.

Throughout the 10-year implementation process, Intel faced and overcame many challenges. This implementation was incredibly broad and deep, encompassing microprocessors through solid storage devices. The challenges that Intel overcame—from technical process to political—are ones virtually any large firm will face in trying to implement lights-out inventory management systems making this work fully transportable to other companies.

Organization

Intel Corporation
Intel is a world leader in the manufacturing and design of essential products and technologies that power the cloud and an increasingly smart, connected world. Intel delivers computer, networking, and communications platforms to a broad set of customers including original equipment manufacturers (OEMs), original design manufacturers (ODMs), cloud and communications service providers, as well as industrial, communications, and automotive equipment manufacturers. We are expanding the boundaries of technology through our relentless pursuit of Moore's Law and computing breakthroughs that make amazing experiences possible. Intel is a perennial *Fortune 100* company with annual revenues exceeding $60B and over 100,000 employees worldwide.





Pediatric Heart Network

Collaborative Systems Analytics: Establishing Effective Clinical Practice Guidelines for Advancing Congenital Cardiac Care

Congenital heart defects (CHDs) are the most common birth defect, occurring in approximately 1 percent of births. They are the most common cause of infant deaths due to birth defects, and survivors often face health issues into adulthood. Variances in surgical practices to treat patients with congenital heart defects among different healthcare centers have led to inconsistent surgical outcomes, some with negative consequences for patients.

This collaborative project of Pediatric Heart Network (PHN) investigators and operations research experts at Georgia Institute of Technology aims to improve the outcome of CHD surgeries by establishing best clinical practice guidelines (CPGs) that can be adopted rapidly across multiple hospitals.

Systems process analyses were carried out at five pediatric heart centers to identify practice variance and associated processes and factors that offer opportunities for improving care delivery and clinical outcome. The team constructed a comprehensive care model to analyze the interplay of care and coordination, management, resources, and the interdependencies of practice on outcomes. Combining observations and data from each site, a large-scale simulation-decision-optimization model was designed. Recognizing that length of stay (LOS) is a good surrogate for success, the model was designed to identify factors that influence length of stay. Using clustering analysis and machine learning, seven factors were identified: pre-op procedures, surgery length, time of extubation (the removal of the breathing








apparatus), tube-removal and chest closing, intensive care unit care management, discharge planning and education, and step down care.

Further analysis and collaborative learning using multidisciplinary team site visits led to the decision to focus on time of extubation. A clinical practice guideline (CPG) regarding early removal of breathing apparatuses after surgery was established. Each hospital would adopt the new protocol and measure its impact according to the standards set forth by the Pediatric Heart Network.

Comparing outcomes during 12 months pre- and post-CPG implementation, after implementation we observed an increase in early extubation rates from 12 to 67 percent, and a decrease in median duration of postoperative intubation from 21.2 to 4.5 hours. There was also a trend toward shorter ICU length of stay (71.6 hours pre- versus 54.2 hours). Overall, the five hospital sites experienced LOS reductions ranging from 12 to 35 percent, decreased time to oral feeds, and an earlier discontinuation of IV analgesics.

Earlier resumption of normal feeding, and reduction in analgesics usage lessen risks of complications. Indeed, since analgesics have been associated with cognitive impairment and brain development in children, it is noteworthy that our post CPG data indicated a reduction of 25–42 percent analgesics usage. Shorter mechanical ventilation time and LOS for patients reduce exposure to critical care therapies and indwelling devices, which subsequently reduces the risk of hospital-acquired infections (HAI). HAI is one of the top 10 leading causes of death in the United States.

In terms of cost savings, our early extubation CPG results in roughly 27 percent savings, or $13,500 per surgical procedure, on average. It reduces 65 percent in clinical care cost, 46 percent in pharmacy, 44 percent in laboratory, and 32 percent in imaging. Each year approximately 40,000 babies are born in the United States with a congenital heart defect, many of whom require multiple surgical procedures. Hence, our work translates to more than 540 million U.S. dollars on procedural savings alone. In addition, there is great potential to magnify cost savings by adapting the CPG to conditions beyond congenital heart diseases, since intubation is required in many surgical procedures.

Finally, it is noteworthy that the hypothesis testing and dissemination of findings required less than two years, as opposed to conventional randomized trials that often take five years or more. Multiple sites adopted the changes with consistently good outcomes, thus providing high confidence in the clinical findings. Further, this work was accomplished with only a fraction (2 percent) of the budget of a typical clinical trial. The collaborative learning framework used herein can serve as a blueprint for other clinical and process improvement initiatives.

Organization

Georgia Institute of Technology and the H. Milton Stewart School of Industrial & Systems Engineering
The Georgia Institute of Technology, also known as Georgia Tech, is a top-ranked public college and one of the leading research universities in the United States. Georgia Tech provides a technologically focused education to more than 25,000 undergraduate and graduate students in fields ranging from engineering, computing, and science, to business, design, and liberal arts. The H. Milton Stewart School of Industrial & Systems Engineering (ISyE) is the largest industrial engineering program in the United States, graduating over 10 percent of the world's industrial engineers. It has been ranked as the number one undergraduate and graduate program in industrial engineering for more than two consecutive decades by the *U.S. News & World Report*.

Pediatric Heart Network
The Pediatric Heart Network (PHN), established by the National Heart, Lung, and Blood Institute (NHLBI) in 2001, works to advance the care of individuals with congenital heart defects and pediatric acquired heart disease. The PHN conducts larger, definitive studies that inform clinical practice and meet regulatory requirements. Since 2001, the PHN has partnered with industry, foundations, and other federal agencies to conduct more than 20 multicenter studies, including a number of Phase I and III clinical trials.

Children's Healthcare of Atlanta
Children's Healthcare of Atlanta (CHOA) is a national leader in pediatric care. CHOA consists of three pediatric hospitals (Egleston, Scottish Rite, and Hughes Spalding), the Marcus Autism Center, 27 neighborhood clinics, and two large primary care centers at Chamblee and Hughes Spalding. In 2014, CHOA managed more than 877,782 patient visits, 25,807 hospital admissions, 38,367 surgical procedures (inpatient and outpatient), and 221,952 emergency department visits with Emory clinicians providing the majority of the care.

University of Michigan C.S. Mott Children's Hospital
University of Michigan C.S. Mott Children's Hospital is nationally recognized for excellence in clinical services, research and education, and consistently ranked as one of the leading pediatric healthcare centers in the country. It is nationally ranked in all 10 pediatric specialties in *U.S. News & World Report's* "America's Best Children's Hospitals."

Children's Hospital of Philadelphia
The Children's Hospital of Philadelphia (CHOP) is one of the largest and oldest children's hospitals in the world and in the United States. It is the first hospital dedicated to the healthcare of children. CHOP has 527 beds, almost 40 percent of which are allocated to neonatal, cardiac, and pediatric intensive care. Each year the hospital admits more than 28,000 children and more than 1,167,000 are seen in the emergency and outpatient departments.

Texas Children's Hospital
Texas Children's Hospital, a not-for-profit healthcare organization, is committed to creating a healthier future for children and women. Ranked fourth in the nation by *U.S. News & World Report*. Texas Children's is known for its expertise and breakthroughs. Each year more than 6,000 children are admitted to Texas Children's Hospital Intensive Care Units. Texas Children's has one of the country's largest, busiest, and highest acuity Critical Care services, with 116 intensive care beds across two campuses, all staffed by critical care trained physicians, advanced practice providers, and nurses.

Primary Children's Hospital
Primary Children's Hospital (PCH) is a free-standing children's hospital that serves the tertiary healthcare needs of infants and children in the intermountain states of Utah, Idaho, Wyoming, Nevada, and Montana. Yearly, there are approximately 13,000 inpatient admissions, 43,000 emergency department visits, and 5,000 inpatient surgeries.

Turner Broadcasting System, Inc.

Turner Blazes a Trail for Audience Targeting on Television with Operations Research and Advanced Analytics

Most broadcasting and cable television networks in the United States sell advertisements and deliver impressions (i.e., audience exposures) to advertisers. For decades, television advertisement deals were guaranteed using only demographic metrics that are specified by gender and an age bracket, such as 25-to-54-year-old people of either gender, or P25-54. Recent technological advances allowed the use of statistical methods like data fusion to enhance viewership data with frequent shopper card data, credit card data, or even custom survey information to construct targeted segments such as "cereal buyers" or "auto intenders." These new, more granular metrics have challenged the traditional ways of forecasting, scheduling, and inventory management within the media industry.

Until recently, the media industry has lagged behind other industries in its adoption of operations research and advanced analytics techniques for forecasting and planning. At Turner, existing business processes consisted of largely manual approaches and several other data and technology challenges had to be overcome to deploy and support robust forecasting and optimization systems, including acquiring detailed programming information ahead of time, enabling internal software systems to consume forecasts, customizing forecasting models for certain networks and special content, refining suitable goals and evolving based on feedback from the market and internal business users, and developing rapid prototypes of optimization models.

Turner has leveraged operations research and advanced analytics to take the lead in



establishing the rules of engagement in this new business paradigm by designing and implementing a series of integrated forecasting and optimization methods that operationalize Turner's advanced targeting products, TargetingNOW and AudienceNOW.

On the forecasting side, the approach is inspired by consumer choice modeling and uses a generalized linear mixed-effects model that builds audience estimates for television based on several factors including time-dependent attributes, program attributes, and competitors' program attributes for shows being aired on other networks. The forecasting model can build estimates for virtually any audience segment based on any dataset and these estimates are computed at the most granular level in the industry today, 30-minute blocks by day.

On the optimization side, large-scale mathematical programming models were created to optimize deal proposals and spot placements. A mixed-integer programming proposal builder generates proposals, and prices them based on remaining available commercial airtime, typically measured in 30-second slots, across all Turner's networks honoring agreed-upon restrictions and parameters. A multi-stage, mixed-integer-programming spot scheduler using short-term audience forecasts optimizes the placement of tens of thousands of commercial spots across all domestic networks subject to a multitude of constraints.

The development of Turner's audience targeting solutions posed business and technical challenges that arose from the disruption of decades-old paradigms about transacting and executing television advertisement deals. Internal and external business processes are being reengineered as Turner blazes a trail with breakthroughs in television campaign measurement and execution, taking the lead in establishing the rules of engagement in the targeting landscape, moving the industry forward, and changing its overall perception as a data-driven organization.

The novelty of Turner's methods has resulted in the filing of five pending patents that are directly or indirectly related to this work. It has been recognized within the media industry by the Association of National Advertisers (ANA), which has awarded Turner with the ANA Genius Awards in Marketing Analytics in the categories of Pioneering Analytics Innovation (2015) and Analytics Science (2016).

To date, 130+ advertisement deals using audience targeting solutions have been executed and advertising revenue for our ad products has grown year over year by an average of 143 percent per quarter. Turner is on track to sell 50 percent of its inventory through audience targeting by 2020, representing billions in ad revenue.

Besides the monetary benefits, audience targeting has changed the rules of engagement for advertising sales, changed executive perception of the value of data and analytics in the business, and helped facilitate a positive emphasis in our corporate culture on being data-driven. The impressive benefit of employing analytics and operations research methods to facilitate audience-based selling has led to faster adoption of advanced analytics in other business functions such as content scheduling, financial planning, marketing, and has been extended to international markets. Based on the success of these systems, Turner is expanding its use of these methods to optimize other areas of media revenue management, including its promotional campaign planning, programing planning, as well as its international markets, starting with Latin America.

Organization

Turner
Turner, a Time Warner company, is a global entertainment, sports, and news company that creates premium content and delivers exceptional experiences to fans whenever and wherever they consume content. These efforts are fueled by data-driven insights and industry leading technology. Turner owns and operates some of the most valuable brands in the world, including Adult Swim, Bleacher Report, Boomerang, Cartoon Network, CNN, ELEAGUE, FilmStruck, Great Big Story, HLN, iStreamPlanet, Super Deluxe, TBS, Turner Classic Movies (TCM), TNT, truTV, and Turner Sports.







The Wagner Prize



The Daniel H. Wagner Prize for Excellence in Operations Research Practice

A History

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

2017 Wagner Prize Committee

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The Daniel H. Wagner Prize for Excellence in Operations Research Practice

2017 Finalists

The final component of the 2017 Wagner Prize competition took place at the INFORMS Annual Meeting in Houston, Texas. There, six teams gave presentations to the Practice Section of INFORMS judging committee seeking to demonstrate that the quality and coherence of their analysis in a real-world application qualified them to win this prestigious award for outstanding practice of operations research and advanced analytics.

All finalists' presentations can be viewed at the INFORMS Video Library by scanning the QR code to the left. A special issue of *Interfaces* will publish the winning paper along with those of the other five finalists listed here:

Crew Decision Assist: Optimizing Crew Deployment for Freight Trains

Pooja Dewan, April Kuo, Dasardh Mallampati, Juan Morales, & Brian Roth, BNSF Railway

Anant Balakrishnan, University of Texas at Austin

Optimized Scoring Systems: Towards Trust in Machine Learning for Healthcare and Criminal Justice

Cynthia Rudin, Duke University

Berk Ustun, Massachusetts Institute of Technolgoy

Outcome-Driven Personalized Treatment Design for Managing Diabetes

Eva K. Lee & Xin Wei, Georgia Tech

Francine Baker & Michael D. Wright, Grady Health System

Alexander Quarshie, MD, Morehouse School of Medicine

Dispatch Optimization in Bulk Tanker Transport Operations

Ted Gifford, Tracy Opicka, Ashesh Sinha, Daniel Vanden Brink, & Andy Gifford, Schneider National Inc.

Robert Randall, Princeton Consultants, Inc.

Forecasting and Optimization Models for Audience Targeting on Television

Wes Chaar, Jose Antonio Carbajal, CAP, & Peter Williams, Turner Broadcasting System, Inc.



The Daniel H. Wagner Prize for Excellence in Operations Research Practice

2017 Winner

The first place winners winners are Tamás Terlaky, Mohammad Shahabsafa, Chaitanya Gudapati, Anshul Sharma, Louis J. Plebani, and George R. Wilson, Lehigh University; and Kristofer B. Bucklen, Pennsylvania Department of Corrections.

The paper, "The Inmate Assignment and Scheduling Problem and its Application in the PA Department of Corrections," describes the team's Inmate Assignment Decision Support System (IADSS) that includes a new hierarchical, multiobjective, mixed-integer linear optimization model, which accurately describes the inmate assignment problem. This is the first time that operations research (O.R.) methodologies have been used to optimize the operations of a correctional system, and be built into its routine business practice; thus, it opens a rich and untouched area for the application of O.R. Pennsylvania Department of Corrections officials say IADSS has "transformed" the inmate assignment process in Pennsylvania and can do the same for state correctional agencies across the United States. In the long run, the system could shorten prison stays and reduce recidivism—the rate at which released prisoners commit new crimes—by giving inmates more timely access to the treatment programs they need to earn parole.

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The UPS George D. Smith Prize



The UPS George D. Smith Prize

A 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 finalists for 2018:

- School of Operations Research and Information Engineering, MEng Programs, Cornell University
- Haslam College of Business MSBA, University of Tennessee

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.

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The UPS George D. Smith Prize

The 2018 Competition

Since the earliest days of operations research (O.R.) and analytics, in order 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 2018 Smith Prize winner, but also the next generation of O.R. and analytics professionals and the next great discoveries on the horizon.

UPS George D. Smith Prize Winners

2017
Operations Research Program, United States Air Force Academy

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

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

2014
MIT, Leaders for Global Operations

2013
Naval Postgraduate School

2012
University of Michigan, Tauber Institute for Global Operations

2018 UPS George D. Smith Prize Committee

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Robin Lougee, Past Chair, IBM Research
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ORIE MEng at Cornell Tech

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The ORIE MEng program at Cornell Tech is designed to produce data scientists and quantitative analysts who thrive in technology-driven environments that use computational tools, algorithms, and large volumes of data to make intelligent decisions.

Led by faculty who are actively shaping the future of Big Data and mentored by experienced practitioners, ORIE MEng students work in cross-disciplinary teams to develop innovative solutions to company challenges and bring their own design ideas to fruition.

https://tech.cornell.edu/programs/masters-programs/master-inoperations-research-and-information-engineering

MASTER OF SCIENCE IN BUSINESS ANALYTICS

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THE UNIVERSITY OF TENNESSEE, KNOXVILLE

ANALYTICS MUST BE TAUGHT IN CONTEXT

The core premise of the Haslam College of Business's Master of Science in Business Analytics (MSBA) is that analytics must be taught in the context it will be used—a business environment—in order for students to become effective practitioners.

The program was the first analytics masters launched within a business school. It was developed to meet the industry's need for professionals who not only analyze large, complex data sets, but also leverage insights from data for competitive business advantages.

INDUSTRY CONNECTION

A REAL-WORLD ANALYTICS PERSPECTIVE

Students learn methodologies not merely from a textbook, but from a faculty with extensive analytics experience in a variety of service and manufacturing industries. Our faculty members are Edelman and Wagner Prize honorees, consult for a wide array of organizations, write impactful practitioner books, and teach in UT's programs for business executives.

BUSINESS ANALYTICS FORUM

The Business Analytics Forum convenes twice a year and brings industry practitioners to campus for a two-day fall conference with approximately 200 attendees. It aims to expand the analytics knowledge of industry partners, faculty, and students; share best practices in analytics; and provide a mechanism for students to learn from industry partners about current issues they face.

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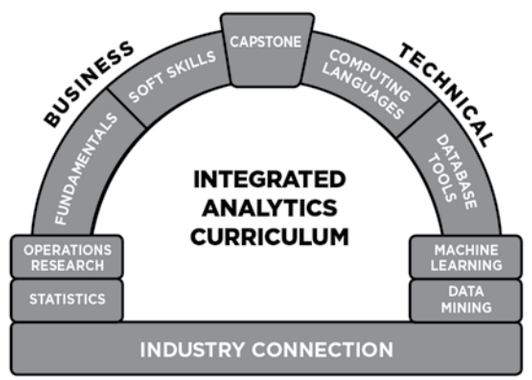
Our core curriculum combines cutting-edge analytics with the fundamentals of business strategy. Students develop accounting, marketing, operations, and supply chain knowledge along with skills in data visualization, analytic software tools, and big data technologies. We also teach students soft skills like teamwork, project management, leadership, and the ability to communicate the results of complex analyses in a way that any manager can understand.

CAPSTONE EXPERIENCE

Our students gain real-world experience throughout the program, interacting with practitioners through a variety of touch points the culmination of which is the capstone experience. During the capstone, student teams work through a challenging analytics project with a corporate client.

The experience simultaneously sharpens their technical, strategic, and soft skills. At the project's end, teams present their recommendations to executives from client companies, most of which are Fortune 500.

HASLAM MSBA CURRICULUM



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The Tauber Institute for Global Operations congratulates the **2018 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.**

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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.

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In 2017, student teams worked on 32 projects submitted by 23 companies, and averaged $18.5 million/per project savings over 3 years. The total savings projected according to sponsoring company calculations, was $575 million.

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TAUBER INSTITUTE FOR GLOBAL OPERATIONS
UNIVERSITY OF MICHIGAN

THE INFORMS PRIZE



The INFORMS Prize

A History

This is the 11th 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.

INFORMS Prize Winners

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.

2018 INFORMS Prize Committee

Tarun Mohan Lal, Chair, Mayo Clinic
Manoj Chari, SAS
Margery Connor, CAP, Chevron
Dayana Cope, The Walt Disney Company
Mark A. Gallagher, U.S. Air Force
Jennifer Rausch, Jeppesen
Peiling Wu-Smith, General Motors

The 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.





BNSF RAILWAY

2018 INFORMS Prize Winner

BNSF Railway

The 2018 INFORMS Prize is awarded to BNSF Railway for extensively deploying operations research and advanced analytics solutions across all facets of its business. BNSF is the product of nearly 400 different predecessor railroad lines that merged or were acquired over its more than 160-year history. The Fort Worth, Texas-based company has more than 41,000 employees spread across its 32,500-mile rail network. BNSF transports goods and commodities for its roughly 10,000 customers, improving people's lives across the continent.

As one of the largest freight railroads in North America, BNSF faces very complex and large-scale logistical challenges. Over the years, BNSF has increasingly turned to advanced analytics and operations research techniques to resolve issues related to train routing, train building, train dispatching, crew scheduling, fleet sizing, locomotive fueling and inspections, equipment distribution, facility simulation, car-to-customer assignment, track maintenance planning, and much more.

In 2013, BNSF increased its commitment to quantitative problem-solving by tripling the size of its Operations Research & Advanced Analytics team to continue focusing on using cutting-edge analytic techniques to help the business. Now, five years later, this centralized team has grown to more than 25 full-time employees with advanced degrees in a variety of fields including operations research, industrial engineering, applied mathematics, computer science, and statistics with an emphasis on optimization, simulation, machine learning, deep learning, and image recognition. The team's work is conservatively estimated to save BNSF more than $110 million annually. These estimated savings are equivalent to more than 0.5 percent of BNSF's revenues and 2.8 percent of the company's net earnings in 2017. It is worth noting that these figures are unable to encompass significant improvements in employee safety and in crew quality of life, arguably the team's most important contributions.

Moving forward, BNSF will continue to improve safety, service, efficiency, and reliability for its customers. The Operations Research & Advanced Analytics team will play a critical role in this mission with its data-driven, quantitative approach to problem solving. As BNSF rides the wave of technological advancement, it is important to remember the company's core identity and the value of its work. In the words of BNSF's EVP Operations, Dave Freeman, "providing supply chain solutions that consistently meet our customers' expectations has always been a priority for BNSF. That is why every day we approach our work with an analytical and results-driven mentality."

UNITED AIRLINES
SM
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• We're passionate about analytics, too

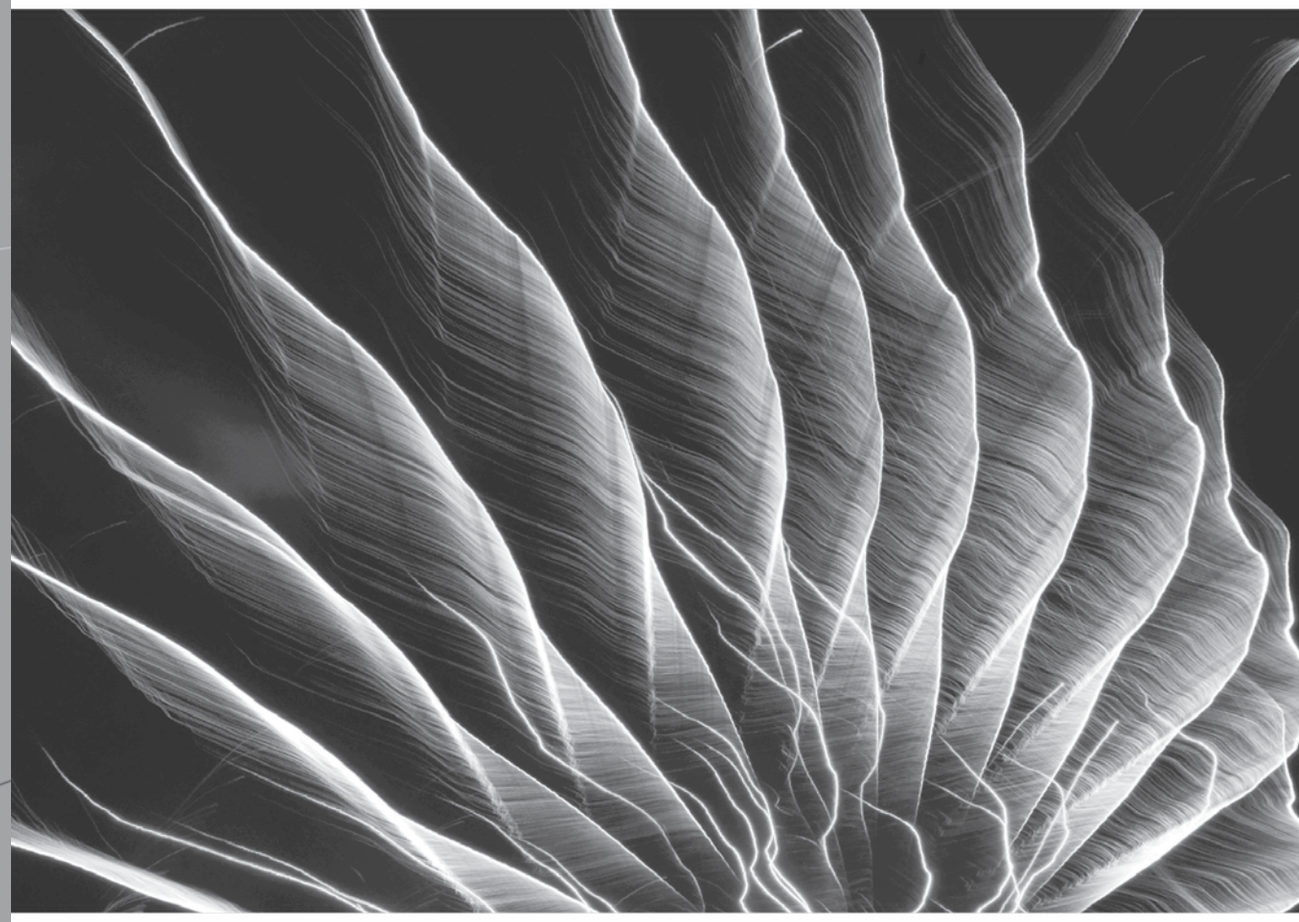
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About INFORMS

The Institute for Operations Research and the Management Sciences

From increased efficiency in business processes to lifesaving advancements in medical treatments to revolutionized transportation and delivery systems, analytics and operations research are impacting nearly every organizational sector. And the world is beginning to take notice. *U.S. News & World Report* listed operations research analyst as one of the top 10 business jobs for 2018. At the heart of this growing field is INFORMS, the world's largest professional association for a vibrant, growing community of more than 12,000 operations research (O.R.) and analytics professionals, academics, and students, representing more than 90 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 recognizing 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 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 over 20 percent of *Fortune 100* companies now employing CAP certified analytics and O.R. professionals, these certifications 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 pertain directly to analytics and operations research applications. 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.

Congratulations to the 2018 Franz Edelman Award finalists and thank you, both for your incredible contributions today, and for inspiring the great O.R. and analytics discoveries and advancements of tomorrow.





JD.COM

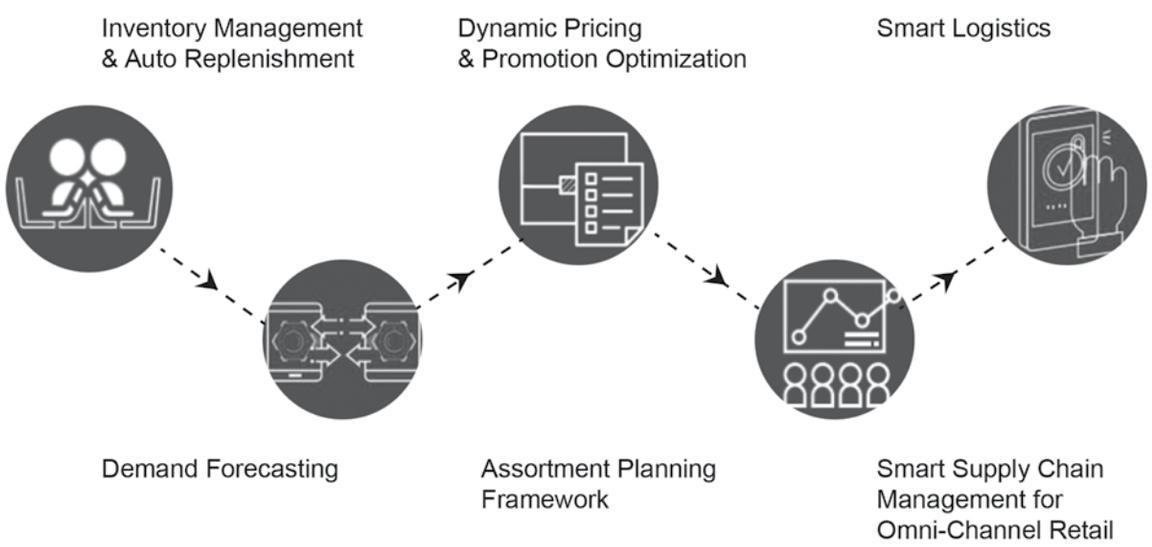
About JD.com

JD.com is both the largest e-commerce company in China, and the largest Chinese retailer, by revenue. The company strives to offer consumers the best online shopping experience. Through its user-friendly website, native mobile apps, and WeChat and Mobile QQ entry points, JD offers consumers a superior shopping experience. The company has the largest fulfillment infrastructure of any e-commerce company in China. JD.com is a member of the NASDAQ100 and a Fortune Global 500 company.

JD Smart Supply Chain Solution

To manage the flow of millions of SKUs through China's largest nationwide fulfillment network, JD has built a modularized smart supply chain solution which supports the design, planning, execution, control and monitoring of supply chain activities, backed by cutting-edge big data, blockchain, IoT, natural language processing, image & vision recognition, machine learning and deep learning technologies.

Smart Supply Chain Management



JD.COM

Smart Supply Chain Control Tower



Unified Supply Chain Demand Forecasting

JD's Unified Demand Forecasting (UDF) system is the core engine of JD's smart supply chain. It supports all major planning systems for JD's daily operations, such as financial forecasting, demand forecasting and order quantity forecasting.

Assortment Planning Framework

JD's Assortment Planning System helps category managers optimize product selection to maximize profit. It leverages big data and AI to identify the consumer decision tree and design specific strategies, enabling optimization of product selection to fulfill customer needs.





Smart Inventory Management and Auto Replenishment

JD's Smart Inventory Management is a big data and AI-based integrated solution that combines smart technology, automation, collaboration and visualization. The Auto Replenishment System supports the replenishment of millions of SKUs for JD.com.

Dynamic Pricing and Promotion Optimization

Leveraging AI, JD's Dynamic Pricing and Promotion Optimization system provides retailers and brands with personalized pricing solutions throughout the entire product life cycle to improve the sales conversion rate and to provide competitive advantages for merchandisers. The system also uses pricing as a key driver to help partners optimize omnichannel promotions.





Supply Chain Optimization

JD's optimization and simulation technologies are widely applied to many decision support and decision making scenarios, including but not limited to inventory management, warehouse location, assortment planning, dynamic pricing, promotion planning, order fulfillment and last-mile delivery.

Smart Supply Chain for Omnichannel Retail

As an integrated service for offline retail, JD's Smart Supply Chain provides complete solutions to omnichannel retailers to complement and enrich offline retail data and empower smart decision making for brick and mortar stores.



To learn more about JD.com:
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INFORMS Section on Practice—Staying True to Our Origins: Advancing the Practice of Operations Research and Advanced Analytics

By Ranganath Nuggehalli, CAP, Chair, 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 satisfying 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, please send an email to me at: rnuggehalli@ups.com. It would be great if you could join us.

Calls for 2018 Nominations

THE FRANZ EDELMAN AWARD
Achievement in Operations Research

FRANZ EDELMAN AWARD

Achievement in Advanced Analytics, Operations Research, and Management Science

The purpose of the competition is to recognize and reward outstanding examples of O.R. and analytics in practice.

Deadline to Submit an Application: Wednesday, October 17, 2018

THE INFORMS PRIZE

Sustained Integration of Operations Research

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

Deadline to Submit an Application: Saturday, December 1, 2018

THE DANIEL H. WAGNER PRIZE

Excellence in Operations Research Practice

The Wagner Prize is given to the authors of a previously unpublished paper detailing a real-world, provably successful application of operations research or advanced analytics that required innovative mathematical development, a unique new algorithm, or a series of coherent O.R. advances.

Deadline to Submit an Application: Tuesday, May 1, 2018

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.

Deadline to Submit an Application: Wednesday, October 31, 2018

These prizes will be awarded at the 2019 Analytics Conference in Austin, Texas
April 14-16, 2019



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Acknowledgments



The Past Edelman Laureates

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 Lakshminarsimha Kompella
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
Luis Reinoso
Madangopal Revoor
Carlos Reinoso
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
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
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
Sven Muller
Jeet Mukherjee
Brian O'Connell
Herbie Pearthree
Roy Rice
Liliana Shelton
Sandy Sun
Gerald Teper
Xiaochuan Zhang Toveyw
Clay Upton
Pamela J. Williams
Liang Xu
Bachman
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
Youssef Drissi
Dick den Hertog*
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

** Indicates member of winning team*

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*
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
Fernado Valenzuela
Jie Wan
Melissa Weatherwax
Andres Weintraub
Liu Xiao Hu
Ming Xie
Jun Yin Wen*
Daniel Yung
Eugene Zak*
Bin Zhang

2010

Gerkotze Bonthuys
Ebert Cawood
Jay Cunningham
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
Miguel de Lascurain*
Willem Louw
John MacNaughton
Kim Mathisen
Marlize Meyer
David Fernando Muñoz, CAP*
John J. Neale
Arturo Palacios-Brun*
Steve Palmer
Hylton Robinson
Omar Romero-Hernandez*
Oscar Rosen
Ruan Rossouw
John Ruark
Luis de los Santos*
James Serio
Francisco Solis*
Gerrit Streicher
William Tarlton
Hentie van den Berg
Anette van der Merwe
Wim Van de Velde
Lorraine van Deventer
Jaime Villaseñor*
Glenn Wegryn, CAP
Sean P. Willems
Cecile Wykes

2009

Dharma Acharya
Jason Amaral*
Dirk Beyer*
Ann Brecht*
Matt Callahan
Brian Cargille*
Felipe Caro
Russ Chadinha*
Kathy Chou*
Matt Collins
Juan Correa
José Manuel Corredoira
Prashant Dave
Gavin DeNyse*
Miguel Díaz
Alexey Ershov
Graeme Everett
Qi Feng*
Chris Fry*
Jérémie Gallien
Javier García
Rune Gjessing
Michael F. Gorman
Sharon Hormby
Shailendra Jain*
Shiva Kumar
Rick Lawrence
Michele Meyers
Holger Mishal*
Marcos Montes
Julia Morrison
Thomas Olavson*
Cookie Padovani*
Claudia Perlich
Andy Philpott
Sesh Raj*
José Antonio Ramos
Saharon Rosset
David Sellers
Kurt Sunderbruch*
Robert Tarjan*
Timothy Tenca
Kjetil Vatn
Krishna Venkatraman*
Julie Ward*
Joseph Woods*
Bin Zhang*
Jing Zhou*

2008

Erwin Abbink*
Terra Baranowski
Jonathan Berry
Erik Boman
Michael Brennan
Robert Carr
Lorne Cass
Michael Cirillo
Maria Delbom
Charles B. Duke
Helga Einarsdottir
Mats Eklund
Patrik Eveborn
Pieter-Jan Fioole*
Matteo Fischetti*
Marte Fodstad
Kim Fox
George Gray
William Hart
Lars Hellemo
Jonathan Herrmann
Ken Howard
Dennis Huisman*
Robert Janke
Leo Kroon*
Miro Lehky
Vaughn Lowe
Gábor Maróti*
Kevin Morley
Regan Murray
James Oiesen
Cynthia Phillips
Cyndi Quan-Trotter
Sudhendu Rai
Lee Ann Riesen
Frode Rømo
Mikael Rönnqvist
Thomas Scheermesser
Lex Schrijver*
Adri Steenbeek*
Ved Sud
Midori Tanino
Thomas Taxon
Asgeir Tomasgard
James Uber
Jean-Paul Watson
James Wetherly
Roelof Ybema*

2007

Corne Aantjes
Deirdre Borrego
Dwight Branvold
Vinayak Deshpande
Kent Everingham
Matt Gaskins
Jerry Hwang
Tim Hyatt
Irina Ionova
Ananth Iyer
Michael Jacks
Goos Kant
Alexei Khavaev
Eva K. Lee*
Patty Mackenroth
Venu Nagali
Gary Polaski
Mark Pridgen
Frederick C. Riedlin
David Sanghera
Patrick Scholler
William V. Shearin
Michael A. Shirk
Greg Shoemaker
Jorge Silva-Risso
Tim Thurston
Marco Zaider*

2006

William Best*
Raymond H. Bittel
Richard Carnevale
Sridhar Chandrasekaran*
Louis Cox, Jr.
Ross Darrow
Stéphane Dauzère-Pérès
John Elieson
Christoper A. Forgie
Dirk Guenther
Kjetil Haugen
Ulrich Koester
William H. Lee
Per Olav Myrstad
John J. Nestor
Atle Nordli
Asmund Olstad
Robert M. Peterson
Douglas Popken
B.V. Rao
Alf Reistad
Barry C. Smith
Mandyam Srinivasan*
Geir Teistklub
Russell Wooten
Faker Zouaoui

2005

Jeffrey Alden*
Dennis Begg
D.A. Beis
Ann Bixby
Lawrence Burns*
Michael Concordia
Theodore Costy*
Brian Downs
Toshiharu Hasegawa
Rick Hughes
Richard Hutton*
Craig Jackson*
Jim Jacobs
David Kim*
Kevin Kohls*
David Levine
P. Loucopoulos
Paul Martyn
Jonathan Owen, CAP*
Y. Pyrgiotis
Tuomas Sandholm
Mihiro Sasaki
Katsushige Sawaki
Mike Self
Atsuo Suzuki
Mark Turnquist*
David Vander Veen*
K.G. Zografos

2004

Martin Barkman
John C. Butler
Alexander Chebeskov
Herman Chiu
Mathieu Clerkx
Ton de Kok
Jacques Desrosiers
Yvan Dumas
James Dyer
Thomas A. Edmunds
Rob Harlan*
Richard Hicks
Fred Janssen
Jianmin Jia
Mike Kanaley
Joshua Kanner*
Alev Kaya, CAP
Byung-In Kim
Seongbae Kim
Bob Kraas
Benoit Lacroix
Kam-Keung Lai
Edmond Leung
Yong Liu
Jiyin Liu
Richard Madrid
Sean Marshall
Theresa Metty*
Chris Milligan
Tom Moore*
Thomas Morris*
Katta Murty
Alexander Oussanov
Winfried Peeters
Alexander Popov
Kevin Potts*
Robert Pruneau
Olga Raskina*
Jeffrey Robbins*
Surya Sahoo
Quentin Samelson*
Avner Schneur*
Rina Schneur*
James Smith
Ron Sorensen
François Soumis
Sridhar Tayur
Loren Troyer
Mitchell Tseng
Jan van Doremalen
Erik van Wachem
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William Bingham
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David Ahlers
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T.O. Carroll
Donald P. Coveleski*
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Allen Lee
Robert Stark
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Figure 1. Powerful visualization features help compare multiple scenarios

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