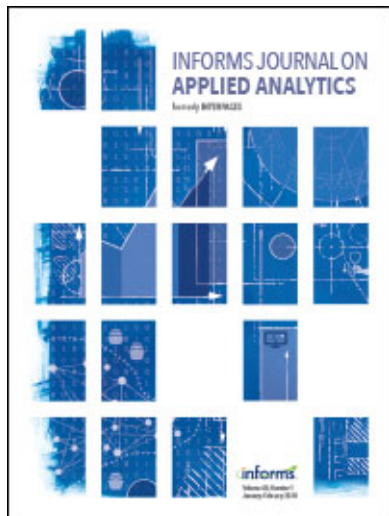




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THE FRANZ EDELMAN AWARD
Achievement in Operations Research

Introduction: 2015 Franz Edelman Award for Achievement in Operations Research and the Management Sciences

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This special issue of *Interfaces* is devoted to the finalists of the 44th annual competition for the Franz Edelman Award for Achievement in Operations Research and the Management Sciences, the profession's prestigious award for the practice of operations research and business analytics. As in previous years, the six finalists this year cover a wide range of industries and functions.

Keywords: OR practice; business analytics; OR implementation; OR success stories.

It is an honor for us to serve as special issue editor and chair, respectively, of the 44th annual international competition for the Franz Edelman Award for Achievement in Operations Research and the Management Sciences. This is a competition that brings together the best in operations research (OR) practice. This year's competition was held on April 11, 2015 at the INFORMS Conference on Business Analytics and Operations Research in Huntington Beach, California. Six finalist teams described how they applied OR and business analytics to solve diverse and difficult problems. These problems include making decisions regarding the development of new crop varieties, managing parts with infrequent demand, predicting demand for cloud computing in near real time, optimizing prices, scheduling millions of pilgrims at Makkah, and developing a portfolio analysis tool for ground combat weapon systems.

These entries highlight not only the high-impact practical models the proponents have created, but also the remarkable and diverse ways in which these proponents have made OR modeling and analysis

a part of strategic thinking and operational practice at their organizations. Change management is a key component of successful OR practice, and the papers in this issue show how to bring about change to achieve remarkable results. For example, although some decision models may contain excessive details, these entries illustrate how reasonable approximations can aid in model implementation and deployment without hindering success.

About the Edelman Award Competition

The Franz Edelman Award Competition is jointly sponsored by INFORMS and CPMS, the Practice Section of INFORMS. The purpose of the competition is to bring forward and recognize outstanding examples of OR/MS practice. The award is named in honor of Franz Edelman, who established one of the earliest industrial OR/MS groups in North America at RCA. He worked at RCA for more than 30 years and is counted among the fathers of innovation in OR/MS.

The awards are for implemented work that has had significant, verifiable, and measurable impact.

INFORMS presents trophies commemorating the award to the client organizations that used the finalists' work and presents medals and cash awards to the finalist authors. This year, the prize money totaled \$15,000, with \$10,000 going to the first-place winner. More important, the finalists have the honor and satisfaction of knowing their work has been recognized by their peers as the best in the profession. In addition to having their efforts described in this special issue of *Interfaces*, all finalists have their presentations made available at the INFORMS Video Learning Center website at <http://www.informs.org/Find-Research-Publications/Multimedia-Books/Edelman-and-Wagner-Videos>.

The Process

The Edelman Award process began with a call for abstracts in early September 2014. The number of people supporting the Edelman competition is large, with more than 40 participating on the finalist selection committee. To name them all would be difficult, but we thank them for making the competition a success, noting especially the hard work of the verifiers, coaches, judges, and the Edelman Award Gala Committee.

The selection committee reviews all entrants and selects a set of semifinalists. Verifiers then work behind the scenes to validate the claims made by each semifinalist, and convey this information to the rest of the selection committee. The verifiers directly communicate with the entrant's OR team, the users of the work, and client management. Verification is a crucial element of the competition because it ensures that only the highest-achieving OR work makes it to the Edelman Award finals. All verifiers are provided with written guidelines and sample verification reports, and novice verifiers are paired with experienced verifiers. The verifiers this year were Layek Abdel-Malek, Carrie Beam, Sudip Bhattacharjee, John Birge, Antonio Carbajal, Gavin DeNyse, Pooja Dewan, William Fox, Stephen Graves, Arnold Greenland, Roger Gung, Yoshiro Ikura, Ananth Iyer, Shailendra Jain, Grace Lin, Irvin Lustig, Anna Olecka, Pelin Pekgun, Graham Rand, Anne Robinson, and Michael Trick.

The selection committee studies and discusses the verification reports to select the six finalists. Coaches are assigned to each finalist team; these coaches help the

finalists improve their papers and presentations for the competition. The coaches this year were Layek Abdel-Malek, John Birge, Ken Fordyce, Arnold Greenland, Yoshi Ikura, Ananth Iyer, Shailendra Jain, Irvin Lustig, Anna Olecka, Greg Parlier, Pelin Pekgun, and Randall Robinson.

Judges study the papers, listen to the presentations, and then discuss the finalists' accomplishments until they reach a decision on which finalist best exemplifies the ideals and standards of the Franz Edelman Award. Relevant factors include the overall impact and value of the application, the level of technical innovation, the difficulty of the obstacles surmounted, and the work's portability to other application contexts. The judging panel consisted of Michael Trick (chair), Susan Albin, Carrie Beam, Srinivas Bollapragada, Pooja Dewan, Michael Hayward, John Milne, Jonathan Owen, and Anne Robinson. Judge Carrie Beam helped edit one of the papers following the competition.

The Banquet

This was the 10th year that the Edelman finalists were honored at a gala banquet on the evening of the competition. The Edelman Gala Committee comprised Allen Butler (chair), Jeffrey Alden, Ann Bixby, Peter Buczkowski, Antonio Carbajal, Pooja Dewan, Russ Labe, Ranganath Nuggehalli, Jonathan Owen, Randall Robinson, Michael Trick, and INFORMS staff members Courtney Biefeld, Cheryl Clark, Jeffrey Cohen, Mary Leszczynski, Barry List, Laura Payne, and Kara Tucker. Jack Levis was the master of ceremonies.

At the banquet, authors of the Edelman finalist papers were designated as *Franz Edelman Laureates* and presented with medals in recognition of their achievements. Organizations that were significantly involved in the OR development and application were inducted into the *Franz Edelman Academy*, and high-ranking representatives from these organizations were honored on stage. The culmination of the evening was the announcement of the 2015 first-place team from *Syngenta*.

The Finalists and the Papers in This Issue

Here is a brief summary of the finalists listed in the sequence that their papers appear in this special issue.

Syngenta for *Advanced Analytics for Agricultural Product Development*

Syngenta developed a suite of analytics tools to improve its decision making for creating new commercial varieties of soybean seeds. These decisions include which plant varieties to mate, which traits to select for breeding, and where, when, and how to evaluate varieties. Syngenta's ultimate objective is high crop yields, while also considering cost and the development of seeds that are robust to different environmental conditions, such as soil type, topography, disease, insects, and weather. Discrete-event simulation estimates the resulting cost, time, and probability of successfully transferring the desired traits into new seeds. An evolutionary optimization algorithm minimizes attrition, cost, and development time. One tool randomly generates a large set of feasible solutions and presents the user with an efficient frontier of experimental design choices. Data quality is improved through the identification of environmental influences on test results. The tools are used iteratively with users changing their decisions and data between runs. The result is more than \$287 million in product development cost avoidance from 2012 to 2016.

Defense Logistics Agency for *PNG: Effective Inventory Control for Items with Highly Variable Demand*

Most parts that the Defense Logistics Agency (DLA) manages have demand in less than half of every year's quarters. Many of its other parts have demand in most quarters, but with quantities that vary considerably. LMI, a not-for-profit government consulting firm, developed methods used by the DLA for determining the reorder point (s) and order-up-to inventory level (S) for both types of parts. For parts with infrequent demand, sets of possible values of s and S are simulated and a mixed-integer program is invoked repeatedly to create a trade-off curve among inventory cost, service, and buyer workloads. For parts with highly variable demand, the authors apply the Zheng-Federgruen algorithm (with a modified objective function). For both types of parts, trade-off curves are presented to managers, who select a point corresponding to a given level of inventory cost, service, and buyer workload by price group. This has led to higher fill rates, reduced buyer workload, and savings of about \$400 million annually.

IBM for *IBM Predicts Cloud Computing Demand for Sports Tournaments*

With the rapid growth of mobile devices and social networking, the demand for cloud computing capacity of sporting events is volatile and difficult to predict. Consider, for example, the Twitter "buzz" that results as a closely contested golf or tennis match approaches its conclusion. To better forecast and react to changes in cloud computing demand in near real time, IBM developed a suite of forecasting tools that are used in providing digital experiences of major sport tournaments. This software uses a blend of time-series, multiple linear regression, and chained discrete-event simulation modeling to create forecasts with horizons from 24 hours to under 30 minutes. As a result, IBM has reduced the cloud computing resources that need to be provided by about 50 percent, while it continues to provide excellent customer experiences.

Ingram Micro for *End-to-End Business Analytics and Optimization in Ingram Micro's Two-Tier Distribution Business*

Ingram Micro is the world's largest distributor of information technology products. Based on the demand price elasticity for product and customer groupings, it optimizes prices and provides data-driven negotiation guidance for use with high-volume customers. Ingram Micro uses predictive scoring of potential end customers to generate leads and data-driven marketing to end customers through its digital platform. Since 2010, this work has yielded a cumulative benefit of \$1.3 billion of incremental product revenue.

Saudi Arabia Ministry of Municipal and Rural Affairs for *Improving Pilgrim Safety during the Hajj: An Analytical and Operational Research Approach*

During the past three decades, overcrowding of the annual Hajj pilgrimage to Makkah led to several stampedes and thousands of casualties. Following a stampede in early 2006, the Ministry of Municipal and Rural Affairs of the Kingdom of Saudi Arabia (MOMRA) launched projects to improve infrastructure and crowd management. MOMRA had modeling support from the German University of Hamburg, the University of Technology (Dresden), and ETH Zurich, Switzerland. They developed a series of mathematical programming scheduling models that assign paths and stoning times to groups of pilgrims. Their mixed-integer programming (MIP) models include a MIP that

assigns pilgrim groups to subareas of campsites (a layout problem). They also used simulation to identify potential areas and periods of high crowd densities, and thus facilitated strategic planning of infrastructure investments and confirmed that optimized schedules do not have unforeseen outcomes. From the time this work commenced in 2006 through 2014, no stampedes occurred. Sadly, hundreds died during the September 2015 Hajj, when the authors and MOMRA were no longer involved in the scheduling and routing recommendations. This tragedy highlights the need to sustain the use of O.R. and to carefully manage the execution of the resulting plans and schedules.

U.S. Army for *Maximizing the U.S. Army's Future Contribution to Global Security using the Capability Portfolio Analysis Tool (CPAT)*

The United States Army—in conjunction with Sandia National Laboratories, Booz Allen Hamilton, and Tele-dyne Brown Engineering—developed and deployed a multiple-tier set of MIP models to optimize the planned portfolio of ground combat vehicles (e.g., tanks) over time. Given a limited budget (by year) and a wide variety of business rules, the Army determine purchases and upgrade decisions to maximize fleet performance and minimize costs. Because of page limitations, their approximately 100 MIP constraint types are described only in the online supplement to their paper. A key aspect of their multiple-tier MIP approach is the modeling of a different level of granularity with each run. Their portfolio analysis tool is regularly run to influence major decisions. For example, they continued modernization of the \$10 billion Stryker

family of vehicles (originally slated for cancelation), and they reallocated over \$20 billion by not pursuing the Ground Combat Vehicle program.

Conclusion

The Edelman finalists' papers make this issue of *Interfaces* special for both practitioners and academics. Practitioners can benefit in at least four ways. First, they will find better ways of doing things using OR/MS models in a diverse group of organizations in both the private and public sectors. Second, they will find better ways to advocate their ideas to others in their organizations by pointing out the impact from adopting OR/MS modeling. Third, they will learn how to bring about change in an organization to make OR-based modeling and analysis an integral part of the culture. Finally, they can be inspired to tackle challenging problems and make the modeling choices necessary for their effective solution and deployment.

Academics will find validation of the advanced methodology they teach and will be able to demonstrate what can be achieved with OR/MS. Furthermore, these examples illustrate how model customization is often required to suit the problem context.

Acknowledgments

Selection committee members, verifiers, coaches, judges, and the Edelman Gala Committee all deserve thanks for the significant effort they put into making the Franz Edelman competition a success. We thank Alice Mack, the manuscript editor of this issue of *Interfaces*, and the INFORMS staff who helped with many aspects of the process.