The Operations Management (OM) field is thriving at the Smith School of Business. Our faculty is very well known in the academic community and are beginning to be well known in the practitioner community as well. The research ranking of the Operations Management faculty is regularly in the top-10. The faculty are also associate editors in some of the most prestigious journals like Manufacturing & Service Operations Management (M&SOM), Production and Operations Management (POM) and Management Science. Our faculty also work on the most important issues of the day including healthcare operations, pricing and revenue management, product innovation, energy/environmental issues and social networks.

Operations Management is also a well sought after undergraduate degree, and coupled with supply chain management is becoming a niche for our MBA students as well. OM courses now proliferate in our new Master of Science programs. We believe that with good business principles one can do a lot of good in this world. Many of the students from the Smith School of Business work on consulting projects for non-profit companies, and the single most important toolkit that they use are concepts and ideas from operations management. We are very happy that the faculty in the OM area contribute significantly to the research, teaching and outreach mission of the Smith School. We are confident that our OM alums will also make the world a better place.

Dean G. “Anand” Anandalingam
**Frank Alt**  
Ph.D., Georgia Institute of Technology  
Frank Alt is an Associate Professor of Management Science & Statistics. Alt is a recipient of the Krowe Award for Teaching Excellence (1993 and 1996) and the Distinguished IBM-TQ Teaching Award (1994) from the Robert H. Smith School of Business. He was recognized with four stars in the Business Week Guide to the Best Business Schools (1997) for his teaching performance in the MBA program. Alt’s research interests include statistical quality control, applied multivariate analysis, and forecasting with a particular interest and expertise in multivariate process control.

**Michael Ball**  
Ph.D., Cornell University  
Michael Ball is the Orkand Corporation Professor of Management Science and the Associate Dean of Faculty and Research. He also holds a joint appointment within the Institute for Systems Research (ISR) in the Clark School of Engineering. Dr. Ball’s research interests are in network optimization and integer programming particularly as applied to problems in transportation systems and supply chain management. He is the Co-Director of NEXTOR, the National Center of Excellence for Aviation Operations Research.

**Sean Barnes**  
Ph.D., University of Maryland  
Sean Barnes joined the department as an Assistant Professor of Operations Management in Fall 2012. His current research interests are modeling the transmission of infectious diseases, healthcare operations management, simulation, and network analysis. He has authored work in peer-reviewed publications such as the INFORMS Journal on Computing, and Infection Control and Hospital Epidemiology. He has also authored a chapter on Applications of Agent-Based Modeling and Simulation to Healthcare Operations Management to appear in an upcoming book.

**Margrét Vilborg Bjarnadóttir**  
Ph.D., Massachusetts Institute of Technology  
Margrét Vilborg Bjarnadóttir is an Assistant Professor of Management Science and Statistics. Prior to joining Smith, she held an academic position with Stanford Graduate School of Business. She specializes in operations research methods using large scale data. Her work spans applications ranging from analyzing nation-wide cross-ownership patterns and systemic risk in finance to drug surveillance and practice patterns in health care. She has consulted with both health care start-ups on risk modeling using health care data as well as governmental agencies such as a central bank on data-driven fraud detection algorithms.

**Zhi-Long Chen**  
Ph.D., Princeton University  
Zhi-Long Chen is a Professor of Operations Management. Prior to joining the Smith School in 2001, he was an assistant professor at University of Pennsylvania for 4 years. His research interests cover supply chain scheduling and coordination, routing/scheduling of logistics operations, capacity planning, and dynamic pricing. Dr. Chen has conducted a number of NSF funded research projects and is working closely with industry on several projects in the areas of supply chain optimization and pricing.

**Wedad Elmaghraby**  
Ph.D., University of California at Berkeley  
Wedad Elmaghraby is an Associate Professor of Management Science and Operations Management. Prior to joining the Smith School, she was on the faculty of the ISyE at Georgia Institute of Technology and NYU Stern School of Business in the Operations Management group. Her current research interests are in behavioral operations management with an emphasis in (i) pricing and (ii) the design and study of online auctions for business-to-business markets.
**Michael Fu**  
Ph.D., Harvard University  
Michael Fu is Ralph J. Tyser Professor of Management Science. In addition, he has a joint appointment with the Institute for Systems Research and an affiliate appointment with the Department of Electrical and Computer Engineering, both in the Clark School of Engineering. He was named a Distinguished Scholar-Teacher at the University of Maryland for 2004-2005. His research interests include simulation modeling and analysis, operations management, applied probability and queueing theory, with application to manufacturing and finance.

**Bruce Golden**  
Ph.D., Massachusetts Institute of Technology  
Bruce Golden joined the faculty of the UMD Business School in 1976 and served as a Department Chairman from 1980 to 1996. Currently, he is the France-Merrick Chair in Management Science at the Robert H. Smith School of Business at the UMD. He has received numerous awards, including the Thomas L. Saaty Prize (1994 and 2005), the University of Maryland Distinguished Scholar-Teacher Award (2000), the INFORMS Award for the Teaching of OR/MS Practice (2003), and the INFORMS Computing Society Prize (2005). His research interests include heuristic search, combinatorial optimization, networks, and applied operations research.

**Raghu Raghavan**  
Ph.D., Massachusetts Institute of Technology  
Raghu Raghavan is Professor of Management Science and Operations Management. His research interests and activities cover a broad domain including auction design, data mining, economics, information systems, computational marketing, networks, optimization, and telecommunications. He has published on a wide variety of topics and numerous academic outlets such as Management Science, Operations Research, Decision Support Systems, and the INFORMS Journal on Computing. He holds two patents, and has won numerous awards for his work.

**Ilya Ryzhov**  
Ph.D., Princeton University  
Ilya Ryzhov is an Assistant Professor of Operations Management and Management Science. His research deals with the role of information in decision analysis, exploring the way in which new information influences and improves decision-making strategies. He develops efficient ways to achieve this balance, with applications in pricing, revenue management, and optimization of energy costs. His work has appeared in Operations Research. He is also the coauthor (with W.B. Powell) of the book Optimal Learning.

**Tunay Tunca**  
Ph.D., Stanford University  
Tunay Tunca is an Associate Professor of Operations Management and Management Science. Prior to joining University of Maryland, he was an Associate Professor of Operations, Information, and Technology at Graduate School of Business at Stanford University. He has also held positions as a visiting scholar at Wharton, M.I.T., Hewlett Packard and Yahoo Inc. His research interests include economics of operations and technology management, theoretical and empirical analysis of procurement contracts and processes, economics of security, and the role of information and forecasting in supply chains.

**Yi Xu**  
Ph.D., University of Pennsylvania  
Yi Xu is an Assistant Professor of Operations Management. He teaches and conducts research in the areas of operations management with an emphasis on product assortment planning, pricing, product development and innovation, and Marketing and Operations Interfaces. He is particularly interested in exploring mechanisms that spur innovations and developments of new technologies which transform competitive dynamics and enable novel operational strategies.


**RECENT HONORS & AWARDS**

**Michael Ball**
- INFORMS Fellow
- Received Best Paper Award in Finance and Policy at the 9th USA/Europe ATM 2011 R&D Seminar
- Co-Director of NEXTOR, National Center of Excellence for Aviation Operations Research (2009 - present)
- Area Editor, Operations Research (2009-2011)
- Associate Editor, Operations Research

**Sean Barnes**

**Zhi-Long Chen**
- Changjiang Scholar Award given by China’s Ministry of Education (2009)
- Plenary Talk, Tenth International Conference in Information and Management Sciences, held in Tibet, China (2011)
- Associate Editor, Operations Research

**Wedad Elmagraby**

**Michael C. Fu**
- INFORMS Fellow
- IEEE Fellow
- Winter Simulation Conference Best Theoretical Paper Award (2009)
- OR Program Director, National Science Foundation (2010-2012)

**Bruce Golden**
- INFORMS Fellow
- Ranked first among 30 INFORMS Fellows with respect to h-index and other measures (2008)
By definition, urgent care patients cannot choose when they need to go to the hospital. But hospitals have to choose when, and for how long, to offer certain specialized treatments; to accommodate specialists’ schedules this is usually during the day. Since elective surgeries are also usually scheduled during the day, the hospital is less busy at night. Therefore, a patient visiting the emergency room in the middle of night often gets quicker access to surgery and the intensive care unit (ICU). It is well known that long waiting times can impair health care outcomes, so it could perhaps be assumed that night patients experience comparably improved outcomes.

Seeking to identify the mechanisms driving the variations in care quality for trauma patients, France-Merrick Chair Bruce Golden and his colleagues have taken on this question; they find that outcomes are worse at night, so factors other than wait times must be having important effects. Professor Golden notes, “There is a ‘Golden Hour’ in medicine. Not named for me, it describes the period – also not necessarily 60 minutes in length – in which specialized surgery and other procedures can do the most good for trauma patients. Since night arrivals are not waiting as long for surgery, they are often treated within this period, but their outcomes are still wanting when compared to day patients. This is because senior surgeons tend to work during the day and the generalists working at night are reluctant to call in the eye surgeon at four in the morning, for example. Consider also that surgeons may work the night shift only a few times a month and therefore are tired, not used to keeping such hours.”

Looking at this problem from the trauma care perspective is useful, since the treatment cycle is relatively short and events in the cycle are easy to represent in a mathematical estimation model (did the patient require follow-up surgery, 1 for yes, 0 for no). It is also important because trauma from unintentional injury is the number one cause of death among young, wealth-creating individuals. Improving this situation could have a positive impact on national income, vital at a time of rising health care costs. Furthermore, reducing the extra surgeries that result from temporary “patch” surgeries could result in significant cost savings for capitated insurance systems such as Kaiser Permanente and the Geisinger Health System, which have a set amount of funding designated for each person they cover, regardless of whether that person seeks care or not.

Past studies have tended to focus on one quality measure, like readmission rates or waiting times, and address the issue from a clinical perspective. They mostly use annually aggregated national data, whereas Professor Golden’s study focus is on within-hospital quality variation. The study data includes treatment and outcome measures for nearly two million patients and comes from the American College of Surgeons’ National Trauma Data Bank. The estimation model includes several measures of quality, but the researchers were careful to avoid including variables that overlap too much (e.g., the fixed effect of the first trauma center and the fixed effect for each center that is based on the first one), so that the variables’ individual predicting power is preserved. Also, since the model includes variables that control for the hospital type (level of trauma center, range of specialists available), they can show that the effect of trauma timing is stronger for lower order trauma centers.

These trauma centers, which tend to be located at rural hospitals, need to be even more strategic with their resources. “Common sense solutions, such as using telecommunications solutions to access specialized guidance and having specialized surgeons work evenings on a regular basis, could significantly improve outcomes without too much extra investment” suggests Professor Golden.

Reforms to hospitals’ internal decision-making process could bring about across the board results by addressing chronic problems (e.g., too few specialized surgeons available). This research offers valuable insights for managers seeking to find a mix of hospital resources that can result in consistently high quality care. It suggests that daytime results are not better because more care is available; the degree of care specialization available also drives variations in care quality resulting from patient arrival time. This means that managers cannot just add more care at night; instead they need to be strategic with the level of resources that they make available.

Related Information
David Anderson, Gordon Gao, and Bruce Golden “Life is all About Timing: An Examination of Differences in Treatment Quality for Trauma Patients Based on Hospital Arrival Time”, submitted for publication.
Companies are risk-takers: they must make decisions under uncertain circumstances and, although these have immediate profit or loss consequences, any result is economic information that can improve future choices (and hopefully increase profits). If a company makes a price change and then observes that demand goes down, it can conclude that future consumers may not be willing to pay as much as they had thought. In industries such as energy and e-commerce, where prices can change every hour, setting a price too high has immediate economic costs. Firms trading in these markets need a way to learn from the sales fluctuations and immediately make better decisions.

On a smaller scale, a firm that performs energy efficiency upgrades to office buildings has to choose combinations of upgrades to offer, like both efficient light bulbs and windows, and online learning can help them find the combinations that will record an above-average reduction in energy costs and therefore complement each other particularly well. Firms that want to hedge against high electricity costs can buy forward contracts for today’s prices and online learning can help them determine how many they should buy. In all these cases, the decisions’ results provide valuable online information in addition to their economic impact.

Assistant Professor Ilya Ryzhov, together with Princeton Professor Warren Powell and Cornell Assistant Professor Peter Frazier, has developed a new way to assign economic value to online information. Not to be confused with information available on the Internet, it is “online” because the decision-maker observes the information as he goes, in addition to the immediate economic benefit (or loss) that occurs as a result of each decision. Compare this to the “offline” learning that occurs when a product is tested against historical data or in the lab setting before being brought to market.

“Our method mathematically represents how a decision-maker could use online information, really of-the-moment data, to update or correct his beliefs about an environment,” explains Dr. Ryzhov. “It performs comparably well to the technically optimal information-collecting strategy, while being substantially easier to implement in practice.” The formula performs well in a variety of situations, but its special value is in application to problems where, for example, knowing the demand for one product could provide demand information for similar products (known as “correlated beliefs” in the jargon).

So with this new tool the online information’s economic value is compared with the revenues or costs resulting from the decision; managers can use it to calibrate their desired balance of revenue and information. In the near term it is often worth sacrificing some economic rewards in order to collect more and better online information, which may bring greater rewards in the long term. Dr. Ryzhov notes, “The real-time information is especially useful in volatile markets, where each decision carries greater risk and uncertainty. This new technique is important because companies can use it to assign economic value to that information and thus compare it to the opportunity costs of making a short-term loss.”

Online learning requires experimentation, like setting the features in a service and phasing them in and out. This experimentation affects revenue, especially when it involves lowering prices, but the collected information calibrates choices that will improve results in the longer term. Dr. Ryzhov’s approach measures to see whether the value of the new information from the higher price is enough to compensate for the revenue penalty. A new weapon in the battle between far and near term gains.
Companies that have a problem without an obvious solution often turn to their internal research and development (R&D) department, a classic producer of new ideas. R&D departments differ from other parts of a company (e.g., marketing) in that the task of finding one outstanding idea implies many costly failures. A process that has been lowering the cost of poor results is the innovation contest, a form of crowdsourcing.

In 2010, Google announced the Google Lunar X Prize with $30 million in contest prizes to the first privately funded team to send a robot to the moon. In 2006, Netflix launched the Netflix Prize, an open contest with $1 million prizes for the best collaborative filtering algorithm to predict user ratings for films. Innovative in itself, the innovation contest transfers the cost of failure on unsuccessful entrants since members of the public submit solutions to a posted problem in the hope of winning a prize.

But the biggest benefit of a competitive innovation contest is not the lowered cost. Using a model based on extreme-value distribution, Assistant Professor Yi Xu and his coauthor Christian Terwiesch, Andrew M. Heller Professor at the Wharton School, have shown that the wide variety of proposed solutions from outside participants can be predicted to actually produce more diverse and creative ideas than an internal R&D department. Their work characterizes this benefit of innovation contest for three types of innovation. Holding an innovation contest could actually be more costly than maintaining a department, both in terms of coordination costs and also the lowered effort of participants who think they are unlikely to win. Yet Xu and Terwiesch find that the benefit of obtaining more diverse and creative ideas can easily outweigh these issues.

Carefully designing and managing contests can further mitigate these issues. Yet when a problem is highly complex and a lot of expertise is needed, contest coordinating costs may be prohibitive. Contest organizers might need to develop a pool of qualified solvers, for example through advertising or sending invitations. In the case of a highly complex problem, it may be cost-effective to hire an intermediary such as Innocentive.com, which advertises the problem to its stable of experts. Those who are available to work on the problem submit their solutions to the intermediary and it passes the solutions on to the seeking company. Hiring an intermediary can thus allow the seeker’s identity to remain private, which can be beneficial in areas like the pharmaceutical industry, where companies may not want outsiders to know what drugs they are working on. Limiting the number of solvers in this way also serves to mitigate the under investment of effort problem.

It has been long thought that the problem of participants’ under-effort in a large contest would mean that running an innovation contest openly, for example as through a social network, cannot be a successful R&D strategy. But this research shows that the potential to obtain revolutionary ideas can easily outweigh the under investment of time issue. “When we began our research back in 2005,” notes Professor Xu, “Crowd-sourcing and social networking were still in their infancy. Our model was able to predict the power of harvesting ideas from an open social network.”
RECENT HONORS & AWARDS

Bruce Golden
- Harvey J. Greenberg Award for lifetime contributions to the INFORMS Computing Society (2011)
- Invited to be a Plenary Speaker at the Annual Meeting of the Italian Association of Operations Research (2012)
- Finalist for the Best Published Paper in the last three years in M&SOM (2012)
- Editor in Chief, Networks
- Senior Editor, POM

Raghu Raghavan
- INFORMS Telecommunications Section Outstanding Service Award (2008)

Yi Xu
- Management Science Meritorious Service Award (2010)
- Senior Editor, POM

Ilya Ryzhov

Tunay Tunca
- Finalist for the Best Published Paper in the last three years in M&SOM (2009)