2022 EDELMAN GALA

Recognizing Distinction in the Practice of Analytics, Operations Research, and Management Science

2022 EDELMAN GALA

FOR DISTINCTION IN PRACTICE

FRANZ EDELMAN AWARD
Achievement in Advanced Analytics, Operations Research, & Management Science
Emphasizing Beneficial Impact

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
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INFORMS PRIZE
Sustained Integration of Operations Research
Emphasizing Long-Term, Multiproject Success

Houston, Texas | April 4, 2022

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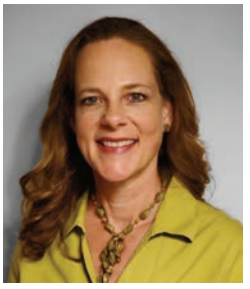
MASTER OF CEREMONY

Erica Klampfl, Ford Motor Company



Erica Klampfl leads the Global Operations Analytics team for Ford Motor Company, delivering artificial intelligence, machine learning, and advanced analytics to a variety of areas in the company including quality, material cost, purchasing, product development, supply chain, manufacturing, sustainability, finance, human resources, safety, and reliability. Erica has a proven track record of driving business value and helping transform operations at Ford through proactive, actionable, evidence-based decision making.

Previously, Erica was the director of Greenfield Labs, where she launched a human-centered design organization tasked with building new products and services for Ford Smart Mobility. This builds on her prior role as the Global Mobility Solutions Manager at Ford, defining Ford's near-, mid-, and long-term mobility strategy that laid the groundwork for Ford's Mobility initiative. Erica started her career at Ford in Research and Advanced Engineering working for more than a decade in developing and applying operations research and other analytics techniques to inform business strategy, strengthen environmental sustainability, and improve manufacturing efficiency.

Erica received a Ph.D. in computational and applied mathematics from Rice University. She served on the Industrial and Operations Engineering Department advisory board at the University of Michigan, the Board of Governors for the Institute for Mathematics and its Applications, was Ford's industry advisor in industrial math at Michigan State University, and is a former mentor of Techstars Mobility Detroit, a start-up accelerator program.

Erica has been active in INFORMS for more than 20 years, serving in a variety of roles such as INFORMS Analytics Conference Chair, twice as INFORMS Prize Committee Chair, WORMS Junior Vice President of Meetings, on multiple committees, and chairing multiple tracks and sessions at both the Annual Meeting and Analytics Conference. She is Ford's INFORMS Roundtable representative. Additionally, she was the second-place winner of the 2014 INFORMS Innovative Applications in Analytics Award, twice a finalist for the Daniel H. Wagner Prize, and her contributions were among those that supported Ford winning the 2013 INFORMS Prize.

She was recognized as a recipient of the 2015 *Connected World* magazine's Women of M2M award for her efforts in helping push connected technologies forward to help Ford become a better corporate citizen and technology leader. She was also a finalist for the 2015 TU-Automotive Influencer of the Year Award and was featured in *Automotive News*. She is a frequent keynote speaker at global conferences and industry events, has dozens of external publications, and internal recognitions including the Henry Ford Technology Award, numerous Ford Technical Achievement Awards, Ford Global Diversity & Inclusion Summit Awards, several Trade Secrets, and more than a dozen filed patents.

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On behalf of all of us at FICO who support the opportunity to make a difference in the world with O.R. and analytics, congratulations to the winners of the Franz Edelman competition!

Each year, FICO also honors innovators who have solved some of the world's toughest problems, created competitive advantages, and achieved outstanding business results using FICO's predictive analytics and decision management solutions.

We'd like to use this opportunity to proudly announce the 2022 FICO Decisions Awards Winners:

AI, Machine Learning, and Optimization:
Bank of America and **Grupo Fleury**

Cloud Deployment: **ACT**, **Vodafone**, and **SA Taxi**

Customer Onboarding & Management: **Banreservas**

Debt Management: **Swisscard** AECS GmbH

Decision Management Innovation: **Procter & Gamble**

Financial Inclusion: **Home Credit China**

Fraud & Security: **PULSE**, A Discover Company

Regulatory Compliance: **BNSF**

An independent panel of judges evaluates submissions based on each project's scale, results, level of innovation, and use of best practices.

We would also like to thank our esteemed 2022 panel of industry judges for their time and consideration:

Sidhartha Dash, Research Director at Chartis

Paul Deall, Head of Risk, Mortgages at Westpac (previous winner)

Senthil Erulappan, Director, Product Engineering for Merchant, Risk and Collections at FIS

Armando Junior, General Manager, Risk and Compliance at Dock (previous winner)

Sheila Leverone, Chief Marketing Officer at eDriving (previous winner)

Sibulelo Ncamani, Head of Operational Risk and Governance at Absa Bank (previous winner)

Graham Rand, Operational Researcher and Editor of Impact

Dinesh Suresh, Head, Digital Builds for Consumer Secured Lending at OCBC Bank (previous winner)

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ANALYTICS AND OPERATIONS RESEARCH TODAY

2022 EDELMAN PROGRAM NOTES

By Radhika Kulkarni, INFORMS President

Welcome to the 2022 Edelman Gala! Thank you for joining me and the rest of the INFORMS community as we recognize and celebrate the recipients of four of INFORMS' most esteemed awards: Daniel H. Wagner Prize for Excellence in Operations Research Practice; UPS George D. Smith Prize; INFORMS Prize; and the Franz Edelman Award for Achievement in Advanced Analytics, Operations Research, and Management Science.

The hard work and incredible contributions of this year's finalists not only showcase to the rest of the world the transformative power of O.R. and analytics to save lives, save money and solve problems, but also serve to guide and inspire the next generation of O.R. and analytics researchers and professionals.

Daniel H. Wagner Prize for Excellence in Operations Research Practice

For the past 20 years, the Daniel H. Wagner Prize has recognized strong mathematics applied to practical problems that not only have a significant impact in application, but are also communicated with clean, intelligent writing.

In 2021, the Wagner Prize was presented to a team of researchers from the University of Pennsylvania and the University of Southern California for their contribution to deploy a national-scale targeted testing system to allocate limited testing resources in Greece to screen visitors for COVID-19 at the border.

UPS George D. Smith Prize

The INFORMS UPS George D. Smith Prize, named in honor of the late UPS chief executive officer, recognizes universities around the world that develop and maintain a strong relationship between their students and industry partners to help better prepare the next generation of O.R. and analytics practitioners.

This year's finalists are: Eindhoven University of Technology, Industrial and Applied Mathematics, Department of Mathematics and Computer Science; Master of Management Analytics, Rotman School of Management, University of Toronto; and Purdue University, Krannert School of Management.

INFORMS Prize

The INFORMS Prize is presented each year to organizations with a strong commitment to and effective integration of O.R. and analytics into its decision-making process, maintaining multiple initiatives with lasting impacts. Over the years, the INFORMS Prize has been presented to leading organizations including Amazon, UPS, Booz Allen Hamilton, Walt Disney Company, U.S. Air Force, and Intel. I am pleased to share the 2022 INFORMS Prize winner is Wayfair.

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

The world's most prestigious award for achievement in the practice of O.R. and advanced analytics, the Franz Edelman Award, annually recognizes organizations whose applications of O.R. and analytics have transformed the world around us. This year's finalists have made revolutionary contributions in omnichannel e-business efficiency, data collection optimization, pandemic response strategies, vehicle packaging and pricing, vaccine development and biomanufacturing effectiveness. Finalists for the Edelman Award have contributed to a cumulative impact of more than $363 billion since the award's inception and countless other nonmonetary benefits.

The 2022 Franz Edelman Award finalists are Alibaba, General Motors, Gobierno de Chile, Janssen Pharmaceutical Companies of Johnson & Johnson (Janssen), Merck Animal Health, and the U.S. Census Bureau.

Alibaba, which aims to build the future infrastructure of commerce, has designed many multiplatform retail business models, ranging from mobile apps to social networking to brick-and-mortars, and more. Alibaba's merchandise covers general supplies to fresh produce. Each of these different channels and their products bring unique features regarding demand forecast, inventory management, and recommendation systems. These challenges are being solved through a series of algorithms to align supply with demand. These algorithms have generated hundreds of millions of dollars of savings in shrinkage and inventory reductions and sustained revenue increase for Alibaba.

General Motors (GM) is on a journey toward helping to create a world with zero emissions, zero crashes, and zero congestion. Decisions on new product content, packaging, and pricing are central to this goal and the GM customer experience. Vehicle Content Optimization (VCO) helps GM make these decisions while offering a full-line portfolio of vehicles that meet the vast diversity of customer needs. Developed entirely within GM, VCO combines advanced consumer market research, discrete-choice models, and novel optimization algorithms into a user-friendly, fully productionized system. To date, VCO has been used on more than 85 new vehicle programs globally, enabling more than $2 billion of profit in 2019 and 2020 alone.

To combat the COVID-19 crisis, the **Chilean Ministries of Health and Sciences** partnered with the **Instituto Sistemas Complejos de Ingeniería (ISCI)** and telecom company **Entel** to develop innovative methodologies and tools. These innovations have been used in key decisions aspects that helped shape the strategy against the virus, including tools that shed light on the actual effects of lockdowns in different municipalities; helped

allocate limited intensive care capacity; multiplied the testing capacity; provided on-the-ground strategies for active search of asymptomatic cases; and implemented a nationwide serology surveillance program that greatly influenced Chile's decision regarding booster doses.

To accelerate the development of the Johnson & Johnson COVID-19 vaccine, the R&D Data Science team at **Janssen** worked with the Massachusetts Institute of Technology (MIT) to co-develop and refine a machine learning-based COVID-19 epidemiological disease spread model, building on MIT's DELPHI scenario analysis tool, capable of predicting future COVID-19 infection spread months in advance at a global level. This model enabled Johnson & Johnson to place its Phase 3 clinical trial sites in high-incidence areas with 90% accuracy. This resulted in a highly-diverse trial completed approximately six weeks early, paving the way for the U.S. Food and Drug Administration's Emergency Use Authorization of the first single-dose COVID-19 vaccine.

Merck Animal Health offers veterinarians, governments, farmers, and pet ownersi d one of the widest ranges of veterinary pharmaceuticals, vaccines, and health management solutions. After four years of collaboration, a portfolio of optimization and decision support applications were implemented that substantially improved biomanufacturing effectiveness. Biomanufacturing uses living organisms to grow active ingredients in vaccines and therapeuticals. This high-tech manufacturing process generates challenges not found in many other industries, including the high cost of equipment and labor-intensive nature of operations. The initial implementation had a 30%-50% increase in the output of critical medicines in specific areas.

The **U.S. Census Bureau** conducts the Decennial Census as mandated in the U.S. Constitution. Previously done with manual assignments, in 2020, optimization and machine learning techniques automated the scheduling, workload assignments, and management of field data collection. MOJO, an operational control system based on these techniques, provided optimization of caseloads handled by enumerators through a geographic information system. The 2020 Census resolved 99.9% of all addresses in the nation and MOJO, via assignment optimization, provided a productivity increase of more than 80%. The system was developed in collaboration with Princeton Consultants, among others.

Thank you for joining us for the 2022 Edelman Gala. It is wonderful to once again be able to celebrate in person the incredible global impact of O.R. and analytics. On behalf of everyone at INFORMS – members, staff, leadership, volunteers, and more – thank you for helping us spread the word of the many incredible ways O.R. and analytics are saving lives, saving money, and solving problems.

THE JOURNEY TOWARD ZERO HUNGER

Reflections on Winning the 2021 Franz Edelman Award
By Sérgio Silva, United Nations World Food Programme (WFP)

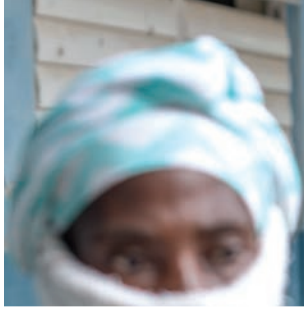
Global hunger continues to rise at an alarming rate: the latest estimates show that 283 million people across 80 countries around the globe are experiencing extreme levels of acute hunger. This represents an increase of around 110% compared to 2019, driven by the combined impacts of conflicts, climate change and the economic fallout of the COVID-19 pandemic, which has disrupted the lives and livelihoods of millions. The humanitarian needs in 2022 are the highest they have been in decades, and the United Nations and partner organizations are gearing up to respond.

As governments continue to respond to their own economic challenges as a result of COVID-19, humanitarian funding is not expected to increase in line with growing needs. This means it is more important than ever for humanitarian organizations to find ways to do more with less. One key tool to facilitate this is innovation to improve the effectiveness and efficiency of humanitarian response, and the United Nations World Food Programme (WFP), 2020 Nobel Peace Prize Laureate and winner of the 2021 INFORMS Franz Edelman Award, has risen to address that challenge.

Humanitarian operations are complex to manage by nature because they seek to address multifaceted problems with limited resources in unstable operational environments. Planning and managing the entire supply chain of WFP assistance comes with many unique challenges: from high demand volatility to funding restrictions, security and access limitations, and data inconsistencies. As needs evolve and new information comes to light, it is critical to continually monitor and understand each operation, quickly adapting and reevaluating plans, and optimizing the use of limited resources.

WFP has been embracing the power of analytics. Engineers and mathematicians have taken a leading role in supporting complex operations, using analytics as an enabler to strengthen the integration between functional areas, augment visibility on WFP operations, and find concrete ways to maximize efficiency and effectiveness. Working closely with its partners in academia and the private sector, WFP has been developing a suite of tools ranging from automated dashboards (bringing together descriptive and predictive analytics) to decision support systems (such as control towers and optimization models).

This coordinated, proactive, and data-driven approach to managing humanitarian operations has resulted in a wide range of benefits, including savings of more than $150 million USD – enough to support two million food-insecure people for an entire year. An investment on WFP's part has seen the growth of a dedicated team of experts in cross-functional and operations-oriented analytics, who work across the organization to analyze vast swathes of data to drive informed decision making, supported by cutting-edge technology.



"Our investment in the use of data and analytics has revolutionized the way that we do our work."
– Alex Marianelli, WFP Director of Supply Chain

As humanitarian needs reach higher levels than ever before, the more than 20,000 dedicated staff members at United Nations World Food Programme continue to work day and night to reach more than 100 million people in need globally with life-saving food assistance. In 2022, WFP is aiming to reach 137 million people, its highest number ever, and analytics and operational research will be paramount to meeting this goal.

Over the last decade we have seen first-hand the revolutionary effects that analytics can have on the design and management of humanitarian operations, and many of our humanitarian partners have started their own journeys to adopt these valuable analytics tools and methodologies. Winning the Edelman Award demonstrates the impact of analytics in this sector, and the interest of the analytics community at large to use their expertise toward improving food security and realizing other Sustainable Development Goals.

WFP cannot express how grateful it is for this recognition and interest. The world is facing daunting challenges and ensuring food security for all will require us to rethink our food systems as a whole. We will need to develop holistic approaches to transform the global food system into something more sustainable, not just from an environmental point of view, but economic and societal as well. We will need to crunch a lot of numbers and connect, through data and analytics, complex fields of expertise and experience. We encourage the global analytics community to take up this challenge and get involved, as analytics will continue to be crucial in identifying the optimal pathways toward Zero Hunger.

"Analytics help us stretch every dollar as far as possible. As the world continues to face one of the greatest humanitarian challenges in history, it is key for us to be as innovative and efficient as we can. Data and analytics are great propellers in our mission to save lives and change lives."
– Amir Abdulla, WFP Deputy Executive Director

OPERATIONS RESEARCH: BILLIONS AND BILLIONS OF BENEFITS!

By Jeffrey M. Alden, General Motors Analytics Research

An impressive $363 billion U.S. dollars of impact! How was it estimated? How broad is the impact? Is there more? Since 1974, Edelman Award finalists have published their project accomplishments in the *INFORMS Journal on Applied Analytics*. While reviewing the 295 articles, their cumulative monetary impact was estimated under the following guidelines:

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

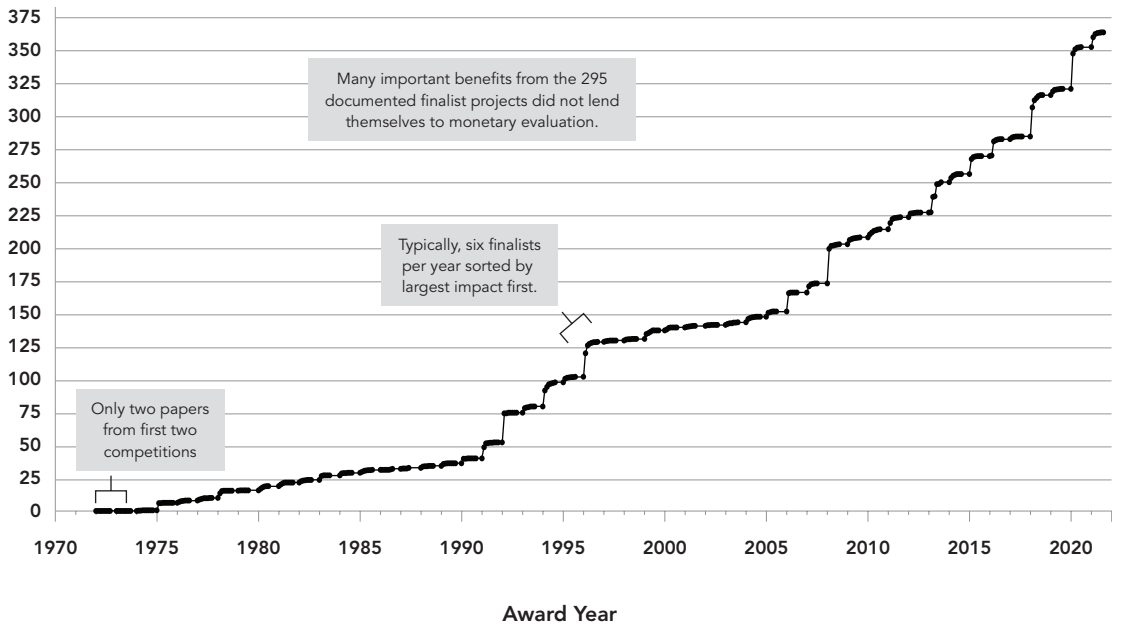
These conservative guidelines exclude important yet difficult-to-quantify reported benefits, such as better: legal dispute resolution, cancer treatments, food assistance, airline safety, epidemic disease control, on-time railways, space shuttle heat shielding, and water quality. For example, there are more than 22 finalist papers with significant life and health benefits. Most are difficult to quantify, however, a CDC project on future) U.S. epidemics expects annual savings of 6,000 lives valued at $12B[1] and one U.S. Army project estimates 4,500 avoided casualties by reducing requirements for helicopter and ground-convoy movements.[2]

Nearly all finalist papers report nonmonetary benefits and often tout them as most important and longer lasting by establishing, for example, ongoing practices and organizational changes that improve health, safety, cooperation, decision making, timeliness, and job satisfaction. Clearly, reported monetary benefits significantly 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. Edelman finalists represent 149 different application areas including aviation (safety, traffic), banking, canal operations, communications (broadband, broadcasting, radio spectrum), consumer products, crowd control, cruise lines, delivery (express, truck), defense (Air Force, Army), education, financial (contract bidding, credit card, fraud, investment, pension, settlement), fire protection, forestry, food assistance, healthcare (blood collection, cancer, diagnosis, disease control, elderly, hospital, medical displays, pharmaceutical, surgery), hotel management, energy production and distribution (coal, gas, electric, nuclear, oil, wind), land use, manufacturing (electronics, computers, food, paper, seeds, steel, tires, vehicles), marketing, mining, printing, sanitation, security (airport, police),

Benefits more than $363 Billion from Edelman Finalist Projects 1972–2021

(Conservatively quantified benefits. Realized plus at most 2 years anticipated, in 2022 U.S. dollars)



senior housing, social networks, sports, tax collection, transportation (airline, highway, railway, rental, outer space, school bus), treasure hunting, waste management, water (flood, flow, resources, quality), and weapons dismantlement. The list goes on and on! In fact, 758 organizations[3] from business, government, and academia are recognized and honored as supporting or benefiting from finalist projects.

Finally, this is just the "tip of the iceberg" because the Edelman Competition only captures those O.R. professionals choosing to compete! Just think, the 1,467 Edelman finalist authors[4] represent about 12% of the current INFORMS membership. Undoubtedly, a vast number of projects with significant impact 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 "hundreds of billions of dollars" when asked about the value of O.R.!

[1] For CDC: 6,000 lives/year ≈ 314M U.S. population * 5% epidemic penetration * 10% die under current practices * (100% - 80% fatality reduction under improved practices) * 1 epidemic per 200 years. Value of quality year of life in U.S. as least $2M/average life ≈ $50K/year (a standard value) * 78 years life expectancy * 50% average life lived. Total expected annual impact is $12B = 6,000 * $2M. See "Advancing Public Health and Medical Preparedness with Operations Research," *Interfaces*, Vol. 43, No. 1 (note Figure 6). Numbers are reasonable values offered by the author.

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

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

[4] Interesting how the average number of authors per paper has grown from 1.8 over the first 10 award years (1973–1982) to 8.2 over last 10 award years (2012–2021). Linear regression gives 0.16 annual growth in average authors per paper with $R^2 = 0.78$.

FRANZ EDELMAN AWARD

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

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

In its 52nd year, the international Franz Edelman Competition has shined a spotlight on the most outstanding real-world applications of operations research (O.R.) and analytics that are transforming our approach to some of the world's most complex problems. Every year, organizations from around the world – both large and small, profit and nonprofit, business and governmental, private and public – compete for the Edelman Award. All selected finalists have realized substantial benefits that range from life-saving medical advancements to millions in cost savings and efficiency gains, all from the practical application of advanced methods of O.R. and analytics.

Rich with insightful research, the abstracts from finalist papers are shared in *INFORMS Journal on Applied Analytics*. In addition, full-text versions and video of the competition presentations are available online.

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 in 1995 to create INFORMS, the Edelman Award became the flagship event in a growing awards program.

Born in Germany not long before Hitler came to power, Franz Edelman overcame significant adversity at a young age. After fleeing the Nazi regime as a teenager in the late 1930s, Franz Edelman found himself in England, where his alien status resulted in internment, and an interlude of lumberjacking in Canada. After navigating these obstacles, he received his undergraduate education at McGill University, and later earned a Ph.D. in applied mathematics from Brown University. He then joined the RCA Corporation as an engineer concentrating on computational topics. Franz 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 in a North American corporation.

As he continued in his advancement of the O.R. profession, Franz Edelman advocated that success in O.R. 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. Following his death, the Franz Edelman Award was named in his honor and continues to advance the O.R. practice to which he contributed so much.

THE FINEST STEP FORWARD: JOURNEY TO THE FRANZ EDELMAN AWARD

Every year, the recipient of the Franz Edelman Award for Achievement in Advanced Analytics, Operations Research, and Management Science is selected from a pool of incredibly accomplished finalist teams, representing leading organizations from around the world. The finalist projects are the result of years of research, hard work, and collaboration for a transformative impact for each organization. The selection process at INFORMS also begins long before the award is ever presented.

After issuing a call for entries, INFORMS often receives more than two dozen submissions from organizations with a summary illustrating a practical operations research (O.R.) application in which the results had significant, verifiable, and quantifiable impact for the organization.

The Franz Edelman Award Committee is comprised of nearly three dozen O.R. practitioners and academics from leading O.R. programs, including IBM, SAS, General Motors, Hewlett-Packard, Boeing, General Electric, UPS, Duke University, Virginia Tech, and more. By November of each year, this committee will have narrowed the applicant field to a group of semifinalists, and by the end of each year, six are recognized as Edelman Award finalists.

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

Once the Edelman Award Committee has announced the six entries that will advance to the finals, each finalist prepares a journal-quality paper and a 40-minute presentation that will be held during the INFORMS Conference on Business Analytics and Operations Research (held virtually in 2020 and 2021 due to the COVID-19 pandemic). A team of experienced coaches is assigned to each finalist team to guide them throughout each step of the process, and help ensure that the team's paper and presentation will convey the significance and monumental impact of the work to the panel of judges.

As the INFORMS Conference on Business Analytics and Operations Research approaches, the finalist teams prepare for the final stage of the competition. The finalist papers are presented to the judges, who then begin the long review process. Each judge independently studies the papers and provides input to a group discussion. The finalists are assigned a focal point judge who conveys valuable feedback from the judging committee to the finalist coaches. This feedback helps each team identify

areas with potential for clarification or improvement prior to the final presentation, which takes place on the second day of the INFORMS Business Analytics Conference.

On the day of the Edelman Competition, each team conducts a 40-minute presentation, followed by a 10-minute period of questioning by the judges. As they assess each of the team's presentations, the judges follow a strict set of guidelines, including the importance of the application, the novelty and portability of the team's technical solution, the quality and effectiveness of the implementation, and the total impact of the project in both quantitative and qualitative terms. Once the final presentation is complete, the judges sequester themselves to carefully review all 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 that represents more than 50 years of operations research and analytics excellence.

Following the Edelman Competition, the incredible achievements of all the finalists are showcased in the January/February issue of the *INFORMS Journal on Applied Analytics*, which is dedicated to improving the practical applications of operations research and analytics to decisions and policies in today's organizations and industries. In addition, the competition is recorded and all presentations are made available via streaming video shortly after the end of the INFORMS Business Analytics Conference. During the INFORMS Annual Meeting in the fall, which attracts more than 7,000 O.R. and analytics professionals, academics, and students from around the world, the first-place team shares a keynote address, while the other finalists will again be invited to reprise their work to share during a meeting session.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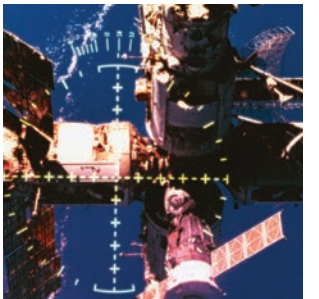

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EDELMAN FIRST-PLACE AWARD RECIPIENTS

2021 **U.N. World Food Programme**
"Toward Zero Hunger with Analtyics"

2020 **Intel Corporation**
"Intel Realizes $25 Billion by Applying Advanced Analytics from Product Architecture Design through Supply Chain Planning"

2019 **Louisville Metropolitan Sewer District**
"Analytics & Optimization Reduce Sewage Overflows to Protect Community Waterways in Kentucky"

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

1972 **The Pillsbury Corporation**

THE 2022 SELECTION COMMITTEE & VERIFIERS

We wish to thank the following individuals for their dedication and service as Selection Committee members and 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.

- Carrie Beam, *Chair, Edelman Award; University of Arkansas*
- Layek Abdel-Malek, *NJIT, v*
- Sudip Bhattacharjee, *University of Connecticut, v*
- Ann Bixby, *Aspen Technology*
- Aaron Burciaga, CAP, *Amazon Web Services, v*
- Ulas Cakmak, *Infor, v*
- Pooja Dewan, *OTIS Elevator Company, v*
- Carol DeZwarte, CAP, *Convoy Inc, v*
- Goutam Dutta, *Indian Institute of Management, v*
- Gul Ege, *SAS Institute Inc., v*
- Ken Fordyce, *Arkieva, v*
- Diala Gammoh, *NBC Sports Next, v*
- Michael Gorman, *University of Dayton*
- Ananth Iyer, *Purdue University, v*
- Mustafa Kabul, *Aera Technology, v*
- Burcu B. Keskin, *University of Alabama*
- Don Kleinmuntz, *Kleinmuntz Associates*
- Matthes Koch, *Desior Consulting, v*
- Russell P. Labe, CAP, *RPL Analytics Consulting*
- Grace Lin, *Tzu Chi University, v*
- Tim Lowe, *University of Iowa*
- Aly Megahed, *Facebook, v*
- Polly Mitchell-Guthrie, *Kinaxis, v*
- Sven Müller, *Otto von Guericke University Magdeburg, v*
- Chanel Murray, *PNC Bank, v*
- Yanni Pappadakis, *Zoetis, v*
- Sanjay Prasad, *IBM, v*
- Michael Prokle, *Fortune Brands GPG*
- Mikael Rönnqvist, *University of Laval, v*
- Onur Seref, *Virginia Tech*
- Inderjeet Singh, *Infor, v*
- Zohar Strinka, *Analytics Strategies LLC, v*
- Kendra Taylor, *KEYfficiencies, v*
- Kermit Threatte, *Shopify, v*
- Rajesh Tyagi, *GE Global Research, Retired, v*
- Joyce Weiner, *Intel, v*
- Xiaodi Zhu, CAP, *New Jersey City University, v*

"v" Indicates Verifiers

THE 2022 COACHES & JUDGES

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

The role of the coach is to ensure each team's paper and presentation conveys the work in a manner that may be well understood by a general operations research audience. Often a coach is paired with an associate coach who lends another perspective to the process. The judges must work together, evaluating the evidence to determine which finalist is most deserving of the Franz Edelman Award for Achievement in Advanced Analytics, Operations Research, and Management Science. The award is for implemented work that has had significant, verified, and preferably quantified impact.

Franz Edelman Coaches

- Layek Abdel-Malek, *NJIT*
- Sudip Bhattarcharjee, *University of Connecticut*
- Aaron Burciaga, CAP, *Amazon Web Services*
- Ulas Cakmak, *Infor*
- Pooja Dewan, *OTIS Elevator Company*
- Carol DeZwarte, CAP, *Convoy Inc*
- Ken Fordyce, *Arkieva*
- Mustafa Kabul, *Aera Technology*
- Grace Lin, *Tzu Chi University*
- Aly Megahed, *Facebook*
- Chanel Murray, *PNC Bank*
- Sanjay Prasad, *IBM*
- Onur Seref, *Virginia Tech*
- Inderjeet Singh, *Infor*
- Zohar Strinka, *Analytics Strategies LLC*
- Joyce Weiner, *Intel*

Franz Edelman Judges

- Carrie Beam, *Chair, Edelman Award; University of Arkansas*
- Manoj Chari, *Elon University*
- Gul Ege, *SAS Institute Inc.*
- Michael Gorman, *University of Dayton*
- Julie Ivy, *North Carolina State University*
- Tim Lowe, *University of Iowa*
- Kendra Taylor, *KEYfficiencies*
- Rajesh Tyagi, *Chair-Elect, GE Global Research, Retired*
- Kermit Threatte, *Shopify*


ANALYTICS
AUTONOMY
DECISION SUPPORT
MODELING & SIMULATION
SENSING SYSTEMS
Congratulations to the 2022 Franz Edelman Finalists!
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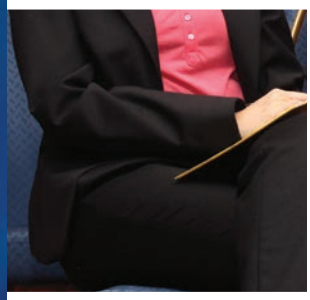
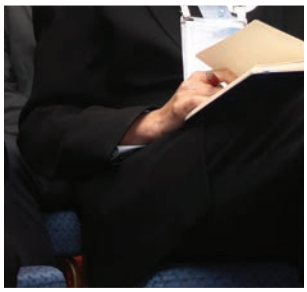
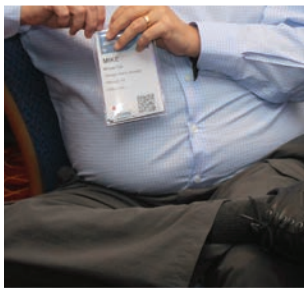





THE EDELMAN LAUREATES

The individuals who author Edelman finalist papers are deemed Franz Edelman Laureates.

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

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

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

THE EDELMAN ACADEMY

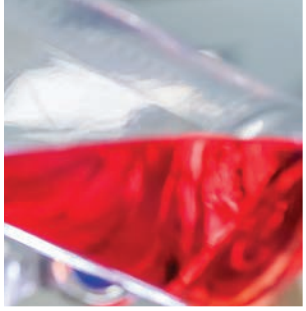
Each year, participating organizations are inducted as members of the Franz Edelman Academy.

The primary client organization, or beneficiary of the finalist work, is inducted into the Edelman Academy at the Edelman Gala during the INFORMS Business Analytics Conference. Academy members serve as role models for other organizations.

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 52 years of extraordinary contributions to society through the innovative application of operations research and advanced analytics.







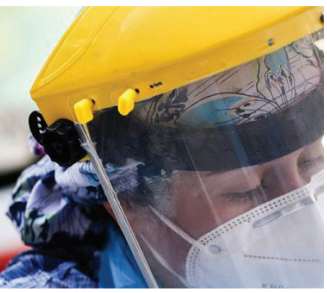




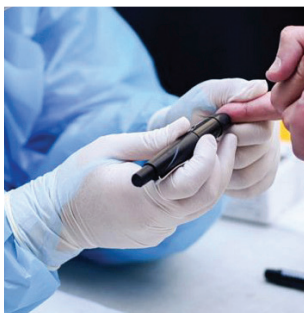




U.S. Census



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THE 2022 FRANZ EDELMAN AWARD FINALISTS

Introducing the six finalists for the 2022 Franz Edelman Award.

Over the past several months these Edelman finalist teams, with guidance from their team coaches, have demonstrated to the Edelman selection committee that their work is among the finest examples of operations research and analytics practice in the world. One of these organizations will be recognized as the best in class, the first-place recipient of the 2022 Franz Edelman Award for their work to help save lives, save money, and solve problems.

A shortened summary of each of the 2022 finalist team's work is described in the following pages. Papers including the full project description will be published in the January/February 2023 issue of *INFORMS Journal on Applied Analytics*. This journal, published by INFORMS, is dedicated to improving the practical application of operations research and advanced analytics in today's organizations and industries.

The finalists for the 2022 Edelman Award include the following:

- Alibaba
- General Motors
- Gobierno de Chile
- Janssen Pharmaceutical Companies of Johnson & Johnson (Janssen)
- Merck Animal Health
- U.S. Census Bureau
























ALIBABA

Integrated Forecast, Inventory, Price Optimization, and Recommendation Has Reduced Millions in Inventory and Shrinkage Costs for Alibaba Retail Businesses

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Alibaba, one of the largest e-business platforms in the world, has actively driven technology innovation in the digital transformation of businesses from commerce to logistics. Alibaba is an innovator in retail segments and has designed many retail business models to enable both online orders and offline in-store shopping of products from general merchandise to fresh products like produce and other perishables. These models, which exist in various business subsidiaries within Alibaba, form a new multi-format retail infrastructure.

These business models have brought with them many novel features to retail operations in demand forecast, inventory management, and personal recommendation systems. The features include, but are not limited to, distinct demand patterns, interactions among products, complex inventory operation procedures, such as the

mixture of inventory retrieval patterns, real-time price markdowns via various promotion strategies, and personal recommendation with inventory availability considerations. An overview of the challenges associate with these features is as follows.

- Complex demand patterns affected by interactions of products. The demands of many products might not be normal due to the existence of distinct online and offline demand streams and the various promotion events. They usually exhibit potentially seasonal patterns and are affected by complicated interactions, such as complementary and substitution relationships between products.

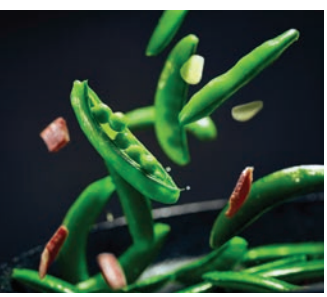
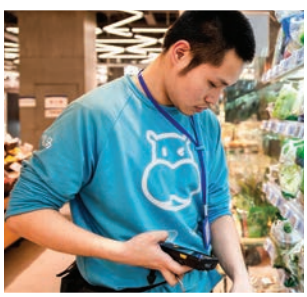
- Complex inventory operations characteristics. To start, inventory models are typically based on given distributions such as normal or Poisson, yet this assumption may not hold in practice. Second, the behaviors of products' inventory, especially those with short life cycles, such as fresh produce, are affected by customer selection patterns. Third, many products are replenished, and the lead-time variations could be dependent upon, order calendars. These features are especially typical in omnichannel retail, and have significant impact on the inventory management.

- Recommendations with inventory and markdown considerations. Personalized recommendation systems are common in online applications, yet it is rare to consider markdown options and inventory availabilities with these systems. Both markdown and ranking optimization (with inventory considerations in recommendation systems) are online optimization problems and are challenging to solve in real time.

To address these problems, Alibaba has developed a series of novel and effective state-of-the-art models and algorithms to align supply and demand, increase service level, and reduce inventory and shrinkage costs.

1. A series of deep-learning forecasting models that employs a modular neural network structure with modules that capture the trend, seasonality, sporadic components of each time-series, as well as a graphical neural network structure to learn the interaction among product. Specific optimization techniques accelerate network training to accommodate more complex neural network structures without sacrificing stability.

2. Simulation-based inventory optimization algorithms translate an inventory management problem into a simulation-optimization problem. The simulation samples multimodel forecast distributions and mimics complex customer consumption patterns and replenish calendars. Simulation optimization techniques based on local search techniques with novel inventory moves have dramatically reduced

the computation time, and achieved superior performance for benchmark problems.

3. A series of planning and real-time online optimization models have been integrated into personalized recommendation systems. The models exploit price elasticity across various promotion strategies to optimize markdowns and item rankings according to the real-time inventory availability and deep-learning-based techniques help solve problems with trillions of variables all within online time limitations.

These algorithms have achieved hundreds of millions of dollars in shrinkage and inventory costs annually, while maintaining and/or increasing the service levels in all Alibaba retail subsidiaries.

Moreover, these features are increasingly typical in many recent retail business operations, and the solutions to these problems are fundamental to not only Alibaba and retail business, but to many other industries as well.

ORGANIZATIONS

Alibaba Group

Founded in 1999, Alibaba Group enables businesses to transform the way they market, sell and operate, and improve their efficiencies. The Alibaba Group provides the technology infrastructure and marketing reach to help merchants, brands, retailers, and other businesses leverage the power of new, innovative technology to engage with their users and customers and operate in a more efficient way.

Alibaba DChain

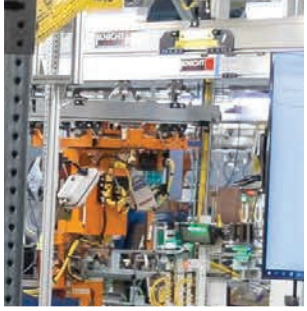
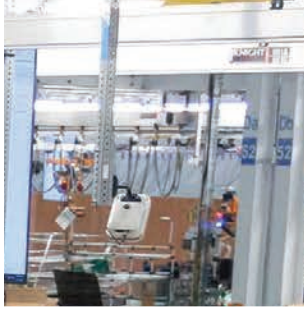
Alibaba's digital supply chain backbone, supporting more than 30 Alibaba business units and millions of merchants' supply chain operations within the Alibaba ecosystem. Millions of orders are processed daily on their platform, from distribution models to consignment models to matchmaking models. Leveraging advanced technologies and agile development models, Alibaba's DChain provides end-to-end supply chain capabilities from planning, purchasing, inventory management, warehousing, logistic routing, and consumer service.

Freshippo

Alibaba's new retail platform is driven by data and technology. Featuring a supply of fresh aquatic products, as well as fruits and vegetables, Freshippo originates diverse business lines with an increasing consumer mindshare. Its community-based, one-stop new retail experience center is preferred by consumers in pursuit of quality life in first- and second-tier cities. Leveraging technology, Freshippo makes customer-centric provisions for consumers a "Better Life Right Here!"





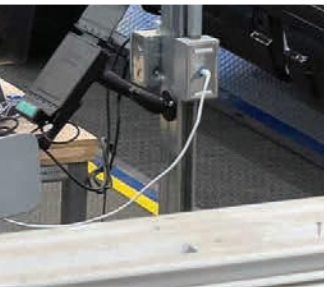













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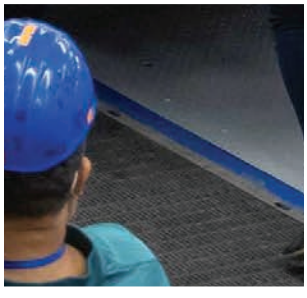
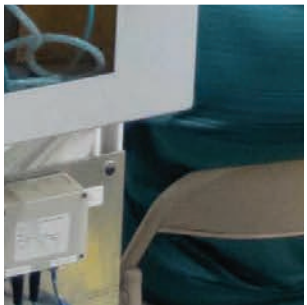
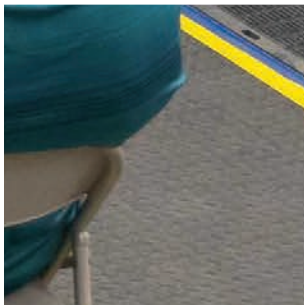
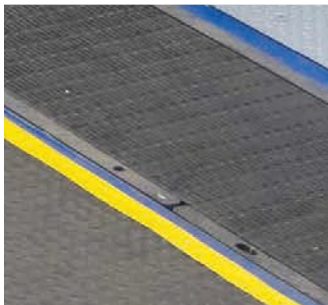
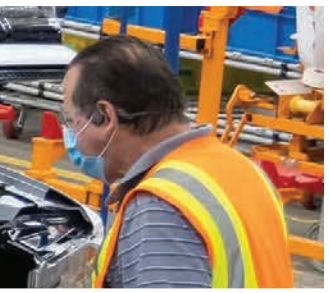
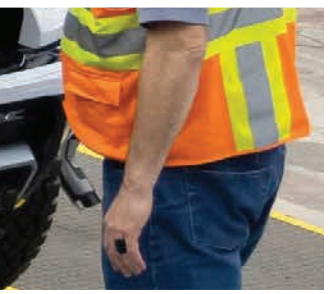






GENERAL MOTORS

Vehicle Content Optimization at General Motors

Founded in 1908 and headquartered in Detroit, Michigan, General Motors Company (GM) is among the world's largest global automotive companies, producing almost 7 million vehicles around the world annually, under brand names like Chevrolet, Buick, GMC, and Cadillac. GM's goal is to deliver world-class customer experiences at every touchpoint, and to do so on a foundation of trust and transparency. Its vision is a world with Zero Crashes, Zero Emissions, and Zero Congestion.

GM spends billions of dollars each year designing new vehicles and bringing them to market. The vehicle development process is complex and long (often three to six years from concept to production). Decisions made years in advance can swing profitability by hundreds of millions of dollars and can significantly impact customer experience.

One critical set of decisions centers on how to "content and price" the future vehicle. This

involves creating a vehicle order guide that specifies how many trim levels will be offered and for each trim level, which features will be standard, optional, or not available. To assist and improve this complex decision-making, GM has created a customer-based analytics process called Vehicle Content Optimization (VCO). The objective of VCO is to develop a vehicle order guide that maximizes customer satisfaction, leading to greater GM profitability and market share.

Prior to the development of VCO, creating a vehicle order guide relied on subject matter expert experience and judgment, along with manual, time-consuming ad hoc analyses. Vehicle content and packaging decisions are complicated by the fact that the problem is combinatorically complex. There can be hundreds of consumer-facing features in a vehicle program. Manually analyzing all possible vehicle order guides is practically impossible.

Developed entirely within GM, VCO combines advanced consumer market research, discrete-choice models, and novel multiobjective nonlinear optimization algorithms into a user-friendly, fully productionized system, facilitated by a collaborative process with subject matter experts. The process of creating VCO includes the following:

- Performing custom market research using conjoint and build-your-own vehicle exercises to understand how consumers make tradeoffs between price and features, just as they must when selecting a vehicle in real life.

- Applying custom hierarchical Bayesian techniques to estimate how much customers desire each feature, as well as their price sensitivity. This enables GM to simulate consumer behavior using a custom mixed logit model (i.e., market simulator).

- Running "what-if" simulations where alternative vehicle order guides are constructed. The resulting vehicles are presented to the simulated customers, allowing the observation of how customers select among the alternatives.

- Using an intelligent search algorithm – based on a hybrid approach combining elements of genetic algorithms, cross-entropy, and problem-specific heuristics – to automatically create alternative order guides. The algorithm yields an efficient frontier, which is a set of order guides that produces the most profit, most volume, or some blend of both goals, subject to a variety of complicated business constraints.

These optimal order guides are utilized to develop insights that help GM's product teams iterate toward final vehicle order guide development. In particular, a dedicated VCO implementation team generates the optimized order guides, iteratively collaborates with product teams to incorporate additional strategic program constraints not explicitly modeled in VCO, and creates a new practical order guide, which is scored for profit and share improvement.

Development and implementation of the major innovation VCO was a multiyear journey for GM. The implementation team developed best practices for working with stakeholders, getting their "buy-in" and trust for changing content decisions, and strengthening relationships between key stakeholders. As of 2021, VCO has been used on more than 85 vehicle programs globally. VCO has enabled more customer-centric product development and more efficient engineering, sourcing, and manufacturing. GM Finance has verified that VCO enabled $4.4 billion dollars of lifecycle profit, making it an enormously impactful example of operations research and applied analytics.








Moreover, VCO is used to address additional business problems including trim level price optimization and complexity reduction. The core choice-modeling technology pioneered in VCO is also leveraged for a wide-range of other applications, including long-term electric vehicle forecasting and vehicle portfolio planning scenario analysis, which are essential to helping GM achieve its goal of zero emissions.

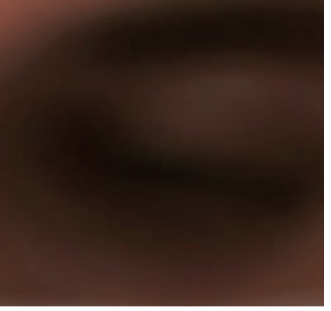
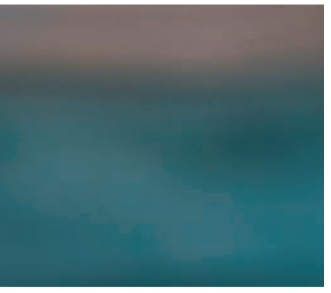
When making billion-dollar product development investments, the stakes are high. Moving people from intuition and known processes to a fundamentally new data and analytics-driven approach is a substantial organizational challenge. VCO enables cross-functional collaboration from a multitude of business stakeholders with competing objectives, which represents a significant organizational achievement. The journey of building credibility and "buy-in" from stakeholders, and implementing the change management required for full adoption, was as challenging as the technical hurdles overcome in developing the VCO capability. Today, VCO is a critical asset in GM's content and pricing decision process as the organization strives to achieve its customer-centric long-term vision.

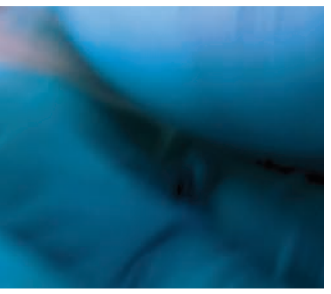
ORGANIZATION

General Motors

General Motors (NYSE:GM) is a global company focused on advancing an all-electric future that is inclusive and accessible to all. At the heart of this strategy is the Ultium battery platform, which will power everything from mass-market to high-performance vehicles. GM, its subsidiaries, and its joint venture entities sell vehicles under the Chevrolet, Buick, GMC, Cadillac, Baojun, and Wuling brands. More information on the company and its subsidiaries, including OnStar, a global leader in vehicle safety and security services, can be found at www.gm.com.


COVID - 19
VACCINE


GOBIERNO DE CHILE

Analytics Saves Lives During the COVID-19 Crisis in Chile

During the COVID-19 crisis, the Chilean Ministry of Health and the Ministry of Sciences, Technology, Knowledge and Innovation partnered with the Instituto Sistemas Complejos de Ingeniería (ISCI) and the telecommunications company Entel to develop innovative methodologies and tools that placed operations research and analytics at the forefront of the battle against the pandemic. These innovations have been used in key decision aspects that helped shape a comprehensive strategy against the virus, including tools that: (1) shed light on the actual effects of lockdowns in different municipalities and over time; (2) helped allocate limited intensive care capacity; (3) significantly increased the testing capacity and provided on-the-ground strategies for active screening of asymptomatic cases; and (4) implemented a nationwide serology surveillance program that significantly influenced Chile's decision regarding vaccine booster doses that also provided information of global relevance.

This fruitful partnership between the public and the private sector and academia was supported by the collection, processing, and analysis of massive amounts of critical data, which was used to feed various models and develop decision-support tools that informed the most critical decision-making. Early in the pandemic, the team started using massive cell phone data to solve the big data challenge of identifying mobility patterns, which enabled quantifying the impact of lockdowns and voluntary shelter-at-home decisions across the country. The use of advanced econometric models showed that said impact was highly heterogeneous and dependent on socioeconomic levels, and that infections positively correlated with mobility. The different dashboards and reports produced provided the Chilean government with critical insights regarding the lockdown strategy throughout the country and its plan to support lower income populations with additional measures to increase compliance.

In the context of testing and tracing, the team combined the aforementioned mobility patterns with granular epidemiological data to develop index-based nationwide heat maps to guide active screening efforts to detect asymptomatic cases in public spaces, which continue to be an integral component of the national testing strategy. In addition to this essential planning tool, the team developed and piloted testing monitoring programs based on group testing, which helped to dramatically increase the testing capacity by more than 50%. Despite all prevention efforts, many people were nevertheless infected, and a fraction of them became severely ill, thus requiring hospitalization. To support the centralized management of critical beds, the team used an ensemble of stochastic and machine learning models to produce short-term demand forecasts of intensive care beds at the regional level throughout the country. These forecasts were reported by the Minister of Science to the president and his crisis advisory committee, and were key inputs to inform the coordinated efforts for adapting and augmenting the supply of this scarce resource and reallocating patients across regions. The intensive care capacity was never once surpassed during the pandemic.

Regarding vaccination rollout, Chile followed a multiplatform approach, favoring vaccine availability over choice of a specific technology. While this strategy put Chile among the leaders in inoculations worldwide, it created the need to monitor vaccine effectiveness, because such information was not available elsewhere. With this in mind, the team designed and implemented a centralized surveillance system that monitored the presence of Immunoglobulin G antibodies (IgG) in the population. The information provided by this system, which used mobility data and integer programming to design the sampling mechanism in the general population and was fed to a statistical model of IgG waning dynamics, was instrumental to the government's decision of implementing heterologous first and second booster shots. Chile became one of the world pioneers in booster shots.

By providing scientific evidence supporting the decision-making behind the Chilean strategy against the pandemic, the project helped provide transparency and objectivity to decision-makers and the general population. According to conservative estimates, the number of lives saved by all of the initiatives together is more than 2,000, equivalent to around 5% of the total death toll in Chile during the pandemic. The saved resources associated with testing, ICU beds, and working days amounts to $200 million USD.

The project faced a large number of difficulties, including the fact that it was carried out in possibly one of the most complicated situations faced by any country in the last decades, and solutions were

urgently needed. The only way the project had any chance to succeed was by the joint work of a quite heterogeneous group of people, from engineers and researchers, to political authorities, to healthcare workers on the ground, all of whom were facing huge amounts of stress. Building trust among these groups was fundamental for the efforts of one group to be followed by the next group in the line of work. This project required an enormous amount of coordination between institutions and its officials. And finally, as it dealt with very delicate information, the results had to be communicated with care – something that required further interaction between authorities and scientists, with the results carefully explained to the national media.

ORGANIZATIONS

Instituto Sistemas Complejos de Ingeniería (ISCI)

ISCI is a Chilean Excellence Research Center, where people from different universities and disciplines of engineering and economics interact. It develops high-level scientific and technological research, and contributes to the formation of new researchers. It connects with the public and productive environment in order to transform its cutting-edge research into innovative solutions to real-life problems.

Chile's Ministry of Health

The mission of this Ministry is to build and maintain a health model based on strengthened and integrated first-care approach, which locates the patient in the center, with emphasis on the care of the population during their entire life's cycle. The Ministry also stimulates the promotion and prevention of health, as well as traceability and financial coverage.

Chile's Ministry of Sciences, Technology, Knowledge and Innovation

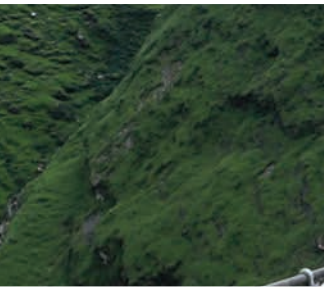
This Ministry collaborates and advises the President of the Republic in the design, formulation, coordination, implementation, and evaluation of the policies, plans, and programs destined to strengthen the national system of science, technology, and innovation, guiding it to the sustainable development of the country and the generation of knowledge as a result of the research with scientific-technological base.

Entel Ocean

Entel Ocean is the digital business unit of Entel, the largest telecom company in Chile. It specializes in developing safe, flexible, and scalable solutions in order to digitally transform businesses, solving technological challenges for efficient, integrated, and sustainable management through the application of data science and analytics.









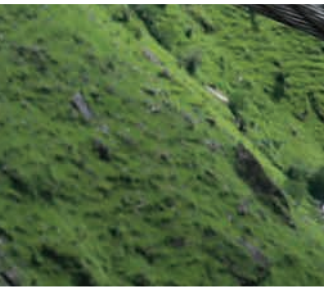
STOP
Do you need to open it!




unicef







JANSSEN PHARMACEUTICAL COMPANIES OF JOHNSON & JOHNSON

Data-driven COVID-19 Vaccine Development for Johnson & Johnson

Since the initial Wuhan, China outbreak in December 2019, the world has been upended by the COVID-19 pandemic. As of October 2021, more than 230 million cases and 4.7 million deaths have been reported globally. To curtail the spread of SARS-CoV-2, most governments implemented nonpharmaceutical interventions (NPIs) spanning social distancing, self-isolation, and travel restrictions, culminating in lockdowns around the world. The pandemic also engendered unprecedented socioeconomic strain, leading to growing unemployment and recessions in some of the world's largest economies.

Given the unsustainable costs of NPIs, there is much hope being placed on clinical solutions to COVID-19, which has spurred extensive vaccine research worldwide.

One crucial part of vaccine development is the Phase III clinical trial that tests the vaccine for its real-world efficacy. Janssen Pharmaceutical Companies of Johnson & Johnson (Janssen) has enumerated the first successful implementation of utilizing machine learning models to accelerate Phase III vaccine trials, working with the single-dose Johnson & Johnson Ad26.CoV2-S vaccine (also known as the Janssen COVID-19 vaccine) to optimize its trial locations for high incidence rates.

In addition, Janssen and the Massachusetts Institute of Technology (MIT) introduced DELPHI, a novel, accurate, policy-driven machine learning model that serves as the basis of their predictions.

DELPHI is used to overcome the need for long-term predictions through the development of a scenario analysis toolkit. The DELPHI-driven site selection identified hotspots with 90%+ accuracy, shortened trial duration by 6-8 weeks (~33%), and reduced enrollment by 15,000 (~25%). In turn, this accelerated time to market enabled Johnson & Johnson's vaccine to have a direct impact on preventing more than 21,000 hospitalizations and nearly 3,300 deaths directly amongst vaccinated individuals and indirectly across close contacts. Within these populations, the vaccinated averted nearly $2 billion USD in estimated medical, social, and economic costs.

Several geographies identified by DELPHI have since been the first to identify COVID-19 variants of concern (e.g., beta and omicron in South Africa and gamma in Brazil) resulting in early data of how the vaccine responds to new threats.

Going forward, Johnson & Johnson is already implementing a similar approach across its business including supporting trial site selection for its RSV (respiratory syncytial virus) vaccine, modeling procedure demand for its medical device unit, and providing guidance on return-to-work programs for its 130,000 employees. Continued application of this methodology will shorten clinical development while evolving the economics of drug development by altering the level of risk associated with investing in novel therapies. This will allow Johnson & Johnson and others to enable more effective delivery of medicines to patients.

ORGANIZATIONS

Janssen Pharmaceutical Companies of Johnson & Johnson (Janssen)

Janssen is creating a future where disease is a thing of the past. As the Pharmaceutical Companies of Johnson & Johnson, Janssen works tirelessly to make that future a reality for patients everywhere by fighting sickness with science, improving access with ingenuity, and healing hopelessness with heart. Janssen focuses on areas of medicine where the biggest difference can be made: cardiovascular and metabolism, immunology, infectious diseases and vaccines, neuroscience, oncology, and pulmonary hypertension.

Learn more at www.janssen.com and follow Janssen at www.twitter.com/JanssenGlobal and www.twitter.com/JanssenUS. Janssen Sciences Ireland Unlimited Company, Janssen Therapeutics, a Division of Janssen Products, LP, and Janssen Research & Development, LLC, are part of the Janssen Pharmaceutical Companies of Johnson & Johnson.

Massachusetts Institute of Technology

Massachusetts Institute of Technology (MIT) is a private research university in Cambridge, Mass. Established in 1861, MIT has played a key role in the development of modern technology and science, ranking it among the top academic institutions in the world.

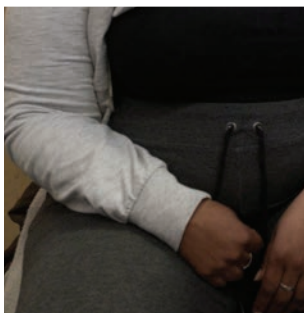
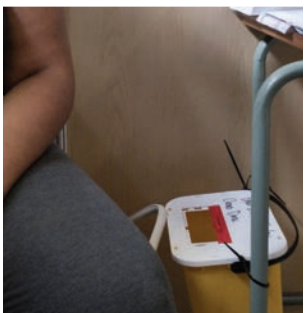


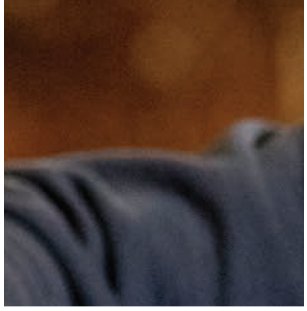
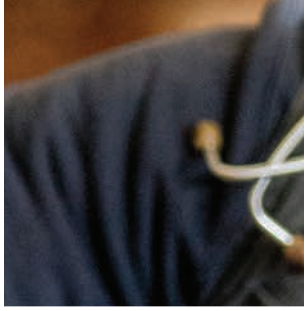






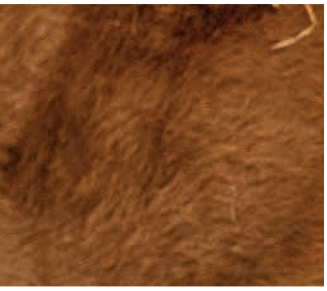





















MERCK ANIMAL HEALTH

Operations Research Methods Transform Biomanufacturing Productivity for Life-saving Medicine

Merck Animal Health produces life-saving medicine for companion and food-producing animals. The use of veterinary medicine also benefits humans by reducing the spread of diseases between animals and humans as well as helping to facilitate a safe, efficient, and sustainable food supply. Merck Animal Health produces various types of medicine, including vaccines to protect against diseases, pharmaceuticals (e.g., antibiotics) to treat diseases, and therapeutics (e.g., insulin) to improve body functions and provide benefits for a range of conditions. Customers can count on Merck Animal Health for more than just medicine, for information, technologies, and veterinary services that advance healthcare.

Cells are the basic building blocks of all living things and are the most amazing factories on earth. Cells import energy and raw material and produce a wide array of proteins and other matter critical to proper body function. For example,

the pancreas creates the hormone insulin, which is a protein critical to sugar regulation. The technical challenge is how to effectively use these cell factories (often in the form of viruses and bacteria) to produce critical medicine.

The modern use of biomanufacturing started in the 1970s with genetically engineered E. coli to synthesize human insulin. Since then, the use of biomanufacturing technologies has exploded, providing medicines to millions of patients. The initial challenge regarded the "scientific knowledge" related to the underlying biological and chemical processes (and how to harness these to produce active ingredients). However, as demand grew, a second challenge emerged: "smarter" operations to increase production yields, lower costs, and reduce lead times. This high-tech manufacturing process generates challenges, such as batch-to-batch variability in production yields, large setup times in the bioreactor (a production step where active ingredients are grown via modern fermentation), a lengthy and complex set of post-reactor steps to purify and meet safety regulations, alternative production paths, a continuous flow that prohibits work-in-progress from waiting for a piece of equipment, the high cost of equipment, and the need for specialized labor skills.

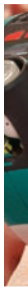
To meet the challenge of smarter operations, the Boxmeer facility of Merck Animal Health (the largest biomanufacturing hub in Europe and second largest in the world) partnered with the School of Industrial Engineering at Eindhoven University of Technology to determine and execute a strategy to use operations research (O.R.) to improve factory performance. Two primary opportunities were identified: (1) improving bioreactor yield and (2) improving end-to-end visibility and scheduling.

The work on improved bioreactor yield focused on two areas: (1) reducing the number of bioreactor setups and (2) optimizing the critical process parameters. The focus of the first work was increasing the quantity produced in the bioreactor by using a novel technology called bleed-feed. This was previously attempted using just the "science" models, without success. The addition of O.R. models (Markov decision processes) to address operational decisions was critical to success. A key to high yields is determining the best process control parameters (e.g., temperature). The nature of biomanufacturing makes it impossible to execute experimental designs in a lab; they must be done in production. This requires a sampling plan with a minimum number of data points while ensuring the best parameters are found. By using Bayesian methods for simulation-optimization, these parameters were determined with minimal cost.

Although the biomanufacturing factory captured a substantial quantity of data for regulatory purposes, it lacked a centralized data source for production parameters (e.g., process times, required sequence of steps, equipment alternatives, and affinity of a product to a process line). Scheduling decisions were manually made using spreadsheets and expert option. At a time when production flows were simpler, this approach worked, however, as the complexity of the science increased, the decision support did not keep pace. End-to-end visibility was critical to avoid infeasible schedules (collisions) and gaps of idle capacity.

The project includes three phases: (1) Collection of process data (e.g., bioreactor processing time or which products can use which bioreactor) and end-to-end mapping to update and retrieve this information; (2) discrete-event simulation modeling to support what-if analysis from different production starts to capacity enhancements; and (3) optimization to search through alternatives to find those that best meet business objectives.

This work in O.R. is used in daily operations at Merck Animal Health and has realized a significant impact. The work on bioreactors has generated a 30%-50% improvement in yield. The



scheduling work has enabled the production of at least one extra batch per week for each of the six process lines, with no additional equipment. Moreover, the scheduling work has been critical to intelligent capacity planning. By adopting an O.R.-based approach, Merck Animal Health increased the biomanufacturing output without expanding capacity. The work has enabled a better matching of production with demand while avoiding manufacturing excursions. With such projects, we believe that O.R. will significantly help the industry provide cheaper and faster access to life-saving treatments in the future.

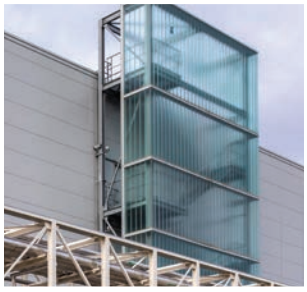
ORGANIZATIONS

Merck Animal Health

Through its commitment to "The Science of Healthier Animals," Merck Animal Health offers veterinarians, governments, farmers, and pet owners, one of the widest ranges of vaccines, veterinary pharmaceuticals, and health management solutions and services. It provides an extensive suite of connected technology that includes identification, traceability, and monitoring products. Merck Animal Health is dedicated to preserving and improving the health, well-being, and performance of animals and the people who care for them. It invests in dynamic and comprehensive R&D resources and a modern, global supply chain.

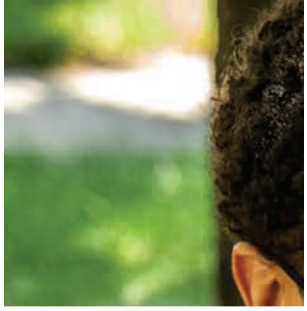
Eindhoven University of Technology

The Eindhoven University of Technology is a research-driven university of international standing, where excellent research and education go hand-in-hand. The engineers educated at the Eindhoven University of Technology are not only excellent engineers, but also strong communicators who understand that users and society should be considered when designing solutions and developing products. The university integrates education and research to enable its students and scientists to become thought leaders, and in close collaboration with public and private partners, translate basic research into meaningful solutions.



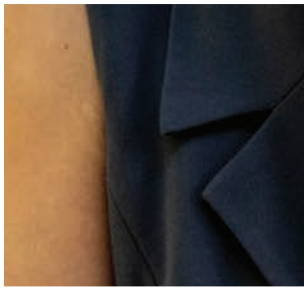










Census
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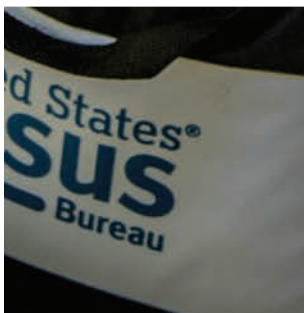
Census



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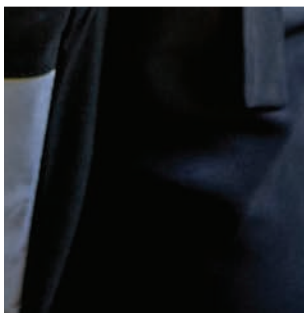
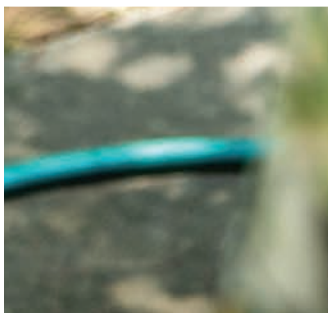

U.S. CENSUS BUREAU

Advanced Analytics Drives Reengineering of Field Operations for 2020 U.S. Census

Article I, Section 2, Clause 3 of the U.S. Constitution mandates that an enumeration of persons living in the United States be conducted every 10 years, and that this enumeration then determines the allocation of members in the House of Representatives. In 1954, the U.S. Congress formally authorized the work of the U.S. Census Bureau and the procedures used in the decennial census. The law requires that every person be counted. To achieve this, the Census Bureau conducts the census in two major parts. The first step is to obtain self-responses to the census questions. The second step is to contact each household that did not provide a self-response. For the 2020 Census, innovative advanced analytic methods were used to improve efficiency and reduce costs of the nonresponse follow-up (NRFU) operation.

The first step in the census involves obtaining self-response to invitations that are sent to every household in the United States. In 2010, these invitations included the questionnaire itself,

which was returned by mail. For 2020, the survey responses were collected on the internet for the first time. Households could also respond by returning a paper questionnaire or calling a telephone representative. About two-thirds of households self-responded to the 2020 Census, with the remaining households becoming part of nonresponse follow-up operations and being counted by enumerators. The Census Bureau deployed more than 300,000 enumerators over a span of only a few months to collect this data from more than 61 million households across the U.S. and its territories.

The nonresponse follow-up operation uses enumerators to visit addresses that have not self-responded to the initial requests sent by mail to residents to collect census data. These enumerators are responsible for visiting the addresses and collecting data for each of those addresses. Each address corresponds to a case; multiple attempts in concordance with the contact strategy are made at each address with the task of collecting the data associated with that address (U.S. Census Bureau, 2019). The goal of the NRFU operation is to visit all households that did not self-respond so that a complete enumeration of the nation's population is obtained. Enumerators are compensated for each hour they are working and are reimbursed for their automobile mileage incurred while performing their visits.

For the 2010 Census, supervisors would take current NRFU cases and assign them to enumerators at a face-to-face meeting, which occurred on a daily basis. Each case was represented in a paper folder, which included the case's address. After receiving a set of assignments, it would be the enumerator's discretion which days to work, what times, and when and what order to attempt each case. Each case assigned to an enumerator was completed by that enumerator, i.e., the enumerator would work the case until a successful visit was completed, or the maximum number of visits was attempted. After a short period, the enumerator would submit the folders of completed cases and receive new cases to work. The enumerator would also self-report workdays and times for payroll on an honor system. They met daily with their supervisors to do appropriate payroll reporting, which included the time that the enumerator worked as well as the mileage accrued. The manual processes required significant management overhead to manage the large number of enumerators and the associated reporting processes.

With the reengineering of field operations for the 2020 Census, the first change was that each enumerator used a custom mobile app on a smartphone that provided the assigned cases for each day and reported the status of the outcome of a visit, which included the collected answers to the survey if the visit was successful. The same app was also used by the enumerators to self-report their working hours and accrued mileage. As a result of Census Bureau consultation with a National Academy of Sciences panel (National Research Council, 2011), a team was formed to increase the productivity of enumerators in NRFU by 20%, ideally by using operations research techniques. As part of that effort, the team designed what would become the MOJO Optimizer.

The inception of the MOJO Optimizer – the second change resulting from the reengineering – meant that enumerators were no longer assigned to cases on a purely manual basis. Assignments of cases to enumerators were machine-generated after midnight in the local time zone, and cases were no longer owned by an enumerator for more than one day. Therefore, a specific address could be visited by different enumerators during the NRFU operation, whereas previously an address would be visited multiple times by the same enumerator. The third change was that for each day, the cases were presented in the order in which the enumerator was to work them – essentially forming a route



through their cases for each day. This optimized routing significantly increased the number of cases each enumerator would visit, thereby reducing the number of hours charged by the enumerators, reducing the mileage reimbursement costs, and removing the need for enumerators to plan their daily casework and route.

The MOJO Optimizer was the "brain" behind the second and third changes. It leveraged machine learning and optimization techniques to provide daily assignments of cases to the enumerators, along with the route that the enumerators should take to increase enumerator efficiency. As a result of the application of these advanced analytics techniques, the cost for the NRFU operation was estimated to have been reduced by $2.5 billion, due to an increase in enumerator productivity, which also resulted in less overhead for managing the complex field operation. In addition, the MOJO Optimizer was a major reason NRFU operations could be adjusted and continued smoothly during the COVID-19 pandemic. Because of a design that emphasizes flexibility and adaptability, the MOJO Optimizer provided the unique and trailblazing answers to this host of obstacles, allowing staff to easily be moved within their work area and throughout the country to take full advantage of staff availability. Without the solution provided by the MOJO Optimizer, it would have been impossible to conduct the 2020 Census field operations during a pandemic using the pen-and-paper process used in prior census operations.

Any opinions and conclusions expressed herein are those of the author(s) and do not necessarily reflect the views of the U.S. Census Bureau.

ORGANIZATIONS

U.S. Census Bureau

The U.S. Census Bureau is the federal government's largest statistical agency, dedicated to providing current facts and figures about America's people, places, and economy. It honors privacy, protects confidentiality, shares its expertise globally, and conducts work openly. The Census Bureau is guided on this mission by scientific objectivity, its strong and capable workforce, its devotion to research-based innovation, and its abiding commitment to its customers. The Census Bureau conducts more than 130 surveys each year in addition to its constitutionally mandated Decennial Census.

Princeton Consultants

Founded in 1981, Princeton Consultants blends AI and management consulting to help industry leaders and fast-growing innovators achieve transformational improvement. Using small teams with world-class technical expertise and deep business understanding, the firm builds groundbreaking AI and optimization solutions and successfully deploys them in 24x7 software systems. Princeton Consultants is a member of the INFORMS Roundtable.

THE WAGNER PRIZE

DANIEL H. WAGNER PRIZE HISTORY

For Excellence in the Practice of Advanced Analytics & Operations Research

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

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

Dr. Wagner then joined the Burroughs Research Center, where he directed a group of mathematicians performing analysis for the development of digital computers.

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

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

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

2021 Wagner Prize Committee

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- Willem van Hoeve, *Carnegie Mellon University*

2021 WAGNER PRIZE FINALISTS

The 2021 Wagner Prize competition took place during the 2021 INFORMS Annual Meeting. Five teams gave presentations to the INFORMS Practice Section judging committee seeking to demonstrate that the quality of their analysis in a real-world application qualifies them to win this award for outstanding practice of operations research and advanced analytics. The judging committee announced the winner during the Annual Meeting, and the winning team of the Daniel H. Wagner Prize will reprise their presentation during the 2022 INFORMS Business Analytics Conference.

Dr. Wagner strove for strong mathematics applied to practical problems, supported by clear and intelligible writing. This prize recognizes those principles by emphasizing good quality writing, strong analytical content, and verifiable practice successes within analytics and operations research.

All finalists' presentations can be viewed at the INFORMS Video Library. A special issue of *INFORMS Journal on Applied Analytics* will publish the winning paper along with those of the other four finalists listed below:

Data-driven Optimization for Atlanta Police Zone Design

- Shixiang Zhu, He Wang, and Yao Xie, *Georgia Institute of Technology*

Collaborating with Local and Federal Law Enforcement for Disrupting Sex Trafficking Networks

- Nickolas K. Freeman, CAP, Burcu B. Keskin, and Gregory J. Bott, *University of Alabama*

Increasing Chip Availability Through a New After-sales Service Supply Concept at ASML

- Douniel Lamghari-Idrissi, *ASML Netherlands B.V. & Eindhoven University of Technology*
- Roy van Hugten, *ASML Netherlands B.V.*
- Rob Basten and Geert-Jan van Houtum, *Eindhoven University of Technology*

Solving the Ride-sharing Productivity Paradox: Priority Dispatch and Optimal Priority Set

- Varun Krishnan, Ramon Iglesias, Sebastien Martin, Varun Pattabhiraman, and Su Wang, *Lyft, Inc.*
- Garrett Van Ryzin, *Amazon, Inc.*

2021 WAGNER PRIZE WINNER

The 2021 Daniel H. Wagner Prize for Excellence in the Practice of Advanced Analytics and Operations Research first-place winners are Hamsa Bastani from The University of Pennsylvania, and Kimon Drakopoulos and Vishal Gupta from the University of Southern California. The winners presented and received recognition at the 2021 INFORMS Annual Meeting.

Interpretable O.R. for High-stakes Decisions: Designing the Greek COVID-19 Testing System

- Hamsa Bastani, *University of Pennsylvania*
- Kimon Drakopoulos & Vishal Gupta, *University of Southern California*

The award-winning paper describes the design, deployment, and impact of a reinforcement learning system for targeted COVID-19 testing of all visitors to Greece during summer 2020. This system, nicknamed "Eva," allowed Greece to simultaneously: 1) optimize the allocation of its scarce testing resources and 2) develop reliable, real-time estimates of COVID-19 prevalence from different origin countries to inform national-level travel protocols. Eva operated continuously from Aug. 6 to Oct. 30, 2020, processing travelers from more than 40,000 households each day, and represents the first national-scale reinforcement learning system deployed to combat the COVID-19 pandemic.

The interdisciplinary team behind Eva included operations researchers, epidemiologists, software developers, and government officials. This team first designed a COVID-19 testing supply chain consisting of 300 medical and emergency personnel to collect biological samples at 40 distinct points of entry, 32 private and public testing labs to process samples, and logistics teams to transport samples from these points of entry to the central labs twice daily. The robustness and speed of this supply chain was crucial to ensuring that real-time information from border testing could be used to quickly adapt testing protocols. Next, the team deployed a novel reinforcement learning algorithm to simultaneously: 1) allocate tests to passenger subpopulations with high-prevalence and 2) learn COVID-19 prevalence across all passenger subpopulations. Although developing this algorithm required new techniques to circumvent a number of practical challenges, the most critical design elements of Eva were shaped by the practical realities of earning trust and "buy-in" from a largely nontechnical set of decision-makers in a period of crisis. Hence, transparent reasoning that enabled human-in-the-loop decision-making was paramount.

Over the course of its operation, Eva identified twice as many asymptomatic infected individuals as more traditional surveillance testing, effectively doubling Greece's testing capacity at the border. Decision-support tools built around Eva's prevalence estimates informed within-country pandemic operations, including allocation of mobile testing units and social distancing guidelines. Finally, these real-time estimates of prevalence were also used by the Greek government to adapt national travel protocols and shared with the European Union. Overall, Eva represents a blueprint for the design of future high-stakes algorithmic decision-making systems in public policy and highlights the importance of transparency and interpretability in system design.

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FOR GLOBAL OPERATIONS
UNIVERSITY OF MICHIGAN

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Project Examples

- Machine learning and advanced analytics
- Sustainability and operations
- Strategy and operations
- Supply chain implementation plan
- New product/process development strategy
- Product complexity analysis
- Lean process design and manufacturing optimization

* Savings average $43 million per project over 3 years.

Winner of the
academia strengthening ties industry
ups george d smith prize

The Tauber Institute for Global Operations congratulates the 2022 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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UPS GEORGE D. SMITH PRIZE

UPS GEORGE D. SMITH PRIZE HISTORY

The UPS George D. Smith Prize is awarded to an academic department or program for effective and innovative preparation of students to be good practitioners of operations research, management science, or analytics. It is accompanied by a $10,000 cash award. The prize committee is pleased to announce the 2022 finalists:

- Department of Mathematics and Computer Science
  Eindhoven University of Technology
- Krannert School of Management, Supply Chain and Quantitative Methods
  Purdue University
- Master of Management Analytics, Rotman School of Management,
  University of Toronto

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 (O.R.). 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 O.R., 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. Smith recognized O.R. as an engineering approach to making decisions, and started advocating the use of O.R. concepts at UPS. Quantitative analysis became the bedrock on which the UPS engineering function was built. Because of Smith'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 Smith's beliefs: to recognize the importance of O.R. in practice, and ensure that members of our younger generation get proper exposure to its value, and in turn benefit society.

2022 UPS Smith Prize Committee

- Andrew Wasser, *Chair, Smith Prize; Carnegie Mellon University*
- Andrew Armacost, *University of North Dakota*
- Al Dupree, *Government CIO*
- Michelle Li, *MIT*
- Patricia Randall, *Princeton Consultants*
- Anand Rao, *PwC*
- Anne Robinson, *Kinaxis*
- Fidel Rodriguez, *Google*
- Aurelie Thiele, *Southern Methodist University*














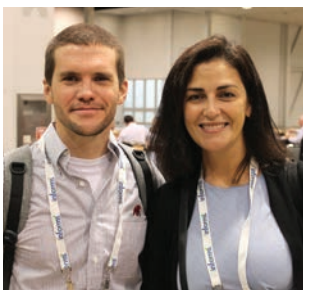





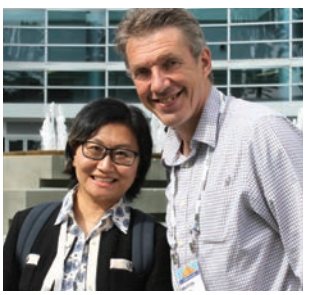



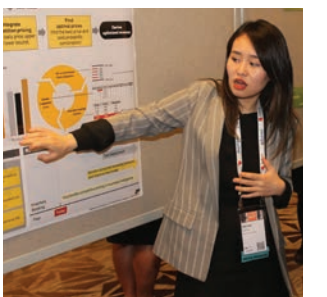

2022 SMITH PRIZE COMPETITION

Since the earliest days of operations research (O.R.) and analytics, to support the developing technology and research, it became increasingly important to prepare young O.R. and analytics professionals to further the growing impact of these fields. The UPS George D. Smith Prize recognizes the importance of a strong partnership between industry and academia in preparing students to be effective practitioners. The diversity, quality, and innovation of this year's finalists presented the committee with an encouraging and exciting glimpse of the future of the profession.

"As we grow in size, our problems increase geometrically. Without operational research, we would be analyzing our problems intuitively only, and we would miss many opportunities to get maximum efficiency out of our operation." – George D. Smith

SMITH PRIZE PAST WINNERS

2021 Tippie College of Business
University of Iowa

2020 Smith School of Business
Queen's University

2019 Department of Operations, Business Analytics, and Information Systems
University of Cincinnati

2018 Haslam College of Business MSBA
University of Tennessee

2017 Operations Research Program
United States Air Force Academy

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

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

2014 Leaders for Global Operations
Massachusetts Institute of Technology

2013 Department of Operations Research
Naval Postgraduate School

2012 Tauber Institute for Global Operations
University of Michigan

Eindhoven University of Technology

We educate students and advance knowledge in science & technology for the benefit of humanity. We integrate education and research to enable our students and scientists to become thought leaders and to design and achieve the unimaginable. In close collaboration with our public and private partners, we translate our basic research into meaningful solutions.

Our society is in need of engineers who can really be the change. Engineers who can contribute to technological solutions to solve the major challenges our world is facing. At TU/e we stimulate our students to be that type of engineer. The master Industrial and Applied Mathematics provides knowledge to become an expert in tackling and solving problems in technology and industry from a mathematical perspective.

CHALLENGE BASED LEARNING
To become a 'future proof engineer': an engineer who is capable of finding solutions for questions that we are not familiar with yet.

STRONG TIES WITH INDUSTRY
Start a career in Brainport Eindhoven, the smartest region in the world.

EUROTEQ ENGINEERING UNIVERSITY OF THE FUTURE
TU/e is a proud founder of EuroTeQ: six leading Universities of Science and Technology working together to create the Engineering University of the future.

FINALIST FOR THE UPS GEORGE SMITH PRIZE

#1
ranked on excellent atmosphere out of all Dutch universities
(National Student Survey 2021)

#2
collaborative publications with industry in the world
(CWTS Leiden Ranking 2020)

TU/e
EINDHOVEN UNIVERSITY OF TECHNOLOGY

BE THE CHANGE

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PREPARING LEADERS

IN OPERATIONS MANAGEMENT AND ANALYTICS

TOP 10 MOST INNOVATIVE UNIVERSITY IN AMERICA
U.S. News & World Report, 2022

#1 DATA SCIENCE MASTER'S DEGREE PROGRAM (MSBAIM)
CIO Magazine, 2019

Purdue University's Krannert School of Management is a thriving ecosystem that celebrates the best of operations research practice.

Using an analytic approach to management education, Krannert has prepared thousands of students for successful careers in a data-driven world.

2022
UPS GEORGE D. SMITH PRIZE
FINALIST

RESEARCH GIANTS

Current faculty in Krannert's Supply Chain and Operations area and the Quantitative Methods area have nearly 46,000 Google citations for their research. Many conduct their research through the Dauch Center for the Management of Manufacturing Enterprises and the Global Supply Chain Management Initiative. Those leading-edge discoveries are passed along to students throughout bachelor's and master's degree programs, particularly those in supply chain and business analytics.

EXPERIENTIAL LEARNING

Students can apply their knowledge in a number of activities outside the classroom, including case competitions, research projects with faculty and consulting opportunities with corporate partners. They walk into job interviews with more than a GPA...they can bring real-world experience into their first assignments.

NUMBERS DON'T LIE

Krannert's strengths in operations management and analytics are well known. The MS in Business Analytics and Information Management has been ranked the #1 Data Science Master's program by CIO magazine; the Operations Management undergraduate and graduate programs have been ranked in the top 10 by U.S. News & World Report for more than 25 years.

Great researchers and teachers, well-prepared students, involved industry partners.

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www.krannert.purdue.edu

Rotman School of Management
UNIVERSITY OF TORONTO

Master of Management Analytics

The Master of Management Analytics (MMA) is a practical degree designed for quantitatively strong students.

During the 11-month program students develop the advanced data management, communication skills and business understanding needed to launch their careers in the field of management analytics. The TD Management Data and Analytics Lab is a key element of the Rotman School's mission to become a leader in the field of management analytics. Drawing on data from both private and public sources, the lab is an invaluable resource to students of the MMA program.

Technical skills gained include working with *Python, R, SQL, Hadoop,* data structuring and visualization, statistical methods for predictive analytics, "big data" clustering, segmentation, and text analytics and experience with planning tools and optimization modeling.

Program Curriculum

- Structuring and Visualizing Data for Analytics
- Modeling Tools for Predictive Analytics
- Big Data Analytics
- Tools for Probabilistic Models and Prescriptive Analytics
- Leveraging AI and Deep Learning Tools in Marketing
- Analytics for Marketing Strategy
- Analytics Insight Using Accounting and Financial Data
- Optimizing Supply Chain Management and Logistics

Experiential Learning

- Students team embark on an 11-month industry practicum (project) where they work with an industry partner on a real management analytics problem.
- Frequent colloquium (mini courses) during the program help students understand management challenges and develop trends in data by covering topics such as:
  - Ethics and Legal Issues in AI
  - Neural Network: Causal Modeling
  - ML Operations

Our Current Program Partners

The following organizations are involved with the MMA program.

Bell
CGI
CIBC
Deloitte
Facebook
Four Seasons Group
Freshbooks
Google
IBM Global Business Services
Janssen
Kinaxis
Mansfield Inc.
Northbridge Financial
Ontario Health
Rogers
Royal Bank of Canada
Sapient Razorfish
SAS Canada
Scotiabank
Sobeys
Synctera
Taplytics Inc.
TD Bank
The Boston Consultancy Group
Vector Institute
Xello
Zafin

Contact us to learn more about the MMA program and our students:

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INFORMS PRIZE

INFORMS PRIZE HISTORY

The INFORMS Prize has been honored during the Edelman Gala for 15 years. 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 O.R. into organizational decision making. It is awarded to an organization that has repeatedly applied the principles of advanced analytics in beneficial and long-lasting ways.

2022 INFORMS Prize Committee

- Bryan Flietstra, *Chair, INFORMS Prize; Steelcase*
- Shane Henderson, *Cornell University*
- Erica Klampfl, *Ford Motor Company*
- Kathy Lange, *SAS Institute Inc.*
- Nilay Noyan, *Amazon*
- Yulia Vorotyntseva, *St. Louis University*
- Chris Weimar, *U.S. Air Force*

INFORMS PRIZE WINNERS

2022 Wayfair
2021 Amazon
2020 UPS
2019 Booz Allen Hamilton
2018 BNSF Railway
2017 The Walt Disney Company & U.S. Air Force
2016 General Motors
2015 Chevron
2014 Mayo Clinic
2013 Ford Motor Company
2012 Memorial Sloan Kettering Cancer Center
2011 Sasol
2010 Jeppesen
2009 Intel Decision Technologies Group
2008 GE Global Research Risk & Value Management Laboratory
2006 Schneider National, Inc.
2005 Air Products & Chemicals, Inc.
2004 Procter & Gamble
2003 UPS
2002 Hewlett-Packard
1999 IBM
1998 Lucent Technologies
1997 Merrill Lynch Private Client Group
1996 Pfizer Inc
1995 Bellcore
1994 AT&T and US West Technologies
1993 New York City Office of Management and Budget & United Airlines
1992 San Miguel Corporation
1991 American Airlines & Federal Express

Notes: Prior to 1995, the award was called the ORSA Prize. No prize recipients were chosen in 2000, 2001, and 2007.

INFORMS PRIZE CRITERIA

The INFORMS Prize selection committee is comprised of seven members as well as the past committee chair, consisting of practitioners and academics, providing a broad representation of the operations research community.

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.

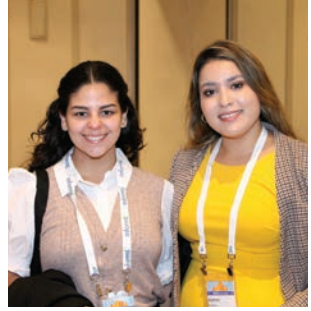
Strategic Advantage for the Organization.
Analytics and O.R. permeate the parent organization's operations and are considered integral and a source of strategic advantage.

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.



2022 INFORMS PRIZE WINNER

Wayfair believes everyone should live in a home they love. Through technology and innovation, Wayfair makes it possible for shoppers to quickly and easily find exactly what they want from a selection of more than 22 million items across home furnishings, decor, home improvement, housewares, and more. Committed to delighting its customers every step of the way, Wayfair is reinventing the way people shop for their homes – from product discovery to final delivery.

Today, operations research (O.R.) and machine learning (ML) models are utilized across a broad spectrum of functions such as marketing, fraud prevention, customer support, supply chain operations, and search to optimize business processes.

In marketing, for example, an ML model estimates how millions of customer interactions help Wayfair customers on their path to purchase. Estimating how these interactions change a customer's lifetime value, whether they occur on the web or through physical interactions such as catalogs or watching TV, allows Wayfair to drive revenue and profit by communicating to its customers a message that resonates with them at each stage of their purchase journey.

Once these customers reach Wayfair's site, personalization models tailor the experience to help customers effortlessly and quickly find the things they love out of a catalog of millions of products. Wayfair's models decide which content to show to customers and how to balance showing novel content to pursue a learning agenda, or expand a customer's awareness of the breadth of Wayfair's catalog, while balancing keeping the customer's experience relevant. Once the product is ordered, ML models help it get from the manufacturer to the customer as quickly and efficiently as possible.

On the other side of the business, Wayfair suppliers benefit from ML models in three primary ways. First, Wayfair utilizes ML to extract information from new suppliers and products, reducing the burden of adding new products to the company's catalog. Once in the catalog, ML helps the company's suppliers understand which products are likely to do well before they are available to consumers to help drive sales.

Finally, ML algorithms are used to detect product similarity, style, and substitutability so the company can source a diverse and personalized set of supplier products to the right customers.

Across Wayfair, this research is driving new ways to do business, augment decision making, and drive a flywheel of great customer experiences and growth.

wayfair
a zillion things home

FICO

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Introducing the FICO "Optimizing Success" Program

A reported 85% of advanced analytics projects fail to reach successful deployment, due to disconnects between model builders and business users. That's why thousands of companies trust FICO Xpress Optimization – which includes Xpress Insight, Solver, Mosel, Workbench, and Decision Optimizer – for their most demanding challenges. With Xpress Optimization, data scientists and business users can collaboratively build, deploy, and execute the type of analytically-powered applications that will enable their firms to transcend the competition.

To help every business enjoy this degree of cross-organizational synergy, FICO created the new "Optimizing Success" program. The Optimizing Success program makes it easier than ever for users of other optimization products – such as IBM's ILOG CPLEX Optimization Studio, Gurobi Optimizer, and SAS Optimization – to migrate to Xpress and achieve an entirely new level of project success.

Under The Optimizing Success Program, New Users Can Receive:

- Free model benchmarking, to compare their current model performance with Xpress 8.13
- One free Xpress Insight-based proof-of-concept application to enable business users to run models as a web application (limited availability)
- Free model conversion from your existing solver API to FICO Xpress, up to 2,500 lines of code
- Free model conversion from your math modeling language to FICO Xpress Mosel, up to 1,500 lines of code; this typically results in a 2-10x matrix generation speedup
- A discount on start-up professional services, such as complex application migration to FICO Xpress Mosel or Xpress Solver API (Python, Java, .NET, C/C++, R, etc.)
- A free community license version of Xpress Insight for a single user/developer
- Free membership in the FICO Optimization Community, free access to online training tutorials, and discounts on customized training courses if needed
- Weekly Xpress office hours, open to all FICO Xpress customers

Why Switch to FICO Xpress Optimization?

FICO has been a leader in optimization for nearly 40 years and continues strong investments in solver performance and R&D. We have a growing, dedicated team of modeling and solver experts, including several hired from IBM just recently, who can help you get the best out of Xpress. We work very closely with our users, and our products are second-to-none in terms of performance, features, functionality, and productivity:

- Xpress Solver offers the widest breadth of fast and reliable solvers, the highest degree of reproducibility of results (independent of the platform), and several solution robustness features, including solution refiner, iterative refinement, MIP Solution Refiner, machine learning for scaling, and diagnostics for numerical issues.
- Xpress Mosel is our expressive and intuitive language for formulating mathematical models and writing complex programming logic. Users can implement advanced Solver functionality, such as callbacks, entirely from within in the Mosel language. Mosel also provides modules that enable distributed computing, and with the help of the Mosel Native Interface, users can define reusable components such as new types, subroutines, IO drivers, and more.
- Xpress Insight empowers business users with the ability to conduct what-if scenario analysis and collaborate with peers for optimal results. Users can also rapidly create powerful, effective, enterprise-ready analytic and optimization applications faster than ever before.

Success awaits you!

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INFORMS

ABOUT INFORMS

The Institute for Operations Research and the Management Sciences

From increased efficiency in business processes that leads to millions in savings, to lifesaving advancements in medical treatments and support of at-risk populations, to revolutionized transportation and delivery systems, analytics and operations research (O.R.) are truly saving lives, saving money, and solving problems. At the heart of this growing field is INFORMS, the leading professional society for a vibrant community of over 11,000 operations research, analytics and data science professionals, academics, and students, representing more than 83 countries around the world, whose impact on the economy and society has been and continues to be nothing short of remarkable.

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

During the COVID-19 pandemic, INFORMS pivoted to transform both its Annual Meeting and Analytics Conference from in-person events featuring thousands of attendees, to fully virtual platforms that welcomed members of the O.R. and analytics community from around the globe. Late 2021 saw a much anticipated return to in-person events, starting with the Annual Meeting in Anaheim, CA and continuing with this year's Analytics Conference in Houston, Texas.

The growing INFORMS advocacy program leverages the expertise of members to provide policymakers in Washington, D.C., with valuable insight regarding the importance of data-driven decision making. INFORMS publishes 17 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 O.R. and analytics methods and applications. In addition, continuing education and Certified Analytics Professional (CAP®) and Associate CAP (aCAP) certification programs provide opportunities for professional advancement at every career stage. With 26% of Fortune 100 companies now employing CAP certified analytics 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 INFORMS membership are smaller, specialized subdivisions that are dedicated to a common theme or technical interest, many of which directly pertain to analytics and operations research applications for industry. INFORMS 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 industry sector.

INFORMS would like to congratulate and thank the 2022 Franz Edelman Award finalists, both for their incredible contributions today, as well as inspiring the great discoveries and advancements of tomorrow.

ADVANCING THE PRACTICE OF O.R. & ADVANCED ANALYTICS

By Pooja Dewan
President, INFORMS Section on Practice

Tonight we have all gathered (in person once again!) to celebrate outstanding achievements in operations research and advanced analytics. This Award Ceremony 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. You can learn more about these competitions in this program book.

The collective focus of the Practice Section and its volunteers 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. For example, we organize a set of practice-related presentations at the INFORMS Annual Meeting each fall, publish quarterly newsletters for Section members, and host monthly happy hour and webinars to bring awareness of the value of applying analytics to real-world problems. Please visit the Practice Section website at connect.informs.org/practice for more information on the Section and all its activities throughout the year.

Members of the Practice Section are a diverse and inclusive group of volunteers from across the globe and represent a wide spectrum of industry, academia, government, and more. We invite you to join us as we pursue our mission of improving the world by using operations research and analytics to save lives, save money, and solve problems. We invite you to join us and share your own unique experience and perspective. The opportunities for networking and collaborating to help advance our profession are endless and extremely rewarding.

If you are interested in volunteering with the INFORMS Section on Practice or would like to see activities that are not currently sponsored by the Practice Section, please send an email to me at: pooja.dewan@otis.com. We look forward to welcoming you to our community!

CALL FOR INFORMS AWARD SUBMISSIONS

Descriptions of INFORMS awards and prizes, and submission deadlines listed here.

Daniel H. Wagner Prize

Excellence in Operations Research Practice

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

2022 Submission Deadline: Sunday, May 1, 2022

Franz Edelman Award

Achievement in Advanced Analytics, Operations Research, & Management Science

The purpose of the Franz Edelman Competition is to bring forward, recognize, and reward outstanding examples of impactful O.R., management science, and advanced analytics practice in the world.

2023 Submission Deadline: Saturday, October 1, 2022

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.

2023 Submission Deadline: Friday, October 14, 2022

INFORMS Prize

Sustained Integration of Operations Research

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

2023 Submission Deadline: Thursday, December 1, 2022

University of CINCINNATI
CENTER FOR BUSINESS ANALYTICS

The Center for Business Analytics congratulates the

2022

Franz Edelman Award Finalists

- Alibaba
- U.S. Census Bureau
- General Motors
- Gobierno de Chile
- Janssen Pharmaceutical Companies of Johnson & Johnson
- Merck Animal Health

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PROBLEM-SOLVE WITH ANALYTICS

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ACHIEVING MORE WITH DATA:
THE CRITICAL ROLE OF BUSINESS ANALYSIS IN BECOMING A DATA-DRIVEN ORGANIZATION

DID YOU KNOW?
Excellence in Key Business Data Analytics Capabilities has
3X ROI
VS laggards.

Research found six important practices led by business analysis essential for organizations to transform to a data-driven culture.

High performing organizations that excel in these key business data analytics practices realize 3X ROI vs laggards in data analytics initiatives.

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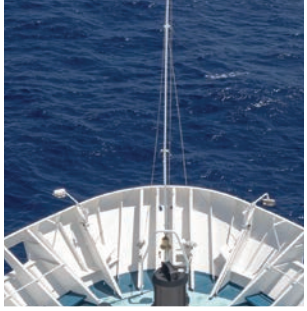








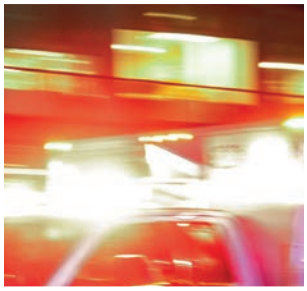

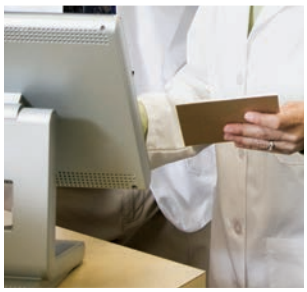




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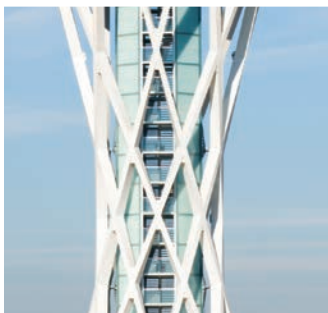

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Keith Wilton

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Chihwei Liu*
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Tsuyoshi Yoshino
Xie Zhijun

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Anthony Brigandi*
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Terry Kent
Roy Marsten
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Thomas R. Sexton
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Thomas Spencer*
Celine Stacy
Radhika Subramanian
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Robert Taggart
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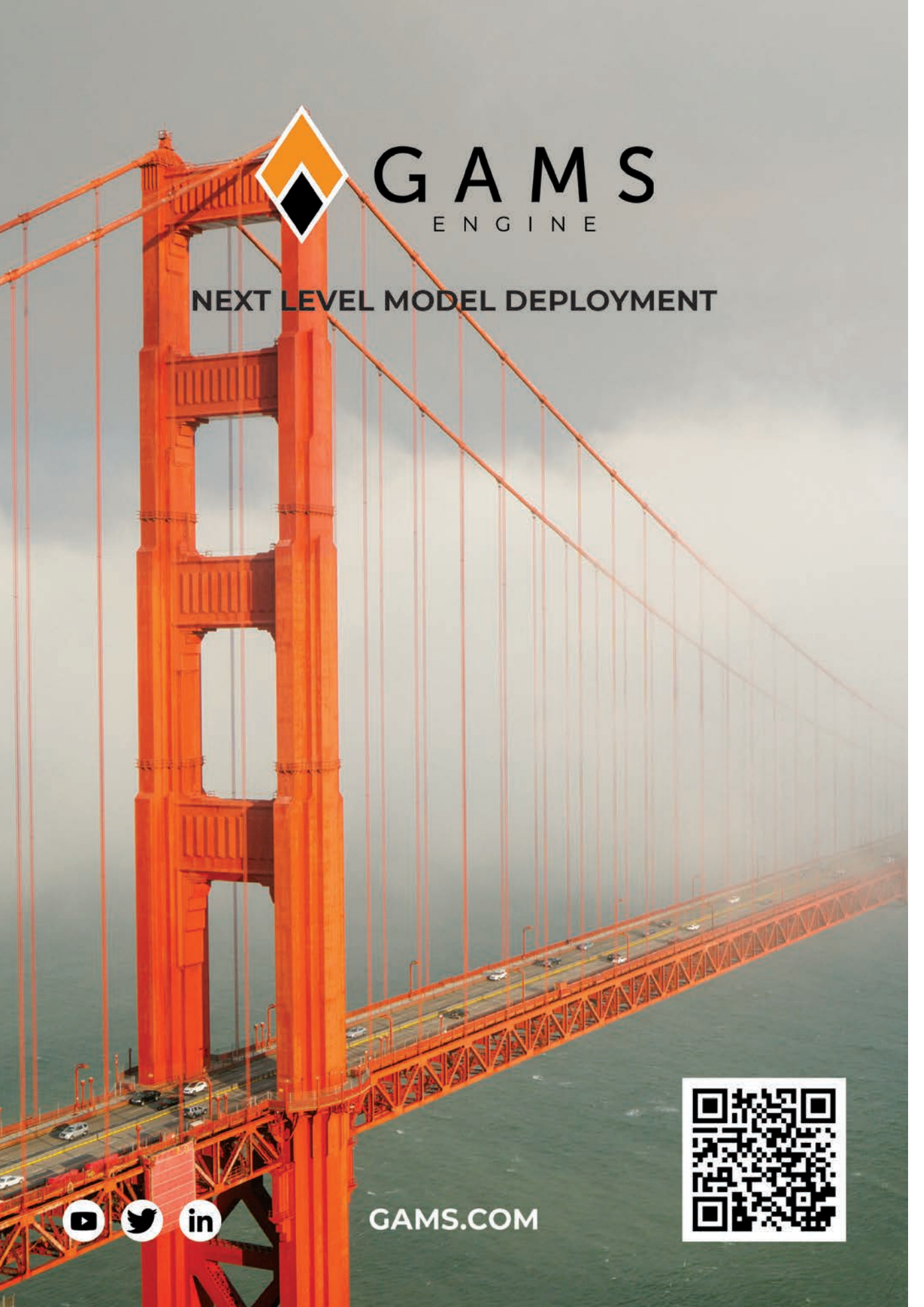
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C.K. Yin

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Nicola Aversa*
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Yoshiro Ikura
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W.L. McMahan
Alvin Silk
Bruce Smith
George Way*

1981

Henry Barker*
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Warren Erickson
Said Hilal
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Lee Brosch
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1979

William Bingham
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John Mote
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Joseph Debanne
Adel Gaballa
Harry Harrison*
William Jahnke
Ronald Lanstein
Jean Noël Lavier
Carolyn Loflin
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1977

John Chambers
Stephen Chen
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Martin Edelstein
William Fudge
Ronald Hudson
Robert G. Johnston
Frederick Knoop
Leonard Lodish
Charles McCallum
Myron Melnyk
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Thomas Saaty
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R. Jaikumar
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J. McDonald*
J. Orlansky
U.R. Rau
R.E. Reichenbach
T.C. Rowan
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1975

Joseph Balintfy
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James Reddy

1974

David Ahlers
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1973

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T.O. Carroll
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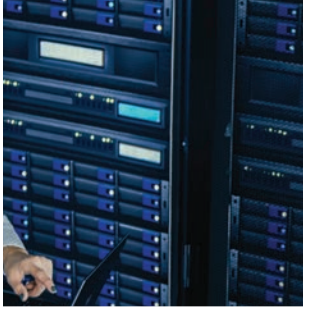



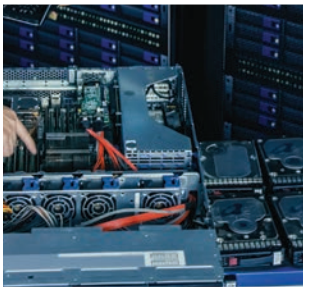



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Great Northern Paper Company
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GTE Laboratories, Inc.

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Harris Corp./Semiconductor Sector
Harvard University
Hazardous Waste Remedial Actions Program
Health Care Financing Administration
Hebrew University
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Hewlett-Packard Company
Hewlett-Packard Laboratories
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JDA Software Group
JD.com
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John Laing Engineers Ltd.
Johnston County (NC) Public Schools

K

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Kenan Systems Corporation
KeyCorp
Kid Risk, Inc.
Kinki University
Kodak Australasia
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L

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Lazada Group
LBW Optimization GmbH
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LTV Steel Company - Cleveland Works

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N

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O

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V

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Visteon Automotive Systems
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W

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Warwick Business School
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Y

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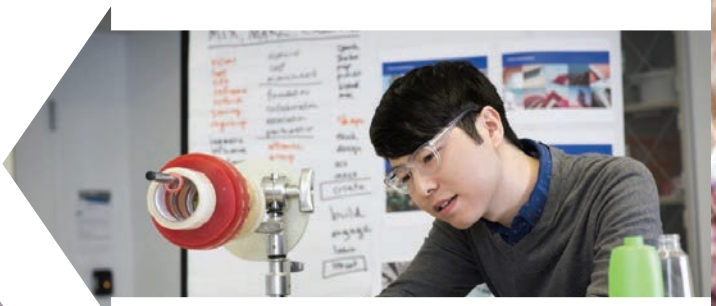

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