



Profiles of UPS Prize finalists

**Trio of programs recognized
for effective, innovative preparation
of O.R. grad students aiming
at practice sector.**

Editor's note:

Each year, INFORMS awards the UPS George D. Smith Prize to an academic department or program for effective and innovative preparation of students intent on pursuing careers as practitioners of operations research. This year's UPS Prize went to the Centre for Operations Excellence at the University of British Columbia's Sauder School of Business. Lehigh University's Enterprise System Center and Department of Industrial and Systems Engineering and Carnegie Mellon University's H. John Heinz III College were finalists. We invited all three finalists to briefly describe their outstanding programs for this special "Innovative Education" issue of *OR/MS Today*.



The Sauder School of Business at the University of British Columbia won the 2015 UPS George D. Smith Prize.

UPS Prize Winner:

Training O.R. students with impact: The Sauder School of Business story

By Harish Krishnan, Stuart Donald and
Martin Puterman

The Masters in Management in Operations Research (MMOR) program at the Sauder School of Business at the University of British Columbia (UBC) provides rigorous and practical training in the quantitative analysis of business problems. Administered by the Centre for Operations Excellence (COE), the MMOR prepares students for rewarding careers as OR analysts and consultants. Since its establishment in 1998, the program has trained a generation of students for successful careers in both public and private sector organizations.

The COE program provides a unique bridge between academia and industry. MMOR students define, execute and communicate the results of annual projects carried out for industry partners. The students work in collaboration with a team of corporate sponsors, other students, staff and faculty advisors. They spend a portion of their time on site with frequent remote interaction with the corporate sponsor's team.

The main goal of this 16-month professional master's program is competency in O.R. practice. Accordingly, the program features a 4 1/2-month industry project as its centerpiece. After eight

months of coursework that provides students with a strong background in operations research and analytics, students are immersed in full-time work on their industry project.

In addition to a full complement of core O.R. and statistical courses, students take a consulting practices course which provides them with the communication and project management skills necessary to carry out a successful project and a best practices course, which explores a number of exemplar O.R. implementations drawn mostly from the Edelman Prize competition.

Students are paired and matched with a COE industry partner company to consult on a significant operational challenge faced by the company, one that they might otherwise approach a consulting firm to address. The students are supported by an extended team. One-on-one mentorship is provided by a COE staff project advisor, guidance is provided by a Sauder faculty advisor, technical support is available from a pool of summer students, and oversight is provided by the COE's directorship. The team as a whole puts in more than 2,300 work hours on each project.

At the start of the projects, students follow the lead of their project advisor. Over the course of the project as students develop their skills, they start taking a leadership role within the project team. Depending on their experience prior to the program and their inherent abilities, each student's trajectory to co-leadership is different. The project provides each student with an opportunity to build on strengths and overcome weaknesses, as well as to demonstrate their ability to creatively solve challenging and open-ended problems.

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UPS Prize FINALISTS PROFILES

Each project's trajectory is also different, depending on the nature of the problem at hand and the industry partner's needs. All projects involve a "discovery" phase, which includes gathering data and better defining the problem, a model-building and analysis phase and finally a "delivery" phase, where a tool or report is provided to the partner. The close working relationship with the partner is reinforced through multiple milestone meetings where students present their progress to the partner's senior management.

In the final semester, students complete their program with elective courses. They also present their project at the annual COE Roundtable, which showcases the students' work to representatives of the local business community. Students often receive employment offers prior to graduation from the industry partner that they worked with. Indeed, some of our long-term industry partners have employed several of our graduates and have established O.R. groups that are largely made up of MMOR graduates.

Origins of MMOR

The program was founded in response to the needs of the local business community. In the 1970s, Vancouver had an active industrial O.R. community based primarily in the forest products industry. By the 1990s, however, the program had all but disappeared due to corporate restructuring and an economic downturn. With advances in desktop computing, local businesses were once again receptive to quantitative analyses and began contacting Sauder faculty for assistance with operations projects. In the absence of a formal structure to carry out projects, graduate students and professors were involved in projects on an ad hoc basis.

In 1995, Sauder Professor Martin L. Puterman with the support of Professor Derek Atkins, created the COE's predecessor, the Bureau for Research on the Application of Management Science and Statistics (BRAMSS). Similar academic-industry partnerships were developed at other universities, including MIT's Leader's for Manufacturing program and the University of Michigan's Tauber Institute.

However, unlike some of these programs that began with significant endowments, BRAMSS had no corporate champions willing to come to bat with large financial commitments. This required a made-in-British-Columbia solution. The Sauder program, which was renamed the Centre for Operations Excellence, had to be built from the bottom up. The challenge was to develop a program that delivered immediate benefits to corporate partners.

Project fees covered a portion of COE expenses, but the COE and its MMOR program would not exist today without the financial support of MITACS (www.mitacs.ca), a Canada-wide organization dedicated to supporting applied industrial applications of mathematics. MITACS provided a significant portion of the COE's initial operating funds and has continued to provide important funding up to the present.

The COE and its MMOR program can legitimately claim to have played a role in the resurgence of operations research in all facets of British Columbia industry. Graduates of the program have gone on to start their own companies, become industry leaders as well as professors at top universities.

Long-standing industry partners, including health authorities in British Columbia and private sector partners such as Boeing Canada, have sponsored projects over several years. Their interaction with the COE and MMOR program has also helped them develop their own operations research and analytics capabilities by building internal teams of analysts, many of them who are graduates of our program. COE projects have substantially influenced practice while also motivating innovative research and generating prize-winning cases.

Harish Krishnan is an associate professor in the Operations and Logistics Division (OLD) and director of the Centre for Operations Excellence (COE) of the master's in management in operations research (MMOR) program at the Sauder School of Business at the University of British Columbia (UBC). **Stuart Donald** is managing director of the COE and lecturer in the OLD at UBC. **Martin Puterman** is professor emeritus and advisory board professor of operations of OLD at the UBC.

UPS Prize Finalist:

Carnegie Mellon's Heinz College emphasizes analytics for impact

By Ramayya Krishnan and
Jon Nehlsen

Stopping electronic intrusion of the nation's most critical IT networks. De-incentivizing piracy of online music and movies. Influencing

teenagers not to make an emotional Facebook post that will follow them for the rest of their lives. These are some of the problems of our age. And these are the problems that students and faculty at CMU's Heinz College use analytics to study and solve.

Carnegie Mellon University's H. John Heinz III College approach to analytics education resides on the bedrock principle that analytic thinking and methods only matter if they can be used to solve real problems. The formula is simple:

Analytics + IT + Deployment = Real-World Impact

Why is this approach important? It's important for three reasons. First, analytic thinking and decision-making require the ability to make sense of data in order to give structure to previously unstructured problems. Second, information technology training must be part of good analytics training because in the real world, data is often incomplete, resident in disparate systems and subject to poor input processes. Further, existing data often have to be supplemented with data from partners or the Internet. Technology training helps our graduates solve for these problems. Finally, organizations are subject to biases, politics and path dependencies which can make it difficult to digest new information or manage change. The emphasis on deployment skills helps graduates solve for these problems as well.

Unique Structure

The Heinz College is home to the graduate School of Information Systems and Management and graduate School of Public Policy and Management, a deliberate structure that exists only at Carnegie Mellon University (CMU). This gives the College great natural advantages in incorporating cutting-edge technologies and methods into curriculum that were, in many cases, invented or perfected at CMU. It also means that Heinz students naturally embrace large societal-scale problems and bring analytics to bear on problems of global importance.

Analytics is not a new idea at Heinz College. The College's roots date back to 1968, when William Cooper, a noted operations researcher, founded the School of Urban and Public Affairs with the mission to educate "men and women for intelligent action." Since its founding, more than 10,000 students have graduated from Heinz



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programs in Public Policy and Management and in Information Systems and Management and have pursued careers in all sectors of the global economy.

Each one of these graduates was steeped in a core curriculum that has always included management science, statistics, economics, data analytics and information technology coursework. Additionally these graduates have each learned leadership and deployment skills through mandatory training in professional speaking and writing, organizational behavior and meta-curricular leadership training activities with partners such as the Army War College. Experiential learning through required internships and semester-long capstone projects with startups, global firms and government agencies are a final important component of the Heinz College experience. These activities ensure that students spend substantial time deploying their skills in the real world before they even graduate. Says Professor Jon Caulkins of the Heinz College approach, "We put it together in a package that allows our students to take these tools and make the world a better place."

Ramayya Krishnan is dean of the H. John Heinz III College and the W. W. Cooper and Ruth F. Cooper Professor of Management Science and Information Systems at Carnegie Mellon University. Jon Nehlsen is senior director of Institutional Relations at the H. John Heinz III College. He is an alumnus of the Heinz College and of the Wharton School.

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UPS Prize Finalist:

Lehigh University's ESC and ISE Department offer vibrant educational ecosystem

By Ana-Iulia Alexandrescu, Tamás Terlaky, Emory Zimmers Jr. and Luis Zuluaga

For the fourth year in a row, the Enterprise Systems Center (ESC) and the Industrial and Systems Engineering (ISE) Department at Lehigh University in Bethlehem, Pa., have been honored as one of the top three finalists of the INFORMS UPS George D. Smith Prize. In close collaboration, the ESC and the ISE Department nurture a vibrant educational ecosystem to produce effective young practitioners of operations research (O.R.) and analytics. The main mission of Lehigh's ISE Department is to prepare undergraduate through Ph.D.-level students for successful careers as O.R. practitioners, equipped with skills to solve complex, real-life analytics problems. To successfully carry out this mission, the ISE Department offers many programs (two undergraduate, five master and one Ph.D.) through which students develop critical and analytical thinking, learn O.R./analytics skills and apply them in a real-world setting. The department

is quick to adapt to the rapidly changing industry landscape, as demonstrated through the development and success of innovative programs such as Analytical Finance and Healthcare Systems Engineering, both preparing successful practitioners that bring valuable insights to their fields.

Besides learning these techniques, ISE Department students are provided, through its ESC, with hands-on experience on applying this knowledge in collaborative projects with a large and distinguished pool of industrial partners. This is accomplished through long-term relationships with industry and government working to increase global competitiveness. The ESC also partners with the Industrial and Systems Engineering Department, centers, institutes and other departments within Lehigh and other universities to foster innovation and student learning. In particular, the ESC has completed more than a thousand research projects with 400 industry partners since it was established as a research center at the ISE Department, Lehigh University almost four decades ago.

The ESC developed the innovative layered mentoring model. More than 3,000 graduate and undergraduate students have participated in these projects, working in interdisciplinary teams with faculty and ESC mentors with substantive industry experience to help companies solve real-world operations problems. In turn, these projects have brought significant economic value for the ESC industry partners. These high-impact results ensure that the ESC will only continue to grow its footprint as a channel to deliver the latest developments in O.R./analytics from academia to the industry sector.

Thanks to the effective use of O.R./analytics quantitative skills and ESC's layered mentoring structure, Lehigh University graduates make substantial impact on the efficiency of partner companies. As a result, our graduates are highly sought-after by companies in all sectors. In particular, beyond engineering positions (about 35 percent), a large percentage of ISE graduates (about 35 percent) start at positions where these analytical tools are at the forefront (e.g., consultant, manager, analyst and Ph.D. positions). Moreover, over time, our graduates rise quickly through the managerial ranks. In fact, after 10 years of graduation, about 50 percent of our graduates position themselves at high-level positions in their respective companies (e.g., vice-president, president, chairman, CEO, manager, director, owner and partner). **ORMS**

*Within the Department of Industrial and Systems Engineering at Lehigh University, **Ana-Iulia Alexandrescu** is the director of HSE and a professor of practice, **Tamás Terlaky** is a professor and department chair, **Emory Zimmers Jr.** is a professor and **Luis Zuluaga** is an assistant professor.*



Lehigh's Enterprise Systems Center and ISE Department have been UPS Prize finalists three straight years.

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CONGRATULATIONS to the winners of the following 2015 INFORMS Practice prizes:

- 2015 Franz Edelman Award: Syngenta for "Good Growth Through Advanced Analytics"
- 2014 Daniel H. Wagner Prize: David Simchi-Levi, Peter Y. Zhang, William Schmidt, Oleg Gusikhin, Don Zhang, Yao Ge, Keith Combs, and Michael Sanders for "Identifying Risks and Mitigating Disruptions in the Automotive Supply Chain" at Ford.
- 2015 UPS George D. Smith Prize: The Centre for Operations Excellence at the University of British Columbia, Sauder School of Business.



Daniel H. Wagner Prize



UPS George D. Smith Prize



Franz Edelman Award

CPMS is proud to support, participate in, or manage the prize committees of these awards. Plan to enter the 2016 Edelman Prize competition: entries are due October 14, 2015. Learn more about the application process for 2016 at <https://www.informs.org/Edelman>

The Practice Section of INFORMS - CPMS

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