

Letter from the Lead Editor

Dear Readers,

A new term started in summer 2015 for the OR/MS Tomorrow online magazine. A brand new editorial team started its term with lots of motivation, ideas and the will to help contribute our grain of sand in order to keep improving the INFORMS student magazine more and more.

For the past several years, this online magazine has been a vehicle for the delivery of the latest news that involves the INFORMS community, as well as a picture of current research and practice in many trending OR/MS topics. I cannot proceed with this letter without thanking all the former editorial teams for their wonderful work and service to our readers.

We are very excited to present you the third thematic OR/MS Tomorrow issue on OR/MS in the Public Sector. The articles in this issue are focused on civic OR/MS and societal challenges as well as the role of OR/MS in decision-making in the Public Sector. This issue includes: an exclusive interview with Dr. Karen Smilowitz of Northwestern University's McCormick School of Engineering; featured journal articles; upcoming conferences and applied projects; our very popular OR/MS across the globe section which, in this issue, discusses the humanitarian challenges of the Syrian migration. We are also pleased to spotlight the University of Michigan INFORMS Student Chapter and the INFORMS Pro Bono Analytics Society. Last but not least, we are launching our Undergraduate Student Competition, and I strongly encourage you to submit your work for consideration if you are an undergraduate student.

I truthfully hope that you will enjoy reading the great articles in this issue of OR/MS Tomorrow as much as we did while preparing it for you!

We will keep struggling to evolve and improve the quality of our magazine day by day. We are always open to new ideas and your feedback. Please do not hesitate to approach us via email at: (orms_tomorrow@mail.informs.org)

Kind Regards,

Sara Nourazari

Sara Nourazari

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Doing Good Well: An Interview with Dr. Karen Smilowitz, champion of analytics for good

In this issue, Dr. Smilowitz shares insights gained from years of experience conducting research in community-based OR projects.

Dr. Karen Smilowitz of Northwestern University's McCormick School of Engineering is a self-proclaimed "operations research geek" and a champion of applying industrial engineering techniques to problems in the social and non-profit sectors.

In this issue, Dr. Smilowitz shares insights gained from years of experience conducting research in community-based OR projects. Drawing from her background in transportation and logistics (Q1), Dr. Smilowitz first became interested in researching social problems when researching a routing problem motivated by interlibrary loans. Over time, she has pursued this interest by partnering with non-profits and NGOs, and building an infrastructure at Northwestern to support her interests through Analytics for Social Good, her interdisciplinary undergraduate course (Q2), and Northwestern's Non-Profit and Humanitarian Logistics initiative (Q3).

Through sharing her numerous and diverse experience, Dr. Smilowitz offers perspective on the unique challenges of social OR and gives advice to those interested in getting involved (Q4). In particular, we learn that this exciting and growing field has opportunities for wide array of skill levels,

backgrounds and interests. Further, this uniquely interdisciplinary field demands a more nuanced definition of the objective, relative to industrial applications which seek to optimize specific financial or operational metrics. This led Dr. Smilowitz and her students to draw from many perspectives to understand how to define and quantify "doing the most good" (Q5).

Q1. You've worked in many high profile and diverse areas. What specifically excites you about your areas of research and how did you get started?

Ans. When I came to Northwestern in 2001, my area of research was transportation – freight transportation. I had done my dissertation looking at package delivery systems like UPS and FedEx. When I arrived here, I started working on similar projects in trucking, and then through the Northwestern Transportation Center, someone at the North Suburban Library System contacted me, and that's a non-profit that does, among other things, interlibrary loans.

In early 2000s, the economy wasn't doing so well, so people were using libraries more, and the budget for their operations was going down.

So, they came to us because they needed help with their routing. It was a great project! It ended up becoming my first PhD student's dissertation.

Methodologically, we started looking at this problem, and saying, you know, it's not just that you can't solve this – this is just a really hard routing problem to look at. I think it was interesting for me from a routing perspective since it incorporated challenges we had not seen in other problems in more commercial settings.

From an impact perspective, they were just a great organization to work with. Even to this day, in my office, I have a resolution from them that, through our results, they were able to save \$18,000 a year! In a commercial setting that may not seem like anything – like noise that you wouldn't worry about – but for a nonprofit, \$18,000 is a large part of their budget.

It was a really great project where we felt like we had an impact in our community, but also, in terms of operations research, it was a very interesting variant on periodic vehicle routing problems that haven't been studied.

That sounds like a very unique application!

What was cool was, because they're an organization here in the area, we were able to go out on delivery rides and see them do the sorting. So, we could understand what was going on and how we could help out. And over the years (we've worked with them for a long time – five years), I had my PhD student work on it, but I've also had a number of undergraduate students work with them as well through independent study and senior design projects.

Q2. You seem to go out of your way to engage undergraduates in your work. Last spring, you

created a new undergrad class called Analytics for Social Good. Could you tell us more about what that process was like?

(More information on the course here: <http://365.iems.northwestern.edu/>)

Ans. Sure! The dean of the engineering school here had had a meeting, maybe three years ago, with some just a couple faculty. His thought was: how do we bring engineering thinking across Northwestern? And so, a couple of us pitched ideas for classes, and I pitched this idea of a humanitarian logistics class that would be offered to students throughout the university. I did a pilot of it as a PhD class, and it was just a fun experience to talk about my own research and the research that has excited me in the area, some of the work that other folks are doing.

Then, last spring, I launched the undergraduate version of the class. It was 60 students, and we brought in students from all six undergraduate colleges throughout Northwestern, representing 25-30 different majors. We had Anthropology majors, we had a French Horn major, we had Biomedical Engineers, Math majors, Econ majors, and a whole lot of industrial engineers, as well.

The students worked in interdisciplinary teams on a number of projects related to community operations, global health, community health, and disaster response and preparedness. We brought in speakers from around the area. Folks that I do work with – like folks from the Red Cross. We also had someone from Microsoft Disaster Response who came in to help with the course's hackathon.

The hackathon was a two-day project in which they were asked to look at new technology to help the Red Cross in their disaster

response and preparedness. And that was fantastic! It was great to watch the students work in these interdisciplinary teams and, over time, begin to think about how they can contribute to the problem from very different perspectives and why that's so necessary – to have the Anthropology student talk about, when you think about fire preparedness in Chicago, why language is important, why culture is important. So, it's things you need to think about as you come up with different solutions.

I was interested to see on the course website that you kept the prerequisites minimal. Was that to foster this interdisciplinary environment?

Right – and the prerequisite issue was tricky to wrestle with. You had to have some level of statistics. But the students had to be juniors or seniors because I wanted the students to be experts at whatever their domain was. I didn't want this to be a watered-down class; I wanted students to come in and say: I am an expert at gender studies, or I am an expert at political economies – and to really use those frameworks that they have learned at Northwestern and apply them to these problems.

So, all of the students were required to do both a written and a video tutorial to talk about their area of expertise. And it was amazing. A student from Communications did this video on how to communicate data better, and that was phenomenal! I thought she had it professionally done, and I was amazed to see that this was one of our undergraduates.

I started to say – the dean had asked us to take engineering thinking and extend it across Northwestern, and I think it also did the opposite: for the engineering students, it really brought Northwestern in. And, for me, I've

been at the university fifteen years, and I don't think I've fully appreciated the quality of the students all around and the expertise that they have.

That was really great, and as the class evolves over the years, I think we will think about how to tap into that more, and think how do we get students – the marketing students, for example. They had all of these neat frameworks to think about volunteering and engagement. We did a project at the beginning talking about Red Cross and engaging volunteers. Thinking about how they approached it from a marketing perspective really informed how other students looked at the problem.

The students really liked that. It took them a little while at the beginning. It was a new experience – just getting students to not be afraid to come over to the engineering school. Over time, they worked in these teams of five throughout the quarter, and each team was a mix of engineering and non-engineering students. They got to know each other and know where their different expertise were.

Q3. Similarly, you also lead the Non-Profit and Humanitarian Logistics initiative at Northwestern. We've already talked about some of your big projects such as the library loans. Do any other projects stand out in your mind, or do you have ideas of other directions you hope to take in the future?

Ans. One of the big changes on the horizon is combining efforts with the Center for Engineering Health, so I think there's a lot of synergy between our work and healthcare. So, I'll be looking at community health and non-profit aspects under that larger umbrella to consolidate efforts.

Speaking of healthcare and

projects, one of the neat projects that I like and that I'm proud of is with an NGO in Liberia, Last Mile Health. We've been working with them for about six months now, and that's been an amazing partnership because, even though there is all this distance and we've never met in person, both sides are very invested. The undergraduate who worked with us last spring is now going to be a finalist in the INFORMS Undergraduate Research Competition. She's just done fantastic work, and that's been really neat to see that.

What she was able to do --- this was a routing problem looking at their community healthcare workers in rural Liberia and their supervisors. You need to locate the supervisors, and the supervisors will go visit the healthcare workers in the field. You need to do schedules and routes for them. Traditionally, in operations research, this is a hard problem because enumerating all these routes is too difficult. Our undergrad, working with Last Mile Health, was able to get to the point where there really weren't that many routes [after factoring in all the constraints from the context.]

Having seen long-distance projects that haven't worked out so well, it's really rewarding to see how well this project is going. We're going to be presenting together at the Health & Humanitarian Logistics Conference in Johannesburg this November.

What has enabled this long-distance project to be so successful?

Since we started working with them they have been really accessible. We do at least weekly conference calls with their team in Liberia. Their sharing data has been fantastic. It's a two-way street – when we present operations research models, we present them in a way that they can understand exactly

what we are doing. These are the constraints. We won't show you the formulation, but we will say this is what we are doing, this is how we are generating the route, and these are the assumptions that we are making. Then, they can come back to us and say if it's not realistic.

Working that closely together despite the distance has been great, and it's exciting to see how this project has taken off. And, as a result of the Analytics for Social Good class, there's an Anthropology student who took my class who through another connection happened to work for Last Mile Health in Liberia this summer, so she's going to be working with us in the fall, and we have a post doc who's going to be working on it.

Q4. You've published and spoken at INFORMS, giving advice to others about doing social analytics. What sort of advice would you give to students who would like to get involved but whose universities don't have the same sort of infrastructure that you are building at Northwestern?

Ans. That's a great question. I think the first thing that you could do is volunteer. Really understand what's going on and what the issues are. That's something I like about doing these local projects in the community because you can collaborate with the partners. I've been working with the Red Cross for about two or three years now, and the students who work on this project are also trained dispatchers. They're on the schedule and they work. It's fantastic because the students will now tell me, "Well, we can't do that because that's not how it works there." That's been great.

We work with the Chicago Marathon and their medical

preparedness. And so, we've had students on-site at the marathon for the last couple of years. Being able to be hands on and really participate gives you an opportunity to understand what is going on.

A lot of times, people at organizations have great insight into where they need to get. If you ask them, "What are your operational problems?", they can tell you what is going on, and they have years of experience and domain knowledge. Then, we come in with the tools to say, "Okay, so how do we get there?"

So, I would say to students: get engaged with an organization. A lot of organizations have great volunteer opportunities, and they may not know right off the bat what to do with an industrial engineering or operations research students, but if you start working at the organization, you can start thinking about what the next steps might be.

Q5. For students and researchers alike, what other advice do you have for engaging in social OR? What do you think makes these problems more interdisciplinary or more challenging than other applications?

Ans. Data is one thing. It gives you a chance to be creative to think how you get the data you need. How do you get data in a way that's not going to impede regular operations? As I mentioned, we work with the Chicago Marathon on medical preparedness and, as part of that, we use their medical data. They have fantastic patient tracking data. So, over the course of the marathon, six to eight hours, they will see one to two thousand patients. We have data on those encounters, and, over the years, we think about how can we make that data set richer?

Well, one way is to record a lot of data, but they are seeing a lot of patients in a short amount of time, and the volunteers are not there to collect data. So we think about how do we streamline the process? How do we get the data that we need in a way that still lets the medical volunteers apply treatment?

From a modeling perspective, addressing things like equity becomes really interesting. We worked with a mobile asthma care provide in Chicago. So, these were large RVs outfitted to be medical facilities, and they work with Chicago Public Schools. There's a great quote from their executive director, who said, if they wanted to be efficient, they'd just go to one spot and have everyone go to them, but that's not outreach. Outreach means going into the community.

That highlights some of the challenges of these problems. When I teach my supply chain class, we talk about economies of scale and risk pooling. You want to consolidate because it helps you deal with uncertainty. But when you are dealing with outreach programs, whether it be the asthma care provider or flu distributions, your goal is to get out into the community, and that means that you are more vulnerable to uncertainty and to risk. So, how do you handle that when the uncertainty is different and the mechanisms you have to address the uncertainty is different?

So, I think it's really challenging. And again, this is where the interdisciplinary nature comes in – having people who can come and talk about what is feasible, what isn't feasible.

So, on some level, it even becomes less clear what you are optimizing?

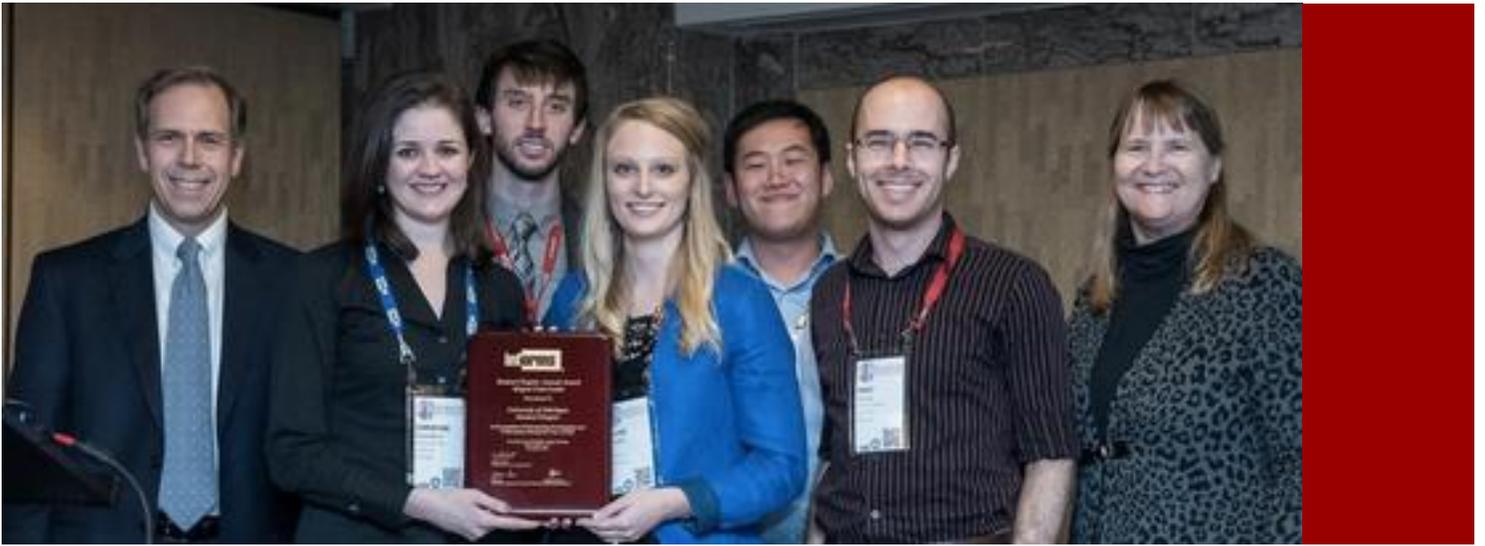
Exactly – we played around with

that a lot in this new class. We looked at equity measures from the economics literature. I ask the question: what does equity mean in your academic discipline? Thinking about how we define equity, and then, when you put it in a computer model, it's just going to optimize what you tell it to do, and it can come up with solutions that don't really make any sense.

That was really fun. It's easy to come up with a mission statement and say you'd like to achieve equity, but sometimes it's hard to quantify that and to come up with solutions that are meaningful – solutions that are equitable but also efficient and don't game the system. You want to give everyone equitable service and treat everyone the same, so you can give everyone bad service, but that really defeats the purpose of also providing resources. So how do you balance those different goals? ■

Thank you so much for your time, Dr. Smilowitz! Hopefully your great insights will inspire more student engagement.

Edited by: Emily Riederer, University of North Carolina



Picture: University of Michigan Student Chapter receiving the 2014 Magna cum Laude award

Dave Hunt, Christine Barnett, Gregg Schell, Kayse Lee Maass, Vicor Wu, Troy Long, and Robin Keller (l-r)

Student Chapter Spotlight

University of Michigan INFORMS Student Chapter

The University of Michigan's INFORMS Student Chapter was initially composed solely of PhD students, but has recently expanded its membership to include Master's and Undergraduate students. This change has allowed the chapter to serve as a cohesive community for all students in the Department of Industrial and Operations Engineering (IOE) interested in OR/MS related topics. Through the continued efforts of the student chapter board, the chapter received a cum Laude award in 2013 and a Magna cum Laude award in 2014.

The chapter hosts several events during the year, including at least one large group event each month. These events range from research seminars to volunteer outreach events to a variety of

professional development workshops. The chapter began the 2014-2015 academic year by welcoming new faculty members Henry Lam and Viswanath Nagarajan to the department with informal "Meet the Faculty" events, during which current students and a new faculty member get to learn more about each other's research and extracurricular interests. This year the chapter will welcome four new faculty members to the department: Pascal Van Hentenryck, Seth Guikema, Ruiwei Jiang, and Matthew Plumlee.

The chapter also encourages students to network with faculty members from other universities. Through the INFORMS Speakers Program, the chapter supplements the University of Michigan IOE department's weekly seminars by

inviting additional speakers to talk on topics related to promoting diversity within the field. The speakers are also invited to provide career advice and discuss their experiences related to diversity in STEM at a student-only lunch. Previously invited speakers include Dr. Laura McLay (University of Wisconsin- Madison) and Dr. Margaret Brandeau (Stanford University). You can read more about Laura McLay's visit on her [blog](#)!

During the 2014-2015 school year, the chapter held several events aimed at fostering student development. For example, the chapter hosted a cultural awareness workshop featuring two specialists who have extensive cross-cultural experience due to



Picture: Dr. Laura McLay (L) and Dr. Margaret Brandeau provided valuable career advice to students during their visits

their positions on the board of directors for international companies. The goals of the workshop were 1) to increase cultural awareness in the professional setting and 2) to provide tools that would help students improve their cultural awareness abilities. Other student-led workshops focused on sharpening technical skills, such as programming and Latex workshops. Additionally, the chapter regularly hosts practice talks before major conferences (e.g. INFORMS Annual, INFORMS Healthcare, POMS, and IIE), during which students receive feedback from the audience. Lastly, the chapter also recently initiated a mentor-mentee program to aid incoming first-year PhD students in the transition to PhD life.

The chapter values regularly serving the community through volunteer outreach events. Since 2013, the chapter has collaborated with the university's Center for Engineering Diversity and Outreach to participate in several local day-long activities aimed at promoting the power and potential of engineering, with emphasis on industrial engineering. These events are hosted by the Females Excelling More in Math, Engineering, and the Sciences



Picture: Many of the IOE students were introduced to whirly ball during a recent student outing

(FEMMES) organization, the university's Xplore program, or the student chapter itself.

Finally, the chapter hosts community-building department-wide events including summer picnics, Whirlyball and bowling. The chapter has many new events planned for the upcoming year including tours of local factories, a career showcase, and networking opportunities with industry

professionals. You are encouraged to stay up-to-date with the University of Michigan's Student Chapter through their [website](#) and [twitter](#) account. ■

Edited by: Bismark Singh, University of Texas at Austin

Special thanks to David Hunt who kindly helped us spotlight Pro Bono Analytics

Society Spotlight

Introducing Pro Bono Analytics

Members of INFORMS have saved corporations billions of dollars by designing more efficient supply chains for retailers, improving processes and scheduling in health care facilities, increasing throughput in manufacturing plants, as well as supporting a wide variety of other industries. INFORMS members have also helped with humanitarian relief efforts and with mitigating the spread of infectious diseases. Just imagine what could be accomplished if more members of INFORMS turned their talents and energy towards solving problems facing underserved communities or addressing issues related to social injustice!

Pro Bono Analytics is a new initiative within INFORMS to match members willing to volunteer their skills with non-profit organizations who would benefit from advanced analytics and operations research techniques. The Pro Bono Analytics Committee is building strategic partnerships with non-profit organizations who address a wide variety of problems facing society. The Pro Bono Analytics Committee is also developing a network of analytics / operations research professionals willing to volunteer some of their time for a good cause.

A similar program, called Pro Bono OR, has been successfully operating in the United Kingdom for several years. Some of the problems for which members of the Operational Research Society have volunteered their time include^[1]:

An international charity to help street children wanted to improve the arguments and evidence for why the group's work should be funded.

A non-governmental organization and social enterprise running a health centre in rural Uganda needed help with its financial position and short-term planning, partly as a result of the complexities of the local reliance on non-cash transactions.

Crimestoppers, a charity that helps solve crime through members of the public providing information anonymously, needed to determine how to take on new business and improve performance without a big increase in staffing costs.

A community youth venture needed to design a risk management plan that had the involvement and backing of trustees to ensure sustainability of the organization.

A housing-related charity running community development projects wanted to improve its use of externally available statistical data and other information in its work.

A charity supporting women affected by domestic violence, facing termination of their funding, needed help in evaluating possible new or replacement funding sources.

RSPCA, the UK's leading animal welfare charity, needed a method to estimate how many dogs there

are in the UK and how many are moving in and out of welfare/rescue.

INFORMS Pro Bono Analytics began this year and is currently working on a few initial projects to test the concept. One project underway is looking at how best to match Boston area residents willing help their neighbors to requests from elderly residents needing snow shoveling assistance after a storm so they are not trapped inside their homes.

If you are interested in volunteering some of your time and talent, or just curious about how analytics / operations research can address problems facing society, please visit www.probonoanalytics.org to sign-up and to follow our progress. Also, watch for events involving Pro Bono Analytics at the INFORMS Annual Meeting in Philadelphia.

^[1] To learn more about these Operational Research Society Pro Bono OR projects and others, please visit www.theorsociety.com/Pages/ProBono/Probono.aspx and <http://probonoOR.blogspot.co.uk/>. These examples were adapted from the ORS Pro Bono OR web site. ■

Edited by: Sara Nourazari, Northeastern University

Featured Research

For this issue, we feature Dr. Peng Shi's article "Guiding School-Choice Reform through Novel Applications of Operations Research" which was published in INFORMS' journal *Interfaces* in 2015. This article summarizes Dr. Shi's award-winning work which he completed as a graduate student and for which he won First Place in INFORMS' Doing Good with Good OR student competition in 2013.

This research formulates an optimization problem for school-assignment reform for the Boston Public School system by considering factors such as equity, convenient, and cohesion. To accomplish this project, Shi fits a discrete choice model and uses

simulation to test how outcome measures vary under different plans. One of the plans he proposed was adopted by Boston Public Schools in 2013.

The article can be read here: <http://pubsonline.informs.org/doi/pdf/10.1287/inte.2014.0781> More information about the INFORMS Doing Good with Good OR student competition can be found here: <https://www.informs.org/Recognize-Excellence/INFORMS-Prizes-Awards/Doing-Good-with-Good-OR-Student-Paper-Competition>. ■

Edited by: Emily Riederer, University of North Carolina

Humanitarian Challenges of the Syrian Migration – OR in Turkey

The distraught image of a three year old Syrian boy, Aylan, washed up on the banks of a Turkish beach is quite powerful, and so is the fact that Europe, Eurasia and Middle East have welcomed more than 4 million Syrian refugees and is struggling with another impending wave of boats arriving on their shores. From January to August 2015, 350,000 migrants arrived on the coasts of the European Union, not counting the undetected entries (US News, 2015).

The unfortunate civil war in Syria is pushing multitudes of the population out of their homes into neighboring countries and Europe. For some, Turkey, Lebanon, Jordan, Egypt, Iraq, Libya, and Yemen are transit countries; the final destination being Germany, Sweden, Greece, Malta, Austria, Armenia, Netherlands, and many more. However many are residing in their neighboring countries since

2011, one of them being Turkey who will provide refuge to approximately 1.9 million asylum-seekers by the end of 2015, making it the world's largest recipient of refugees. Lebanon, on the other hand, registered over 1.2 million at the start of 2015, the second largest recipient (UNHCR, 2015).

Coupled with refugees from Syria are economic migrants escaping troubled countries like Afghanistan, Iraq, Kosovo, Eritrea, and Albania for better employment and standard of living. Unfortunately, this causes attrition of support for the refugees, the ones in need for a safer life, due to the extra time and cost involved in dealing with

economic migrants, the ones in need for an improved life. While for Europe these migrants and refugees provide the much-needed boost in the labor markets, Turkey will have to prioritize Syrian refugees over the others.

As a result, major recipients of asylum-seekers are facilitating: (i) Immigration and expatriation of the refugees, (ii) Rehabilitation while avoiding ghettos, and (iii) Safe transit to Europe. The severity of the crisis and immense loss of life calls for a coordinated effort on the part of humanitarian agencies and governments in Europe, Eurasia, and the Middle East for operational disaster management.

OR/MS Across the Globe

Analytical tools like Operations Research/Data Analysis are at the center of disaster preparedness and response for decision making in a variety of geographical settings to evaluate strategies for dealing with crises vis-a-vis their outcomes in terms of effectiveness of the logistical plan of action, costs and mortality.

The principal needs of food and shelter can be very challenging if close to 2% of Turkey's population constitute refugees. There are close partnerships between the Government, the judiciary, the UN Country Team, donors, NGOs and partners, and the refugees themselves to address the issue at hand as efficiently as possible (UNHCR, 2015). The following section discusses the academic influence of OR in Turkey and evidence of application to the current refugee situation.

OR in Turkey

Academic Influence of Operations Research

Operations Research is both studied and appreciated in Turkey by means of research directed in the areas of production and scheduling, facility management, logistics, energy management, and sustainability (See Öztürk, 2013 for more information on history of OR in Turkey). The Operational Research Society of Turkey (ORST) is a professional organization with the objective of spearheading the growth of Operations Research and its application in national development by contributing to both public and private sectors. It is a part of the International Federation of the Operations Research Societies. Established in 1975, the organization conducts annual conferences, seminars, and meetings for creating awareness and sharing/presenting the research done by faculty and students in Turkey. It also has

regular periodicals that discuss future events, shares research and honors students through scholarships.

Some of the top universities of Turkey, such as, Bilkent University, Sabanci University, and Bogazici University, are a part of the society. These universities teach Operations Research mainly through their Industrial Engineering departments. A few have Operations Research clubs run by students in conjunction with the IIE group and European Students in Industrial Engineering group. This enables exchange of knowledge, information, and helps build network between students in Turkey and in other parts of Europe. Middle East Technical University has a dedicated Operational Research degree program.

The society also gives awards/scholarships to PhD students sponsored through the Association of European Operational Research Societies. The 2016 award was given to a student from Bogazici University. Colloquiums for PhD students are organized at different universities to encourage doctoral studies in Operations Research.

The 16th International Symposium on Econometrics, Operations Research and Statistics took place in Edirne, Turkey in May 2015. Also, the INFORMS Applied Probability Society Conference was conducted in Istanbul, Turkey in July 2015. This shows involvement in both Data Analytics and Operations Research at academic and industry level. These skills could prove to be very useful in crises, especially those demanding disaster management and response.

Application at Grass Roots

With regard to the current refugee and migrant situation, Turkey builds and operates numerous shelter camps, distributes basic supplies,

attempts to provide relief, safety, social inclusion, and rehabilitation. The Government of Turkey, accompanied by its Coast Guard Command, and Disaster and Emergency Management Authority of Turkey directs NGOs and International agencies in providing relief. Effective coordination between these government entities and United Nations High Commissioner for Refugees has resulted in provision of housing (Container camps with basic facilities, cleanliness, and low crime rates), cash, kitchen appliances for cooking, blankets and winter clothes for children, wheelchairs, and first-aid clinics. Logistics, supply chains and resources are optimized for serving the operational needs at reduced cost (UNHCR, 2013 and 2015).

Ankara Refugee Lunch Support Group provides meals to refugees waiting at the registration points and in the camps. The NGO functions independently through donations and funds garnered from external sources. The procurement of raw material, production, and distribution is handled by the volunteers efficiently. Along with the World Food Programme, several NGOs are optimizing their planning, procurement, and distribution to improve nutrition.

These continual efforts on the ground are well supported with ongoing research. ORSAM (Center for Middle Eastern Strategic Studies), a think tank established in Turkey with the objective of directing and encouraging research on the Middle East, is aimed at providing its results to decision making organizations in the public sector, academics, and the private sector. The studies conducted by the organization focus on social, psychological, political, and religious implications of migration on the country.

"The Economic Effects of Syrian Refugees on Turkey: A Synthetic

Modelling" studies cities of Gaziantep, Hatay, Kilis, Şanlıurfa, Mersin, Adana, Kahramanmaraş, Osmaniye, and Mardin, analyzing the causal effects of migration on economic variables such as, international trade, unemployment rate, wage rate, inflation (food prices and rent inflation), house sales, education services and cost of education, and health services in each of the cities. The model constructed through Synthetic Control Method simulated and estimated time paths of the economic variables in absence of migration and compared them with actual time paths to assess their effects on the cities. Empirical analysis coupled with this approach led to findings that highlighted the strength and weaknesses across cities and gaps in their efforts (Öztürkler and Göksel, 2015).

Challenges of uncertain demand and supply, coordination, distribution, temporary warehouses,

scheduling and routing are among the major issues faced by disaster ridden places. Turkey is encumbered with not just these but also with its role as a transit country. Given the circumstances and limited resources, it is doing a remarkable job in sustaining its own population and including Syrians and other asylum-seekers.

References

- Öztürk, A. (2013). Yöneylem Araştırmasının Tarihi Gelişimi ve Özellikleri. *Alphanumeric Journal*, 1(1), 001-011.
- Öztürkler, H. and Göksel, T. (2015). The Economic Effects of Syrian Refugees on Turkey: A Synthetic Modelling. *ORSAM Report no. 196*.
- UNHCR. (2013). *Regional Response Plan 5 Update*, UN High Commission for Refugees.
- UNHCR. (2015). *2015 UNHCR country operations profile – Turkey*.

Retrieved from: <http://www.unhcr.org/pages/49e48e0fa7f.html>.
US News. (2015). Humanitarian Horror Show as Migrant Crisis Overwhelms European Unity. Retrieved from: <http://www.usnews.com/news/articles/2015/09/03/humanitarian-horror-show-as-migrant-crisis-overwhelms-european-unity>. ■

Edited by: Shivani Shukla, University of Massachusetts, Amherst

Journal Articles of Interest

Operations Research in the Public Sector

In this issue, we draw attention to recent articles of interest pertaining to Operations Research (OR) in the Public Sector.

The public sector consists of the governmental entities that provide public services to its citizens such as healthcare, education, police, military, public transportation, etc. Nonprofit organizations (NPOs) are similar in nature to that of the public sector as they provide social services that a governmental entity might or might not provide. Their service mission is usually very specific about maximizing a service objective using their available resources.

Public sector and nonprofit organizations have grown significantly over the past fifteen years both in number and size

(Sinuany-Stern & Sherman, 2014). This rise has been mostly due to economic problems and political policies which have led to more services and funds being demanded. Interestingly, the field of OR was born in the public sector (i.e. military), but it really grew up in the private for-profit sector. After all, the main purpose of OR techniques is to improve operations. According to Fox (2013), "Regardless of where we live, the management of the public sector impacts our lives. Hence, we all have an interest, one way or another, in the achievement of efficiency and

productivity improvements in the activities of the public sector." Not surprisingly the applications of OR in the public sector and in NPOs has been trivial in comparison to the number of applications in the private sector over the past 60 years (Sinuany-Stern & Sherman, 2014). With that said, doctoral students seeking to develop a research stream will likely find the public sector to be a ripe area, possibly containing some exciting research opportunities. I hope you will enjoy the articles of interest I selected below, and hope they will inspire you to perform "The Science of Better" for societal good as these outstanding authors are doing today.

Article 1: Operations research in the public sector and nonprofit organizations, by Sinuany-Stern & Sherman, 2014

The first article I highlight is, "Operations research in the public sector and nonprofit organizations" by Dr. Zilla Sinuany-Stern and Dr. H. David Sherman. They provide an interesting high-level article for our readers interested in solving public sector problems using OR techniques. They identify several high quality research papers and case studies where OR techniques are applied to improve operations or achievements. According to Sinuany-Stern and Sherman (2014), there are essentially two public sectors (government owned and NPO/NGOs), as well as a hybrid sector that contains organizations sometimes referred to as "for benefit corporations." Within each public sector group they identify the problem investigated, the organizational context, and OR technique used to solve the problem. They conclude that deterministic optimization techniques have been used most often historically, and Data Envelopment Analysis (DEA) has

been the primary methodology employed.

Article 2: Implementing Integrated Marketing Science Modeling at a Non-Profit Organization: Balancing Multiple Business Objectives at Georgia Aquarium, by Kumar, Sharma, Donthu, & Rountree, 2015

The second article I highlight is, "Implementing integrated marketing science modeling at a non-profit organization: balancing multiple business objectives at Georgia Aquarium." In this article, Professors, V. Kumar, Amalesh Sharma, and Naveen Donthu from Georgia State University in collaboration with Carey Rountree from Georgia Aquarium set out to use OR techniques to solve a major problem. Specifically, this NPO was challenged with handling multiple objectives: (1) increasing revenues while keeping prices fixed; (2) increasing attendance while keeping satisfaction levels high; (3) reallocating media investment within the same budget increases attendance and revenue budget; and (4) attracting customers that can yield long-term value. Using a combination of Data Envelopment Analysis, Competition Analysis, Spatial Analysis, Media Optimization Analysis, and Pass Holder Lifetime Net Revenue Analysis methodologies, they employed a field experiment which realized a 12% increase in revenue and a 10% increase in attendance. According to the authors, "Although this analysis is specific to GA [the Georgia Aquarium], our framework is scalable and can be applied across all consumer industries, including for-profit firms. This study has armed marketing academia and practitioners with a robust methodology to measure firm

efficiency, and to increase attendance and revenues by identifying suitable target markets and media. Our proposed strategies are effective in identifying, acquiring, and nurturing the most valuable members/customers in a measurable, scientific manner instead of relying on a broad-based, mass marketing strategy (Kumar, Sharma, Donthu, & Rountree, 2015)."

Article 3: Going beyond "same-for-all" testing of infectious agents in donated blood, by Bish, Bish, Xie, & Stramer, 2014

The third article I highlight, is "Going beyond 'same-for-all' testing of infectious agents in donated blood" by Professors Doug Bish and Ebru Bish and doctoral student Ryan Xie from Virginia Tech, in collaboration with Dr. Susan Stramer from the American Red Cross. These researchers are working to identify optimal blood screening policies.

In my conversation with Dr. Ebru Bish she explained that blood products (whole blood, red blood cells, plasma, platelets, etc.) are essential in many modern medical procedures, including organ transplants and other major surgeries, and treatments of cancer patients, trauma victims, premature infants, severely anemic children, and pregnant women with complications. Between 40-70% of the United States (US) population will need a blood transfusion at some point in their lives. However, there are small risks from transfusion-transmitted infections (TTIs). For example, HIV, hepatitis viruses, human T-cell lymphotropic virus, syphilis, West Nile virus (WNV), dengue viruses (DENV) and the babesia parasite causing babesiosis can all be transmitted through blood

products. To minimize the risk of an infection, the blood supply in the US (and other advanced nations) is rigorously screened. In the US, the Federal Drug Administration (FDA) provides a list of TTIs for which donated blood must be screened and approves screening tests for TTIs; generally, each TTI can have multiple FDA-licensed tests, each with a different cost and efficacy. Furthermore, new TTIs can emerge in the donor population. Recent examples of TTIs include WNV, the agent of Chagas' disease (for which routine testing in the US is recommended), DENV, and babesia (for which routine testing does not occur). Given that the FDA may not mandate a specific test set, Blood Centers must establish a testing strategy, including test selection from the available alternatives under a limited budget. (Testing cost is a major component of the cost of blood in the US.)

Several characteristics complicate the test selection decision. If transmitted, health consequences of some agents greatly depend on patient level factors. For example, WNV and babesia infections are more likely to exhibit severe consequences in patients with weakened immune systems. Further, prevalence rates in the donor population are not uniform within the US. For example, babesia is endemic only in certain Northeast and Upper Midwest states. Consequently, a customized, non-universal screening scheme that considers the important characteristics of transmission and prevalence can be very effective for reducing the TTI risk (Bish, Bish, Xie, & Stramer, 2014).

Article 4: Creating impact with operations research in health: making room for practice in academia, by Brandeau, 2015

The final article I highlight is "Creating impact with operations research in health: making room for practice in academia" by Professor Margaret Brandeau at Stanford University. Dr. Brandeau states that "junior scholars often avoid working on practical applications in health because promotion and tenure processes tend to value theoretical studies more highly than applied studies (Brandeau, 2015)." As a doctoral student myself, all I can say to that is, "Preach on, sister!" It personally took me a year to find a dissertation topic that was deemed to have sufficient theoretical quality. Fortunately, our readers will likely find her structured blueprint for identifying and taking on applied healthcare research problems a welcome relief for those more equipped for applied contributions over theory. In her framework, she encourages researchers to focus on important problems, collaborate with domain experts, and effectively communicate analytical results to both OR and non-OR audiences. Finally, she states that, "theory and practice need not be mutually exclusive. Although extra effort is involved, work on both theoretical and practical problems can enrich a junior scholar's portfolio of accomplishments."

Conclusions

The number of applications of OR in the public sector and NPOs has been trivial in comparison to the number of applications in the private sector over the past 60 years (Sinuany-Stern & Sherman, 2014). Government and state entities are regularly mocked for their inefficiencies, and it could be said that it is due to the lack of OR or OR awareness in these areas. I hope this article plants a few seeds in the minds of my peers and inspire them to consider pursuing OR in a public sector domain.

References

- Bish, D. R., Bish, E. K., Xie, R. S., & Stramer, S. L. (2014). Going beyond "same-for-all" testing of infectious agents in donated blood. *IIIE Transactions*, 46(11), 1147-1168.
- Brandeau, M. L. (2015). Creating impact with operations research in health: making room for practice in academia. *Health care management science*, 1-8.
- Fox, K. J. (2013). *Efficiency in the public sector* (Vol. 1): Springer Science & Business Media.
- Reprinted by permission, V. Kumar, Sharma, A., Donthu, N., Rountree, C., Practice Prize Paper—Implementing Integrated Marketing Science Modeling at a Non-Profit Organization: Balancing Multiple Business Objectives at Georgia Aquarium, *Marketing Science*, 2015. Copyright 2015, the Institute for Operations Research and the Management Sciences, 5521 Research Park Drive, Suite 200, Catonsville, Maryland 21228 USA.
- Sinuany-Stern, Z., & Sherman, H. D. (2014). Operations research in the public sector and nonprofit organizations. *Annals of Operations Research*, 221(1), 1-8.

Edited by: Matthew A. Lanham, Virginia Tech

Upcoming Conferences

INFORMS Annual Meeting

The [INFORMS Annual Meeting](#) will be held on November 1st-4th at the Philadelphia Marriott Downtown Hotel in Philadelphia, PA, this year. Like last year's conference in San Francisco, this year is expected to draw thousands of participants from academia and industry. There will be over a dozen different "TutORials" from leading researchers in their fields, as well as almost 50 different [exhibitors](#). A searchable program can be found [here](#).

Decision Sciences Institute (DSI) Annual Meeting

The [Decision Sciences Institute \(DSI\) Annual Meeting](#) will be held on November 21st-24th at the Sheraton Seattle Hotel in Seattle, WA, this year. The theme is Decision Sciences in the 21st Century: Theoretical Impact and Practical Relevance. According to Co-Program Chairs, Dr. Shawnee Vickery and Dr. Natasa Christodoulidou, there are new special focus tracks this year that include Healthcare Management and Public Policy, which is perfect for those wanting to network with other researchers focused on Public OR. A searchable program for these tracks and others can be found [here](#).

Winter Simulation Conference (WSC)

The theme of this year's [Winter Simulation Conference](#) (WSC) is Social and Behavioral Simulation. This conference aligns well with our

current issue on Public OR. It will be held on December 6th-9th at the Hyatt Regency Huntington Beach Resort in Huntington Beach, CA. A detailed program can be found [here](#). For you golfers out there, there is a golf tournament being held before the conference that begins on Saturday December 5th. More details on that can be found [here](#).

Workshop on Information Technologies and Systems (WITS)

For our readers with more of an Information Systems research focus, this year will be the 25th [Workshop on Information Technologies and Systems](#). This conference will be held on December 12th-13th at the Naveen Jindal School of Management on the Campus of the University of Texas at Dallas. The theme is Cloud Computing Management, which is certainly important to many organizations. Per the conference website, "The workshop invites research focused on addressing complex business problems or societal issues using current and emerging information technologies. Of particular interest to the WITS community is research that can change the way information technology functions (e.g., by designing, modifying, or constructing systems) so that it can better solve real-world problems." ■

Edited by: Matthew A. Lanham, Virginia Tech

"The above conferences will most likely be attended by researchers currently pursuing Public OR. I encourage you to check out each conference's program to identify talks, tutorials, or workshops that align most closely with your research interests and get your travel arrangements in order. Aside from the benefits of learning something new, getting a new idea, and networking with leaders in the field, it is surely nice to get off campus and enjoy a new city every now and then."

Case Studies in Civic Operations Research

For more information about the Franz Edelman Award, please go to:

<https://www.informs.org/Recognize-Excellence/Franz-Edelman-Award>

INFORMS routinely celebrates advances in operations research, management sciences, and analytics through a variety of competitions and awards. In particular, the Franz Edelman Award for Achievement in Operations Research and Management Sciences is a prestigious award sponsored by INFORMS to recognize major accomplishments in the implementation of applied projects in both the profit and non-profit sectors. These projects are distinguished by their massive scale of impact on an entity's stakeholders; since its inception, INFORMS states that the projects of its Edelman finalist have created more than \$200 billion in benefits. It is awarded each spring at INFORMS Conference on Business Analytics & Operations Research.

This month, we highlight four past finalists and winners of the Franz Edelman Award who have been acknowledged for their excellent work in applying cutting edge OR research to diverse civic problems.

By examining diverse applications – delinquent tax collection, flood protection, energy transmission, and disease prevention – with quantifiable outcomes, the potential for OR to mitigate pressing public sector problems is clear and exciting. These projects also reflect many of the same challenges in public sector OR as in this month's interview with Dr. Karen Smilowitz, including facing data limitations, defining appropriate objectives in social contexts, and aligning stakeholders.

New York State Department of Taxation and Finance

Project: Tax Collections Optimization for New York State (2011)

Thomas Mattox, NYS Department of Tax and Finance

Gerard Miller, NYS Department of Tax and Finance, NYS

Brenda Dietrich, IBM

Shaun Barry, IBM

The New York State Department of Taxation and Finance (NYS DTF) collects over \$1 billion annually in assessed delinquent taxes. A novel solution was developed to address the challenge of optimizing tax collection activities, in the presence of complex dependencies between business needs, resources and legal constraints. The solution is a unique combination of data analytics and optimization based on the unifying framework of constrained Markov

Decision Processes (C-MDP). The developed system optimizes the collection actions of agents with respect to maximization of long term returns, and generates a customized collections policy that is efficient and adaptive. The system became operational in December 2009, and there has already been an \$83M increase in revenue from 2009 to 2010 (8%), using the same set of resources. Given a typical annual increase of 2-4%, the expected benefit of the developed system is approximately \$120M to \$150M over the next three years, far exceeding the initial target of \$99 million.

Video

Link: https://www.pathlms.com/info/rms/events/262/thumbnail_video_presentations/6894

Dutch-Delta Program Commissioner

Project: Economically Efficient Flood Standards to Protect the Netherlands Against Flooding (2013)

Jaap Kwadijk, Deltares

Carel Eijgenraam, CPB Netherlands Bureau for Economic Policy Analysis

Dick den Hertog, Tilburg University

Jarl Kind, Deltares

In the Netherlands flood protection is a matter of national survival. In 2008, the 2nd Delta Committee recommended that legal flood protection standards be increased at least tenfold to compensate for

population and economic growth since 1953, which would have involved dike improvement investments estimated at 11.5 billion euro. Our research group was charged with developing efficient flood protection standards in a more objective way. We used Mixed Integer Nonlinear Programming to demonstrate the efficiency of increasing the legal standards only in three critical regions. Monte Carlo analysis confirmed the robustness of this outcome. Our results were accepted by the State Secretary in 2012 as basis for legislation. Compared to the earlier recommendation, this successful application of Operations Research yields not only a highly significant increase in protection for these regions (where two-thirds of the benefits of proposed improvements are concentrated) but also some 7.8 billion euro in cost savings. Our methods could be used in decision-making for other flood-prone areas worldwide.

Video

Link: https://www.pathlms.com/info/rms/events/260/thumbnail_video_presentation/6877

Midwest Independent Transmission System Operator, Inc. (MISO)

Project: MISO Unlocks Billions in Savings through the Application of O.R. to Energy and Ancillary Services Markets (2011)

John Bear, MISO

Richard Doying, MISO

Mingguo Hong, MISO

The Midwest Independent Transmission System Operator (MISO) is a nonprofit organization formed through the action of several electric transmission owners. The company operates in 13 states in the Midwest region of the United States and one Canadian province of Manitoba.

MISO transformed the electric utility industry leveraging advances in computing capabilities and using O.R. to create and implement complex algorithms and computer models to introduce centralized wholesale energy markets to the Midwest. These new markets increased the efficiency of the existing electric infrastructure (power plants and high-voltage transmission lines), improved the reliability of the grid and reduced the need for future infrastructure investments in the Midwest. As a result of these advances the MISO region realized between \$2.1 billion and \$3.0 billion in cumulative savings from 2007 through 2010, with an additional estimated value of \$6.1 billion to \$8.1 billion through 2020.

Video

Link: https://www.pathlms.com/info/rms/events/262/thumbnail_video_presentation/6889

U.S. Centers for Disease Control and Prevention (CDC) and Kid Risk, Inc.

Project: Polio Eradicators Use Integrated Analytical Models to Make Better Decisions (2014)

Steven Wassilak, US Centers for Disease Control and Prevention

Mark A. Pallansch, US Centers for Disease Control and Prevention

Radboud J. Duintjer Tebbens, Kid Risk, Inc.

Kimberly M. Thompson, Kid Risk, Inc.

Achieving and maintaining global polio eradication requires that multiple global stakeholders coordinate and cooperate to invest human and financial resources in interventions that prevent virus transmission. Reaching the goal depends on effective tools and interventions, and their optimal use. Poliovirus transmission occurs in a complex global system, with rapidly evolving viruses that readily cross

international borders. Complexities associated with managing poliovirus risks come from: (1) the dynamic spread of the three different poliovirus serotypes that must be individually eradicated, (2) the potential detection of only the small fraction of infections that lead to paralysis, and (3) the use of two vaccines with very different risks, costs, and benefits (i.e., oral poliovirus vaccine (OPV) and inactivated poliovirus vaccine (IPV)). The US Centers for Disease Control and Prevention, one of four spearheading partners of the Global Polio Eradication Initiative (GPEI) (along with WHO, UNICEF, and Rotary International), initiated a collaboration with Kid Risk, Inc. to develop and apply integrated analytical models to answer high-stakes policy questions related to managing the risks of polioviruses with full consideration of both human health and economic outcomes. Over the last decade, the collaboration innovatively combined numerous operations research and management science tools, including simulation, decision and risk analysis, system dynamics, game theory, and optimization to help policy makers understand and quantify the implications of their choices. The insights from these integrated modeling efforts prevented cases of paralysis, saved millions of dollars, sharpened the effective use of polio vaccines, led to management and programmatic improvements, and motivated significant national commitments to increase population immunity and global commitments to finance the GPEI to finish the job.

Video

Link: https://www.pathlms.com/info/rms/events/217/thumbnail_video_presentation/5750. ■

Edited by: Emily Reiderer, University of North Carolina

Undergraduate Student Competition

Undergraduate Research defined

"An inquiry or investigation conducted by an undergraduate student that makes an original, intellectual, or creative contribution to the discipline...."

-The Council on Undergraduate Research

The promotion of research among undergraduate students is an important step in the promotion of their transition towards graduate school and subsequently towards research in either industry or academia.

The co-editors of INFORMS OR/MS Tomorrow (your INFORMS Online Newsletter) would like to invite undergraduate students to participate in the OR/MS Tomorrow Undergrad Student Competition. The goal of this event is to engage undergraduate students in the creation of knowledge and to help them achieve academic growth. In this vein, we invite them to submit a research article that talks about and/or addresses a significant problem/idea in their respective fields of research. Essentially, this is a means of providing students with a platform for sharing their research ideas to the INFORMS community via a special forum that provides visibility for their work.

Eligibility and Rules

1. Student must be an undergraduate student when the nominated paper is written.

2. Paper can be projects done for a company as part of a course, internship, or other activity. They may be undergraduate research projects done at the home institution.

3. A faculty member may serve as an advisor on a project, but the work should primarily have been done by the students.

4. A faculty member cannot be the first author of the paper.

5. No more than three students may be presented as co-authors of a single paper.

6. Only one entry is allowed by a particular author, whether as sole-author or as co-author.

7. Each paper must represent an original analysis and must be a part of the author's own work. Previously published papers are not eligible.

8. Optional: Each entry may be accompanied by a cover letter explaining the significance of the presented research.

The best submissions will be featured in one of the upcoming issues of OR/MS Tomorrow. In order

to be eligible to be published in the next issue of OR/MS tomorrow, the submissions are due by the 15th of December. All submissions received beyond that date will be eligible for entry in the Fall 2016 issue of the newsletter.

All submissions (or clarifications regarding the submissions) may be directed to Siddhartha Nambiar at [<snambia@ncsu.edu>](mailto:snambia@ncsu.edu). ■

Edited by: Siddhartha Nambiar, North Carolina State University



**Thank you for your reading.
We hope you enjoy this issue of
OR/MS Tomorrow.**

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