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DECISION LINE

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PRESIDENT'S LETTER

DSI 2.0

Morgan Swink, Texas Christian University

Greetings friends and colleagues! I am honored to serve as your new president, and I want to tell you about all the exciting things that are happening at the DSI. Please take time to peruse the important initiatives that our officers and board of directors are advancing. Many of us, along with many of you, are working hard to improve almost every aspect of the DSI. As we move closer to celebrating 50 years as an Institute (just four years away), we are together envisioning a major "upgrade" for the next generation, while staying true to the DSI's original mission and vision. We want to build on the DSI's core values of inclusiveness and excellence to deliver value in innovative, new ways. Construction of "DSI 2.0" is well underway!

Thanks to the efforts of many, over the past few years DSI 2.0 has begun to take shape. Major changes include:

- A new home office – the new staff, now located at the University of Houston, is providing excellent support of, and responsiveness to, our Institute's activities and needs, with a leaner and more financially efficient structure.
- New information system and website – as we continue to implement all the working elements of the NOAH system, we are seeing huge benefits in areas of information completeness, accuracy, and currency. This new system gives the home office much improved resource with which to support regional and member services and requests. Check out the new website too!
- Restructured board – in 2014 a leaner structure for the board of directors was approved, in which all board members assume actual responsibilities to get things done! As a result, the board is making and implementing decisions much faster, and with renewed energy.
- Enhanced annual conference – hopefully you have noticed the rapidly improving quality of our annual conference.

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SPECIAL REPORTS

DECISION LINE

DECISION LINE is published five times a year by the Decision Sciences Institute to provide a medium of communication and a forum for expression by its members, and to provide for dialogue among academic and practitioner members in the discipline. For more information about the Institute, please call 404-413-7710.

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Website: Decision Line feature articles and more information on the Decision Sciences Institute can be found on the DSI website at www.decisionsciences.org.

Editor: Maling Ebrahimpour, College of Business, University of South Florida St. Petersburg,140 7th Ave. South, St. Petersburg, FL, 33701; 727-873-4786; mebrahimpour@usfsp.edu

President: Morgan Swink, Neeley School of Business, Texas Christian University, Fort Worth, TX 76129; 817-257-7463; m.swink@tcu.edu

Interim Executive Director: Johnny Rungtusanatham, The Ohio State University, Columbus, OH 43210; rungtusanatham.1@osu.edu

DEADLINES:
May 2015 issue ..... April 10th
July 2015 issue ..... June 10th
October 2015 issue ..... September 10th
January 2016 issue ..... December 10th
March 2016 issue ..... February 10th

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The Decision Sciences Institute is dedicated to excellence in fostering and disseminating knowledge pertinent to decision making.

Mission Statement

The Decision Sciences Institute advances the science and practice of decision making. We are an international professional association with an inclusive and cross-disciplinary philosophy. We are guided by the core values of high quality, responsiveness and professional development.

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MALING EBRAHIMPOUR, EDITOR, University of South Florida St. Petersburg

Maling Ebrahimpour *is Professor of Supply Chain at the College of Business at the University of South Florida Saint Petersburg. He is an active researcher and has authored or co-authored over 100 articles that have been published in scientific journals and proceedings. Most of his work focuses on various issues of quality in both service and manufacturing companies. He received his PhD in business administration from the University of Nebraska-Lincoln and has served on the editorial review board of several journals, including* Journal of Quality Management, Journal of Operations Management, *and* International Journal of Production Research.

mebrahimpour@mail.usf.edu

During the last few years a lot of changes happened in our organization. In his first President's Letter, Morgan Swink, describes the continuation of the progress and further strengthening of DSI in several areas. Please read his letter and send him your comments or send them to me and I will be more than happy to share them with him and publish your comments and his response in the future issue.

Co-Program Chairs (Shawnee K. Vickery, and Christodoulidou) for the upcoming Annual DSI Conference in Seattle are working hard to build a program that is promising to be one of the best ever Annual Conference. Attend this conference and witness for yourself how the DSI Conference is changing in order to meet the ever-changing demand of our membership. You will be nicely surprised to see how all aspects of the conference have been enhanced.

The Staff at the DSI Home Office are now settled in the new place and conducting business on behalf of and for DSI Members. In addition, in this issue, you will read the about the award winning scholarly work of our members that were presented at the DSI 2014 Annual Conference. Award winning authors provide a glimpse of their work. You can read a brief version of Best Dissertation Award, the Best Teaching Case Study, and the Best Analytical Research Paper. If you are interested to learn more about each piece, simply contact the authors.

If you are a junior faculty, please ask a colleague or your doctoral mentor to nominate you for the prestigious Carol J. Latta Memorial DSI Emerging Leadership Award for Outstanding Early Career Scholar. If you are a mentor or know of young and upcoming scholars, please nominate them for this award. The section on Carol J. Latta Memorial DSI Emerging Leadership Award for Outstanding Early Career Scholar describes the process and dateline for applications and nominations to be sent to the DSI Home Office.

The Research Issue Features an article by Amouzegar and Moshirvaziri where they write about "A Primer on Nonconvex Optimization and Its Application." In this article, they present a more complicated situation for making better decision under a more complex environment.

Under the "ECOMMERCE" section, Condren discusses use of a Smartphone App for emergency environment. The question is should older technology be abandoned because of the new apps. Read this interesting article and be the judge.

I encourage you, our reader, to share your opinions, ideas with us by writing and sending it to me at mebrahimpour@mail.usf.edu, or you may send it to the feature editors as shown in this section.

I am looking forward to reading your articles for inclusion in Decision Line.

Maling Ebrahimpour, PhD

Editor ■

CAROL J. LATTA MEMORIAL DSI EMERGING LEADERSHIP AWARD FOR OUTSTANDING EARLY CAREER SCHOLAR

The **Carol J. Latta Memorial DSI Emerging Leadership Award for Outstanding Early Career Scholarship** will be awarded annually at the DSI Annual Meeting to an early career scholar in the Decision Sciences field who has served the Institute and its goals. The recipient will receive a plaque and a token financial award, which is funded by DSI and the Carol J. Latta Memorial Fund.

To be eligible for consideration, the applicant must be nominated by a faculty member or academic administrator. Nominators must submit a nomination letter describing the basis for the recommendation along with the candidate's curriculum vita. Recommendations may be sent electronically to info@decisionsciences.org with Carol Latta Memorial Award in the subject line. Paper nominations may be sent to: Carol Latta Memorial Award, Decision Sciences Institute, ATTN: Ms. Dana Evans, C.T. Bauer College of Business, 334 Melcher Hall, Suite 325, Houston, Texas 77204-6021. All nominations must be received by October 19, 2015.

Award Criteria

This award shall go to an emerging scholar in the decision sciences disciplines who has earned his or her terminal degree (e.g. PhD, DBA, etc.) in the previous five (5) years. Evidence of excellence in research, teaching, and/or service to DSI may be provided as an appendix to the recommendation letter (limited to five pages, Please do not include full journal articles.). Such evidence may include documentation regarding Institute-related professional service (DSI committees, reviewing, session chair, track chair, etc.), teaching performance (teaching award, new course development, etc.), and scholarly research (publications in Decision Sciences, Decision Sciences Journal of Innovative Education, and other highly-regarded journals in the decision sciences field and presentations at DSI meetings). The awardee must be a member of the Institute in good standing.

Please share this email with your junior faculty members and consider their recommendation. ■

From PRESIDENT'S LETTER, page 1

Program chairs have been experimenting with new programs, better food(!), new events, and new venues. The 2014 conference in Tampa was a great success, and 2015 in Seattle promises to be even better!

- A new journal – last year the board and Wiley-Blackwell agreed to launch a new journal, DS: Supply Chain Management. The publications committee is busy searching for an inaugural editor. We see this as a first step toward launching other similarly focused journals in areas of analytics, information systems, and possibly others.
- New colleges – the board has approved the creation of three new colleges in analytics, information systems, and supply chain management. An ad hoc committee led by Marc Schniederjans will work toward establishing policies for the structure and governance of these colleges, which we hope will be the first of many such affinity groups.

An important goal this year is to bring many of these efforts to completion. As we move forward, I have asked the board and home office to also support the following initiatives:

- Launch an outreach campaign – our marketing and member services committees are working together to reach out to past and prospective members of the DSI.
- Clarify and improve Region-Institute support –global and US-based regions of DSI are critically important resources for outreach, growth, and service. I am asking representatives from the regions and the global DSI to work together to renew and establish ways that they can support the respective missions of all organizations.
- Update and improve processes and documents – Janelle Heineke is leading an effort to make our operating processes better, establish standards, and to make sure that our Constitution, Bylaws, and Policies & Procedures documents are accurate and up to date.

As you can see, the conversion to DSI 2.0 is a major undertaking. Please get involved – we need your help! Consider serving on a committee or in a leadership position. Help out with the review and editorial responsibilities of one of our journals. Fill a role in delivering one of this year's regional or global conferences. Don't wait to be asked; you will be welcomed as a volunteer.

DSI 2.0 is on the move! I hope and trust that that the Institute is moving in productive and value-adding directions. Please join the effort, and let me or other the DSI leaders know of your concerns, suggestions, ideas, and needs. See you in Seattle!

Best wishes all,

Morgan Swink
President, Decision Sciences Institute ■

A Primer on Nonconvex Optimization and Its Applications

by Mahyar A. Amouzegar, Cal Poly Pomona; and Khosrow Moshirvaziri, California State University, Long Beach

Mahyar Amouzegar *is the dean of engineering at Cal Poly Pomona, and a senior analyst at the RAND Corporation. He is the founding editor of the Journal of Applied Mathematics and Decision Sciences and is on the editorial boards of Advances in Operations Research, International Journal of Strategic Decision Sciences and International Journal of Decision Sciences. He is a fellow at IMA (UK) and ICA (Canada), a Senior Membe of IEEE and a member of Tau Beta Pi, engineering honor society.*

Khosrow Moshirvaziri *received M.S. and D. Engr. degrees from Stanford University and a PhD from the University of California, Los Angeles. He served as a Staff Scientist with IBM Scientific Centers and at IBM Research and Development divisions. He is currently a Professor of information systems at California State University, Long Beach. He has over 25 years of experience in developing optimization algorithms and software, and delivering course work on system optimization, system simulation, and transportation networks. He is an Editor for Advances in Operations Research, Journal of Industrial Systems Engineering, and Advances in Decision Sciences. His area of research is in the interface of computer science and operations research.*

Introduction

Mathematical Programming (Optimization) is relatively a young field, arguably truly coming to the world stage during the Second World War. Yet, its impact has been felt throughout many disciplines from agriculture to economics, to engineering, to production and transportation, to name just a few areas.

Optimization is essentially defined by three components:

1. A set of *decision variables* (generally hundreds of thousands, if not millions);
2. A set of *constraint functions* that are either convex (relatively easy) or nonconvex (definitely complicated) and the set may include bounds on the variables; and
3. A linear or *nonlinear objective function* (and sometimes more than one).

Then, the usual procedure is to optimize (i.e., minimize or maximize) the objective function subject to meeting the constraints requirements. The solution is called *feasible* if it satisfies all the constraints. It is called optimal (or global optimal) if it is feasible and no other feasible solution has a better objective value.

Roughly speaking, the discipline is divided into three general categories: liner-, nonlinear- and integer programming. When all three components are linear then it's called a Linear Programming but when at least one component is nonlinear then it is called Nonlinear Programming. In the third category, Integer Programming, all or some of the decision variables are integral and some or all of the constraints and objective function may be linear or nonlinear. Thus, a mathematical programming model may be formed by any combination of these categories. For example, let's consider the following simple classroom problem:

> *Acme Corporation produces two products, using the same raw material: Acme Extra and Acme Bold. The profit for production is $10 per one item of Acme Extra and $20 per each item of Acme Bold. However, there are only 10,000 units of raw material available for processing. Moreover, Acme Corporation has a standing contract, where it must produce at least 1,000 Acme Extra and 2,000 Acme Bold. Both products are shipped in trucks and the delivery capacity of the truck fleet is 180,000 item-miles. Acme Extra is delivered to a wholesaler 10 miles away and Acme Bold is delivered to a distributor 30 miles away. How much of each product should be produced in order to maximize profit, given that it takes one unit of raw martial to make either Acme Extra or Acme Bold.*

We can model the above problem as a linear program. Let x denote the quantity of Acme Extra and let y denote the quantity of Acme Bold. Therefore, the problem is to maximize $10x+20y$, while adhering to the contractual agreement and resources constraints.

$$\begin{aligned} &Max\ 10x+20y \\ &s.t. \quad x + y \le 10{,}000 \\ &\qquad 10x + 30y \le 180{,}000 \\ &\qquad x \ge 1{,}000,\ y \ge 2{,}000 \end{aligned}$$

with an optimal solution of $x = 6{,}000$ and $y = 4{,}000$ with a profit of $140,000.

Later, the trucking company informs the management that they have miscalculated the distance to the distributor, and in reality it is 31 miles (and not 30 miles) away. This simple minute change in the data will yield a very different optimal solution of $x = 6{,}190.48$ and $y = 3{,}809.52$ and a profit of $138,095.24 (less than $2,000 loss in profit sounds small but consider a scenario with hundred times the current order quantity). Moreover, it is not possible to manufacture part of an item, so we must model the problem as an integer programming problem.

$$\begin{aligned} &Max\ 10x+20y \\ &s.t.\ \ x + y \le 10{,}000 \\ &\qquad 10x +31y \le 180{,}000" \\ &\qquad x \ge 1{,}000,\ y \ge 2{,}000 \\ &\qquad \boldsymbol{x \ \&\ y\ integer} \end{aligned}$$

with an optimal solution of $x = 6{,}191$ and $y = 3{,}809$ with a profit of $138,090.

Production, transportation, or in general any type of complex process in the real world is rarely linear. That is, there is rarely a one-to-one relationship between input of a process and the output of the process. In our example scenario, you can imagine that in reality one unit of the raw material may not produce one unit of the final product and the company may be able to take advantage of economies-of-scale through better contract with the trucking company.

Let's consider an additional production line constraint, where the capacity of certain process decreases nonlinearly as the production level increases. Perhaps, the capacity is limited by the following additional constraint: $x^2 + y^2 \le 15{,}000{,}000$. This constraint states that the sum of the square of each product must not exceed a certain quantity. This additional requirement changes the problem from a purely linear (or integer) to a linear program with a convex constraint (e.g., a nonlinear problem). The solution to this nonlinear program is, $x = 1{,}734$ and $y = 3{,}463$ with a profit of $86,600.

Thus far, even with the increase in the complexity (i.e., addition of a nonlinear constraint), the usual solution techniques would guarantee an optimal solution because the problem belongs to a class of so-called *Convex Optimization*. The real difficulty arises when the nonlinear problem is *Nonconvex*. That is, the typical solution techniques offered by traditional solvers (e.g., Excel Solver or even a more serious solver such as CPLEX) cannot guarantee "true" optimality, or in the lexicon of mathematical programming, the solution, if it is found, can, and most often does, get "stuck" at *local optima*, and thereby missing the real solution to the problem.

The Source of Difficulty

An inherent difficulty of nonconvex optimization is this latter characteristic, namely that the problem could potentially possess large number of local optima with objective values far from the global (best) solution. Moreover, the feasible region, the set of feasible solutions set, may be nonconvex and disjoint or disconnected, as opposed to being connected (e.g., a regular polytope) and convex in the case of convex programming. This understanding and insight in nonconvex optimization is crucial for relying on the quality of any solution found by a solver. Majority of commercial solvers are calculus-based and connectivity of a feasible region is the key to their success of finding an optimal solution. Hence, there is no guarantee of success if an initial feasible solution is in a region far from the area containing the global solution. In another words, most solvers will fail to produce an optimal solution, no matter how long one lets the solver run.

Let's revisit our illustrative example where, even here, with a small change to the problem we may face with a nonconvex optimization problem. Consider, if the objective is nonlinear with certain characteristics, say the objective is something like $10x^2 + 20y^2$, then the problem become nonconvex (of course, if the objective is $-10x^2 - 20y^2$ then the problem would be convex, so a simple negative sign can make the problem easy or hard) or if the added nonlinear constraint from above changes the direction of its inequality. Let's look at the simple integer program but with the nonlinear constraint reversed.

$$\begin{aligned} &Max\ 10x + 20y \\ &s.t. \quad x + y \le 10{,}000 \\ &\qquad 10x +31y \le 180{,}000 \\ &\qquad \boldsymbol{x^2 + y^2 \ge 15{,}000{,}000} \\ &\qquad x \ge 1{,}000,\ y \ge 2{,}000 \\ &\qquad x \ \&\ y\ integer \end{aligned}$$

The change in the direction of this nonlinear constraint, states that the sum of the square of each product must be larger than a certain quantity. One would expect that the reversal of the inequality would, in fact, make this constraint moot (redundant) since the objective is to increase x and y as much as possible and the new constraint in essence is saying *make it as big as you like*. And yet, because of this so-called *reverse convex constraint*, we have changed the entire problem to one of *Reverse Convex Optimization*. The solution given by typical solvers, barring luck, is likely to get trapped at local optima. The example above, is a simple two-dimensional problem and one expects the Excel Solver to find the global solution (one certainly can find it by just drawing its geometry) but running the solver gives a very wrong solution of $x = 8{,}0000$ and $y = 2{,}000$ with a profit of $120,000, even though the original $x = 6{,}191$ and $y = 3{,}809$ with a profit of $138,090 is the real and correct answer.

Although, the above problem is trivial and with a bit of guidance we can get even the Excel Solver to look for the correct solution, finding global solution for this class of problem is quite difficult and requires sophisticated solution techniques. Despite the difficulties of solving this class of problems, it has become an exciting and active field of research because of important real world problems that need to be modeled as nonconvex optimization. Examples can be found in developing a national water management policy in the Netherlands, in designing an effective needle exchange program to combat the spread of HIV/AIDS,

in developing public policy to manage hazardous waste amongst many other applications (for more information on reverse convex programming and its application see Moshirvaziri and Amouzegar, 2001 and 2011 and the references therein).

Example Scenario

Consider a scenario where a number of industries, each producing various products (i.e., goods) and further as part of their process they also generate waste that could have potential health hazards, say adding to air or water pollutant (i.e., "bads"). Each of these industries produces its goods and bads using a number of inputs (e.g., capital, labor, and fuel). Industries are free to choose their location, output of goods and even bads, subject to the demand for their product and of course, governmental regulation of output of bads. The regulatory agent seeks a regulation, which maximizes the value of economics surplus, less the pollution damage (i.e., benefit to the society). Industries respond only to regulation and with no concern for the pollution damage (for sake of argument, let's omit the environmentally conscious industries for now). The question is how do various pollution regulations perform in this dichotomous environment involving government and industry.

From the industry point of view, the cost of production is a function of output of goods (g), output of bads (b) and factor price (p). The production costs, denoted by function "C", can be expressed as $C(g,b,p)$. If we let $D^{-1}(g)$ be the inverse demand function (i.e., revenue) then in absence of any regulation the benefit function, "B" is just an integral of all inverse demand functions from zero up to consumption levels less production costs, summed over all the individual industry (say there is J of them):

$$B(g,b) = \sum^{J} \left[\int_0^g D^{-1}(x)dx - C(g\ ,b\ ,p\ ) \right]$$

The role of the regulatory agent is to choose a regulation so that when an industry responds to that regulation, "social welfare" is maximized. For illustration, we can assume that welfare is defined as benefit less the pollution damage cost. Let $\psi(b)$ denote the pollution concentration. The pollution cost is a function converting this concentration into a monetary unit and let's define it as $\delta(\psi)$. Consequently, welfare can be defined as

$$W = B(g,b) - \delta(\psi)$$

If the regulator controlled all the outputs and factors of production, then efficient levels of pollution result from maximizing W over g and b. In a more realistic scenario however, the regulator does not have control over production decisions and it may have to consider the objective of the industries as well. In fact, the regulator may have to select a suboptimal regulation (r) in the set of all possible regulation in order to get a "proper" response from the industries. For example, an overly burdensome tax may force the industry to relocate rather than reduce pollution $\mathcal{R}$ and a lax regulation may not achieve the societal need. Mathematically, we can denote the model as a so-called *Bilevel Programming* model:

$$\begin{aligned} &Max\ \ W(r) \\ &s.t.\ \ r \in \mathcal{R} \\ &\qquad Max\ B(g,b,p) \\ &\qquad s.t.\ \ g \ \&\ b \text{ satisfy } r \end{aligned}$$

The above mathematical programming is called bilevel, since there are two levels of optimization. The first level, the regulator, is called the *leader* and it has control over certain decisions (e.g., taxes) that will influence the second level's decision making. The second level, the collection of firms, is called the *follower* and it will react (e.g., setting production level) after observing the leader's decision r. An optimal solution is reached when the leader's decision has induced a desired reaction from the follower (e.g., an optimal level of taxation). Although the process may appear sequential, in reality the problem must be solved all at once. Mathematically, we have an optimization problem that has another optimization problem imbedded in its constraint set. Bilevel programming has become an excellent tool in modeling many types of hierarchical relations extending well beyond environmental economics (Amouzegar and Moshirvaziri, 1997 and Amouzegar, 1999). It has also been shown that bilevel programming models can be converted to reverse convex optimization and under certain conditions can enjoy the solution technique used in that class of nonconvex optimization.

Basic Distinction

It is important to realize the distinction between the bilevel programming problem and the common decomposition of large planning problems into multilevel problems. These methods are all concerned with breaking down a single large optimization into a number of smaller, more tractable units called "local optimization problems". A unique objective function is used to express the overall system goals, the so-called master or global objective function. Separate solutions are obtained for each lower-levels and then combined into a master program to yield a complete solution. The basic distinction of this approach from bilevel programming is the assumption that a single objective function can be devised to accurately represent the upper-level as well as the lower-level goals. Even if this objective function can be decomposed, it is highly unlikely that a satisfactory weighing scheme can be developed to make it agreeable to all subdivisions.

Conclusion Remarks

In this article, we have strived to provide a basic primer on the different classes of decision models and have provided an exploration of their fundamental characteristics and distinctions. We have also provided an illustrative numerical example, walking the reader through each steps as we explained the added difficulties along the way so the reader could appreciate the real complexity of the problem.

Nonconvexity arises in many aspects

See RESEARCH ISSUE, page 17

BY KEN KENDALL, FEATURE EDITOR

Helping Emergency Responders with a Smartphone App: Benefits and Limitations of an Emergency Response System

by William Condren

Introduction by Ken Kendall

Smartphones make life easier, but they also help in critical situations. This month's column, written by William Condren, shows how smartphones are valuable in responding to emergency situations by fire and safety personnel in one town in New Jersey. He bases this on his own experiences as a volunteer firefighter and his interest in emerging information technologies. As you read through the article, you will obviously see the advantages of using the smartphone application called Active911. Given this new technology, are we ready to abandon our old technology such as pagers, or is this just one more technology that supplements what we already have? Read the full article to find out.

The Medford Township Division of Fire is a combination career and volunteer fire department serving the 23,000 residents of Medford Township, NJ and surrounding communities with 24/7, 365 days a year fire protection, rescue, emergency medical services, and emergency response. The Township of Medford is located in Burlington County in Southern New Jersey. The Medford Township Division of Fire oversees the career fire division, consisting of five career firefighters; two volunteer fire companies, as well as an Emergency Medical Services squad. The Fire Division responds to approximately 1,000 to 1,200 calls a year, while EMS responds to anywhere from 2,000 to 2,500 calls a year. This report will focus on the Fire Division, as Active911 is mostly utilized by firefighters within the Medford Fire Division.

Motivation for Introducing the New Technology

Active911 is primarily a smartphone application that allows fire and EMS responders to receive Computer-Aided Dispatch data from the agency's respective dispatch center. It provides turn-by-turn directions to an incident and information on the response area. It also gives the ability to provide an indication of units responding, as well as

William Condren *is a 2014 graduate of Rutgers University—Camden with a BS in Business Management and a minor in Accounting. He is currently employed in accounting, and is pursuing career development in a business discipline. He is a volunteer firefighter for the Medford Township Division of Fire, as well as a private pilot.*

an indication of members responding to their respective stations to respond to the incident. Active911 is also capable of sending automated calls to phones notifying the user of an incident, as well as SMS messages to "dumb phones." Those users are still able to indicate their response/unavailability to others by pressing a number on the phone.

Active911 is responder software that provides users with Computer-Aided Dispatch information, indication of responding/unavailable responders and apparatus, turn-by-turn directions to an incident, as well as information of the area of the response. It is primarily utilized as a smartphone application. The motivation for the introduction of Active911 by the Medford Township Division of Fire is the situational awareness that the software provides. Situational awareness for firefighters is improved by the following features of Active911:

- Real time turn-by-turn directions to an incident
- Indication of which firefighters/apparatus are responding for a call
- Real-time locations of responding apparatus
- Locations of fire hydrants throughout Burlington County, NJ
- Available PDF documents on:
    - Establishing helicopter Landing Zones at all sites within Medford Township
    - Response guidelines for all fire grids within Medford Township
    - Detailed information to the responder on the nature of the call

The software is also highly cost-effective. For only $12 per user per year, users have access to the above information. The information provides responders with greater information on areas within Medford Township and within surrounding communities. For example, units responding to a structure fire can quickly and easily identify the closest fire hydrant to the incident. In the event of a significant motor vehicle accident where the patient needs to be medically evacuated via helicopter, the locations of nearby Landing Zones are readily available within the smartphone app, as well as the procedures to establish them.

How the Emergency Response Technology

The sequence of events for an alert to be issued starts when a caller contacts a 911 dispatch center to report an emergency. In the case of this organization, the dispatch center is Burlington County Central Communications (Central) located in Westampton, NJ. When a 911 call is placed, a call taker answers and gathers information that is necessary in order for emergency services to be dispatched. This information includes the location of the emergency, the type of emergency (police, fire, or EMS incident), the name of the caller, and any other pertinent information. Information is entered into Central's Computer-Aided Dispatch (CAD) system. Information is then forwarded to the respective dispatch "desk."

In this case, the CAD information is forwarded to a dispatcher at the fire desk, who then dispatches the necessary stations (such as Station 251) or, for certain types of calls, specific apparatus (such as Engine 251 or Quint 251). In Burlington County, as well with most fire departments and EMS agencies across the nation, firefighters and EMTs are dispatched through voice pagers. An example of a dispatch is, "Station 258, Station 251, Route 70 and Main Street, a motor vehicle accident."

When the dispatch is generated in the CAD system, the system can be configured to automatically generate and send an email. The Medford Township Division of Fire utilizes this ability in two ways: 1) dispatch emails are sent to a Medford Fire Division email, which then automatically sends an SMS alert to users' phones; and 2) an email is generated and sent to an Active911 email specifically for the Medford Township Division of Fire's account, which will then cause an Active911 alert to be generated to all users.

When the email is generated, codes are reformatted by Active911's system into plain language, and an alert is then "pushed" to all smartphones of users signed up within the Medford Fire Division. The alert can be in many forms: a push alert for smartphones, an SMS text message, an email sent to a user's email, or an automated voice message over telephone. Primarily, Active911 is utilized via its smartphone application and push alerts. The alert is usually received within 60 seconds after the call is dispatched by pagers.

For a sample of how the process looks,

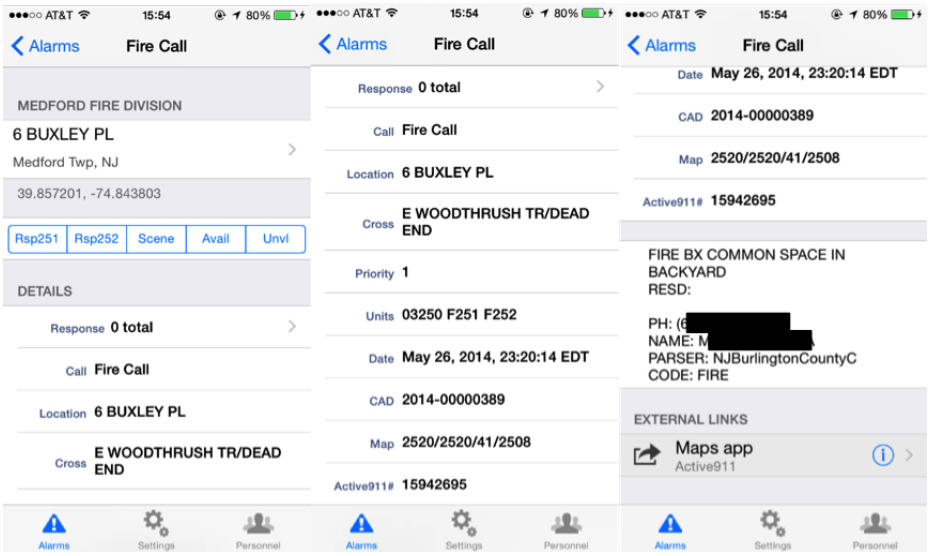

Figure 1. Details of an Active911 Incident Report. These smartphone screens that show relevant information about the incident and responder with links to maps.

a dwelling (house) fire on May 26th, 2014 will be used. This was an "all-hands" fire that was dispatched at 11:20 PM. An alert noise will sound and the phone will vibrate, and the "lock screen" notification will appear as follows (the automated SMS notification also utilized by the Medford Township Division of Fire is seen above the Active911 notification). Upon opening the notification, responders see screen such as shown in Figure 1.

The address, any cross streets, members responding ("0 total" is shown in this example, as the app clears the call after several hours), units/stations dispatched, date and time, the county dispatch number, grid (such as Station 251's or Station 252's jurisdiction), description of emergency, and the caller's information (redacted) are displayed. This information is located under the "Alarms" menu, and automatically displays when the app is opened up after an alert has been received. Note: since this is a "task force" call, both Medford fire stations, as well as Medford EMS, Medford Lakes, and, due to the location's proximity to the township line, Evesham Fire are dispatched. Responders from those stations, if equipped with Active911, will receive the alert, although they may or may not be displayed on the "Units" line. Sometimes mutual aid departments are displayed under "Units," sometimes they are not; it all depends on the way the response grid is set up by each department.

By pressing the rectangle with the incident's address that appears under "Medford Fire Division" at the top, the incident's location, members also viewing and/or responding to the incident in their apps, as well as turn-by-turn Google Maps- or Apple Maps-based (user preference) directions from the user's present location to the incident. Upon "zooming in" on the incident once in map view, users can see icons for response grids, helicopter landing zone procedures, fire hydrants (including hydrant type, as well as a warning if it is out of service, are displayed). Simplified map views, plain satellite map views, as well as satellite map views with street names overlaid are available. The present location of responding members as well as responding apparatus (if the apparatus is equipped with an iPad or similar) is visible in the map view as shown in Figure 2.

Orange icons are responders who have opened the app and are viewing the incident; a "Respond251," "Respond252," or "Respond258" will appear under the users

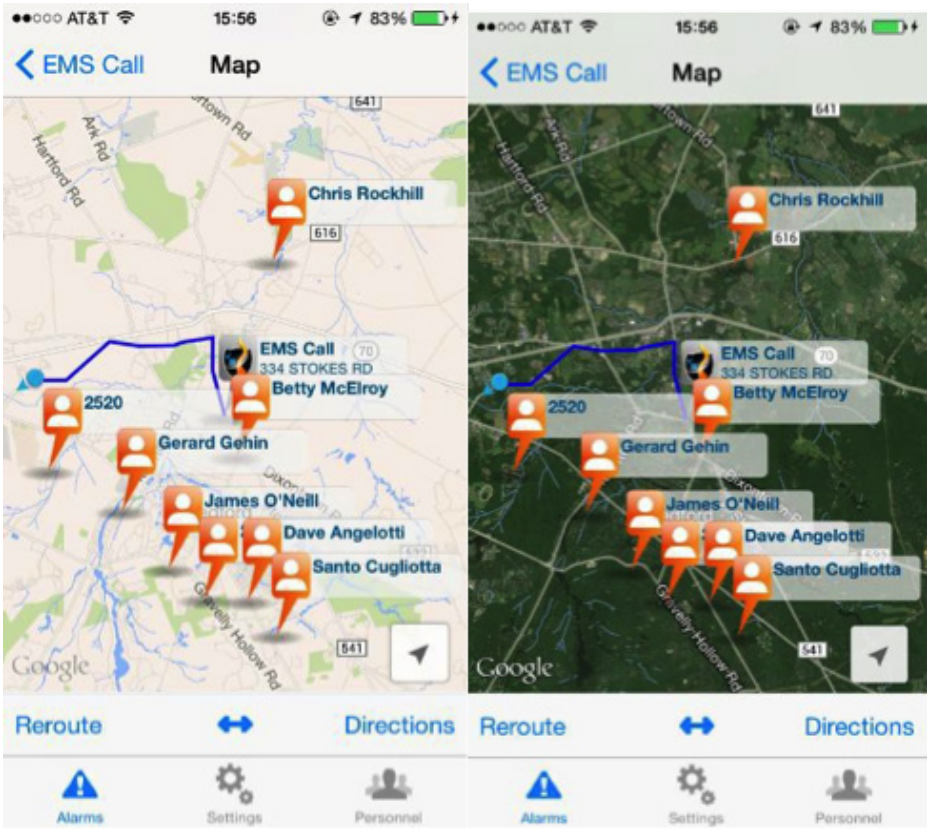

Figure 2. Two smartphone screens showing responders' locations on simplified and realistic maps.

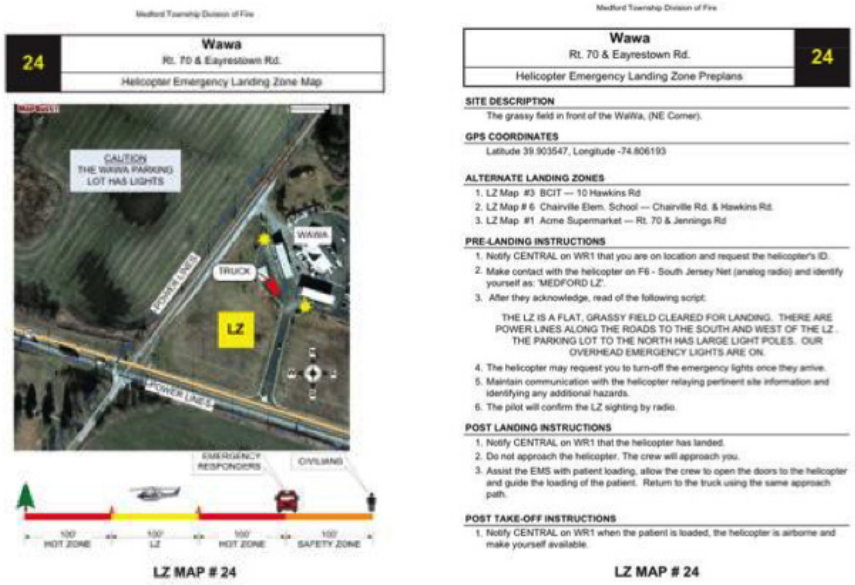

Figure 3. A detailed view of a helicopter landing zone (left) and detailed instructions for a landing zone procedure (right).

name if he/she is responding. Directions to the incident begin at the user's blue icon and are routed to the incident. Pressing "Directions" in the bottom right will display text-based directions. Pressing <-> will change the map type displayed, and pressing "Reroute" will update directions to the incident if, for example, the responder is now on the apparatus instead of wherever the responder was when the call was initially dispatched (directions begin from wherever the incident was initially opened, not the user's present location; the directions need to be "rerouted" for response from the user's present location). Figure 3 shows a helicopter Landing Zone, or LZ, along with a document that displays the relevant procedures for rescue helicopters on this site.

Major Benefits Gained

Emphasis is placed on greater situational awareness being the highest benefit gained by the implementation of Active911. Active911 is not a necessity; however, it is an outstanding "nice-to-have" application for responders. The greater the situational awareness a responder has, the more effective the response, and Active911 focuses on the actual response to the incident. The following features have improved situational awareness by including turn-by-turn GPS based directions to the incident using Google Maps or Apple Maps; notification to all members indicating which firefighters and/or apparatus are responding to an incident. This notification also includes the current location of those firefighters who are responding to the station, and of responding apparatus on the roads.

In addition, situational awareness is improved by supplementing typical terse Computer-Aided Dispatch information sent over pagers such as "A motor vehicle accident, a dwelling, an alarm system" to provide an expanded description of the incident, for example, "2 VEH MVA W/ INJURIES" instead of only "a motor vehicle accident" over the pager, or "CALLER REPORTS FIRE IN BASEMENT OF DWELLING" instead of merely "a dwelling" (house fire) over the pager. While this information is provided by dispatch once the apparatus signs on to Central Dispatch over the radio as responding, this is still highly beneficial information to know as personnel are responding to the fire station prior to the response of an apparatus.

Active911 is also useful in improving situational awareness by offering quick, accurate and up-to-date access to the locations of nearby fire hydrants, Response Guidelines in PDF format, and Helicopter Landing Zone Guidelines.

Lessons Learned about the Technology

Active911 has proven to be a beneficial tool to have as an emergency responder. To reiterate, greater situational awareness, especially during a response to a fire, is highly beneficial. There are several lessons learned during Medford Fire's use that would apply to other departments that are considering implementation. One is that having the knowledge of nearby hydrants, as well as turn-by-turn directions to an incident, are highly beneficial to apparatus operators, as well as officers in command of an incident. Plain and simple, it saves time. Google and Apple Maps also stay up-to-date, while the map books the division was previously relying on are rapidly becoming outdated. It is also much faster to simply open the app and have directions to the incident, rather than having to enter the address on a separate Google or Apple Maps app.

Are Other Technologies Obsolete?

Another lesson learned is that, although Active911 is nice to have, pagers still need to be the primary source of dispatches for a number of reasons. The main reason is that pagers are simply more reliable than mobile phones, and also receive signals in places that mobile phones lose service. Pagers are relying upon radio waves that are much stronger and much more reliable than a mobile phone using cellular data. Cell service drops in and out and the application may not receive the alert if there is a less-than-ideal connection.

Another reason not to be completely reliant on Active911 is that if a call is "upgraded," a new alert will not be received on responders' phones. For example, if Station 251 and Station 258 are initially dispatched to a simple motor vehicle accident the pagers will activate and Active911 will receive an alert. However, if, for example, police arrive at the MVA soon after and report that occupants are trapped in the vehicle and require extrication (a task force call, which would then typically have Station 252, Medford Lakes Fire Department, and Virtua Paramedics dispatched), the pager will activate and the call will then be re-dispatched as a "Motor Vehicle Accident—Rescue Assignment." Active911 will not typically send an additional, upgraded alert for that Rescue Assignment.

One more issue that agencies need to be aware of is the occasional "glitch" with the mapping/directions feature. While it seldom happens, the app can sometimes place the incident at the wrong location. This rarely an issue, as apparatus drivers and officers "know the town" and will typically catch it if the app routes to the wrong location. Mapping failure is not a significant issue, as map books are still carried on apparatus for officers to direct the driver, and the address can always be entered into a different mapping application.

Conclusions

Active911 is a great supplement to assist a fire department or EMS agency in responding to a multitude of incidents. The greatest benefit is assisting officers and drivers in getting to an incident, as well as improving situational awareness of the area where there are ongoing operations. Having the locations of fire hydrants, directions, and response and Landing Zone procedures in the palm of your hand is an outstanding asset. While Active911 cannot be a primary means of notifying responders of an emergency dispatch, it's a great supplement, as well as a great backup.

The responding/unavailable feature is

See ECOMMERCE, page 15

DECISION SCIENCES
JOURNAL OF INNOVATIVE EDUCATION

CALL FOR PAPERS - Special issue on 'Identifying and Managing Critical Success Factors of Online Education'

Guest Editors: Sean Eom, College of Business, Southeast Missouri State University; and Nicholas J. Ashill, College of Business, American University of Sharjah, United Arab Emirates; and J. B. (Ben) Arbaugh, University of Wisconsin Oshkosh

Motivation and Background

We are entering a golden age of e-learning. E-learning could be at a 'Tipping Point' as American's trust in the quality of e-learning grows, and the number of students who take at least one online course continues to increase. Now is the time to make e-learning more successful. The success of an e-learning system can be measured in terms of learning outcomes and learner satisfaction, two dependent constructs that have been widely accepted in the e-learning literature. Learning outcomes are measured by progress on relevant objectives set by the instructor including progress on gaining factual knowledge, learning fundamental principles, and learning to apply what is learned to improve problem solving. Learner satisfaction is measured by the degree of satisfaction with perceived outcomes of taking online courses, courses, and instructors.

This special issue is dedicated to identifying and effectively managing critical success factors for e-learning that enable e-learning outcomes to equal if not surpass those of face-to-face instruction. Moreover, it seeks to draw on experience with e-learning systems to provide direction for future developments in this domain. Conceptual frameworks, qualitative research, and empirical studies in the following areas are encouraged

- Review, critical analysis, and/or meta-analysis of past research to evaluate the current state of e-learning and to guide future directions for e-learning development
- Conceptual frameworks for e-learning
- Dimensions of e-learning systems
  - Human dimension
    - Students: Self-Motivation, Personality, Learning Styles
    - Instructors as Facilitators, Motivators, Moderators
  - Design dimension
    - Learning models (Objectivism, Constructivism, Collaborativism, Cognitive information processing, Socioculturalism)
    - Course content, structure, and infrastructure
  - Learning Management systems and Information technology
    - Technology platforms and tools
    - Security considerations
    - Collaborative meetings and discussion tools
    - Student-created instructional materials
  - Learner control and self-regulated e-learning
    - Problem based learning
    - Self-directed learning
- Impact of interactions on e-learning outcomes
  - Instructor-student
  - Student-student
  - Student-content/learning management system
- Learning outcomes and learner satisfaction
  - Development and validation of measurement instruments

Review Process and Deadlines

Manuscripts for the special issue should be submitted after the authors have carefully reviewed DSJIE's submission guidelines at http://dsjie.org/JournalMission/tabid/84/Default.aspx. Authors submitting a manuscript should indicate that it is for the special issue on 'Identifying and Managing Critical Success Factors of Online Education'.

Deadlines for the special issue are as follows:

June 15, 2015: Submission deadline for initial submission

September 1, 2015: First-round decisions on all submitted manuscripts

November 1, 2015: Submission deadline for invited revisions

December 15, 2015: Final decisions

For more information, please contact the editor (dsjie.editor@gmail.com). ■

Elwood S. Buffa Doctoral Dissertation Award

Fleet Management in the Humanitarian Sector

by Mahyar Eftekhar, W. P. Carey School of Business, Arizona State University

Thesis Abstract:

Fleet management is a major concern for international humanitarian organizations because of (1) the magnitude of transportation-related costs in humanitarian operations, second only to personnel cost and, (2) the pivotal role that transportation plays in the order-fulfillment process. Humanitarian organizations face unusual operating constraints, which include working in areas with poor infrastructure, extreme environmental conditions as well as budget limitations. Most of the existing models derived from commercial supply chains are inapplicable in such a context. Therefore, a new set of tools and theories is required. This dissertation contributes to the development of such a new set of tools. It is composed of two parts that address two related questions in humanitarian fleet management: (1) how to determine the optimal fleet size and the optimal procurement strategy at an aggregate level and, (2) how to optimally manage an existing fleet the field level. Lack of data is the main challenge that prevents humanitarian organizations from adopting data-intensive models developed for commercial supply chains. Accordingly, the first part of this thesis studies how to determine optimal fleet capacity over time and how to minimize procurement costs for different demand profiles in the absence of detailed data. Contrary to conventional wisdom in humanitarian organizations, its findings show that a mixed policy of level and chase procurement strategies minimizes procurement costs and that a level strategy is the optimal approach to procurement in most humanitarian missions. The second part of the dissertation concentrates on fleet management policies at the field level. To optimize fleet performance and maximize demand coverage, humanitarian organizations implement policies to enhance the utilization of vehicles and minimize their physical depreciation. Through the analysis of a large humanitarian organization's fleet in four representative countries (Sudan, Ethiopia, Afghanistan and Georgia) the results of this dissertation suggest that: (1) it is not necessary to assign different vehicles to specific mission types (2) all vehicles should be used following the same usage policy regardless of their mission type and, (3) the vehicle replacement policy implemented by most humanitarian organizations is not effective and needs to be reconsidered. Results also demonstrate that, on average, a utilization-depreciation trade-off does not exist and that a well conceived fleet management policy can allow for both higher vehicle utilization and lower depreciation. ■

Mahyar Eftekhar

is an assistant professor at the W. P. Carey School of Business in Arizona State University. His research specialty is in supply chain management with a special emphasis on humanitarian logistics. He holds a Ph.D. in Operations Management from HEC Paris.

Best Teaching Case Study Award

Container Returns at Pasadena Water Solutions

by John K. Visich, Bryant University; Christopher J. Roethlein, Bryant University; and Pedro M. Reyes, Baylor University

John K. Visich
is a Professor in the Management Department at Bryant University where he teaches courses in operations management, supply chain management, and international operations. He has a Ph.D. in Operations Management from the University of Houston, and his research interests are in supply chain and health care applications of RFID and supply chain sustainability. He has published in a variety of journals and is on the editorial review boards of Decision Sciences Journal of Innovative Education and International Journal of Integrated Supply Management. He is a two-time winner the DSI Best Teaching Case Award Competition (2011, 2014) and he has received the Outstanding MBA Professor Award 4 times from Bryant University MBA students (2007, 2012, 2013, 2014).

Dr. Chris Roethlein
is a Professor in the Management Department at Bryant University where he teaches courses in operations management and supply chain management. He has a Ph.D. in Management Science and Information Systems from the University of Rhode Island and his research interests include quality and communication within a supply chain, strategic initiatives through alignment of supply chain goals, collaborative relationships and leadership excellence. He has published in a numerous journals and is a two-time winner (2011 and 2014) of the DSI Best Teaching Case Award Competition presented by the Decision Sciences Institute.

Pedro M. Reyes
is an associate professor in the Hankamer School of Business, Baylor University and the Director for the Center of Excellence in Supply Chain Management. His research interests consist of global supply chain operations and has been actively researching the use of RFID (radio frequency identification) as an information communication technology for the integration of global supply chain operations.

Synopsis

Michael Wolfe, Manager of Product Packaging and Distribution for Pasadena Water Solutions (PWS), has a growing inventory of returned shipping containers. The containers were used to ship water cleaning systems to industrial customers, and when they were empty they were shipped back to the PWS facility. The container return policy was initiated by Mike's boss, the Vice-President of Manufacturing for PWS in response to PWS's P3 (People, Planet, Profit) sustainability initiative. No one had done a cost-benefit analysis of the new return policy nor had anyone anticipated the popularity of the return option. Mike needs to develop a strategy for returned shipping containers that recovers value and supports PWS's P3 sustainability program. Currently 50 containers are on site, but Mike expects another 200 containers to be returned over the course of the year.

Intended Courses and Audience

The case has been developed for and taught successfully for undergraduate and graduate level courses in Supply Chain Management and Corporate Social Responsibility in the Global Supply Chain. The case can also be used in a core Operations Management course that covers sustainability in the supply chain. Topics covered in the case include closed-loop supply chains, value recovery, cost/benefit analysis, sustainable operations, and the triple bottom line (people, planet and profit – P3). The case can be given as an individual or group assignment, but from our experience the case is best analyzed by a student team.

Learning Objectives

The case has two primary learning objectives for students. The first learning objective is the development of a strategic plan to support a value recovery option. This strategic plan must include a cost benefit analysis of the reuse decision as well as a process to enable the reuse of the containers. This is the profit part of the triple bottom line The second learning objective is to understand how factors that are difficult to impossible to quantify can be used to help guide the decision maker to a realistic strategic plan that meets the requirements of multiple diverse parties. These are the people and planet components of the triple bottom line. The suggested discussion questions provide a basis for class discussion, and pedagogical elements of the case topics can be injected into the discussion.

Teaching Plan

The case is designed to create classroom discussion around the topic of value recovery in the closed-loop supply chain. The case is assigned after the topics of closed-loop supply chains and sustainable operations have been covered in the course. These

topics are presented towards the end of the course so that students are first exposed to forward supply chain characteristics and logistics operations. The teaching note for the case provides an extensive list of topics and resources that can be used to introduce students to closed-loop supply chains and sustainability. Plan for a minimum of 90 minutes to teach the case, though it can be taught in a 75 minute class period by skipping several of the questions.

Our expectation for student submissions are a written report AND a financial analysis model in Excel, both to be e-mailed to the instructor prior to the start of class. A written assignment for this case can be approached in three ways.

Option 1, Formal Write-up From an Instructor Supplied Outline: Identify the key issues; analyze the main issues from a people/planet/profit perspective; discuss the pros and cons of the possible solutions Mike is considering; make a reuse value recovery decision that is supported with a quantitative analysis; and provide long-term recommendations that facilitate value recovery from future returns including grading the quality of the returned containers and future recommendations.

Option 2, Answer Questions: Students can be directed to answer any of the questions posed in the teaching note. At a minimum, questions should cover the key issues, people/planet/profit, possible solutions, and a quantitative analysis of a reuse decision.

Option 3, Formal Write-up Without any Guidance from the Instructor: We usually do not provide case questions to the students nor do we advise them to construct a financial model. We feel the case poses sufficient questions for analysis and recommendation, especially in the last paragraph.

Discussion of the case begins at the start of the class and the teaching note includes 15 questions with answers and solutions that can be used to guide the discussion. The first several questions are fairly straightforward and are used to make sure everyone understands the main issues in the case as well as the complexity surrounding the value recovery decision. You can attempt to draw a decision tree, but the students will see very quickly that the problem is difficult to visually represent since it does not flow in a linear or cause & effect fashion. The remaining questions focus on issues such as: the magnitude of the problem faced by Mike; why the containers are accumulating at Pasadena (viewed from the perspectives of management, the container, information, and the supply chain); a People-Planet-Profit analysis of the problems (a real eye-opener for the students); a pros and cons discussion of the possible solutions; and a quantitaitve analysis of the reuse option using a cost avoidance approach (a cost-benefit model is illustrated in the note). We also provide a grading rubric and a paragraph on what happened.

Keywords: supply chain management, sustainability, triple-bottom line, closed-loop supply chain, returns management, value recovery

The case is forthcoming in fall 2015 in *Advances in Business, Operations, and Product Analytics: Cutting Edge Cases from Finance to Manufacturing to Health Care*, Matthew Drake, ed., Pearson / Financial Times Press and it will also be available through the Case Centre (http://www.thecasecentre.org/educators/).

From ECOMMERCE, page 11

also beneficial. Knowing who is responding to the station for an emergency, as well as how close to the station they are, is helpful in ensuring maximum personnel get onto the apparatus for response to the incident scene. If someone is down the block from the station, personnel in the apparatus will be able to know that and can wait, time permitting. Agencies that wish to adopt this technology can easily do so. While it does have several minor issues and is not absolutely essential to operations, in the capacity that the Medford Township Division of Fire has utilized it, it has been beneficial to our operations.

Captions

Figure 1. Details of an Active911 Incident Report. Thee smartphone screens that show relevant information about the incident and responder with links to maps.

Figure 2. Two smartphone screens showing responders on simplified and realistic maps.

Figure 3. A detailed view of a helicopter landing zone (left) and detailed instructions for a landing zone procedure (right).

Sources

Phil McElroy, Lieutenant, 12-06-2014, Medford Fire Station 251, 10:30 AM

Michael Powell, Firefighter, 12-08-2014, Medford Fire Station 251, 6:00 PM

Thomas Thorn, Division Chief, 12-08-2014, Medford Fire Station 251, 7:00 PM

www.active911.com ■

Best Analytical Research Paper

Final Purchase and Trade-in Decisions in Response to a Component Phase-out Announcement

by Dwayne Cole, Arizona State University; Burak Kazaz, Syracuse University; and Scott Webster, Arizona State University

We investigate a problem faced by a durable-goods manufacturer of a product that is no longer manufactured but still under warranty. A supplier announces that a component of the product will be phased out and specifies a deadline for the final order. A common response in traditional practice is to place a final order sufficient to cover future warranty claims. We analyze and compare this policy with two policies that use trade-in programs to supplement the final order quantity: (i) A full trade-in policy where the firm issues a one-time offer to the entire population that has the product under warranty, and (ii) a matching trade-in policy where the firm issues a trade-in offer to a fraction of the warranty population in each period.

Our analysis leads to two main conclusions regarding lessons for managers. First, we find that the savings from the use of a trade-in program can be significant, and we identify easy-to-estimate measures that drive the magnitude of savings. Second, we find that a full trade-in policy is likely to be preferred over a matching trade-in policy in environments with low uncertainty in warranty claims and return volume. The policy is also easier and more practical to implement. However, as uncertainty increases, a firm may benefit by combining elements of both policies – an initial offer to a sizable fraction of the warranty population followed by periodic offers to remaining segments over time. ■

Dwayne D. Cole
is an Assistant Professor at the School of Business & Industry, Florida A&M University. His research is motivated by issues that arise at the intersection of supply chain management, operations management, and marketing distribution channels. Dr. Cole received his Ph.D. in supply chain management from Syracuse University.

Burak Kazaz
is the Stephen Becker Professor, the Laura J. and L. Douglas Meredith Professor for Teaching Excellence, executive director of the H. H. Franklin Center for Supply Chain Management, and associate professor of supply chain management at the Whitman School of Management, Syracuse University. His research focuses on supply chain finance and risk mitigation in agricultural, manufacturing, and retail supply chains.

Scott Webster
is the Bob Herberger Arizona Heritage Chair in Supply Chain Management at the W.P. Carey School of Business, Arizona State University. His research focuses on managing risk and uncertainty in supply chains, most recently in agriculture, manufacturing, and retail settings.

Photo of four "old timer" DSI members taken recently at the Sun Ridge Canyon Golf Course in Fountain Hills, AZ. Left to right: Jim Hershauer, Arizona State University; Jack Wacker, Iowa State University' Ev Adam, University of Missouri - Columbia; and Bob Markland, University of South Carolina.

"These four intrepid golfers did go out to play a round

Through the mountains and canyons of Arizona they did abound

Hitting golf balls everywhere they could roll

Some golf balls even made it into the hole"

- Contributed by Bob Markland

From RESEARCH ISSUE, page 7

of human activity and thus many problems of physical systems lend themselves to nonconvex optimization. In particular, those that involve budget constraints and economies of scale, and those of engineering design problems. Thus, due to extensive areas of application in all branches of science, nonconvex optimization has attracted attention of practitioners not only in the OR/MS community but also in many new arenas such as those in healthcare management, environment, and communications.

With the advent of computing technology and ever increasing processing power, solving optimization problems of many real-world systems have become computationally feasible where only a decade ago they were deemed prohibitive. We can afford, to a certain extent, to skip simplifying assumptions of linearity, convexity, and continuity or the smoothness that were made for the purpose of obtaining some approximate solutions. Yet, an untrained practitioner would need to gain a higher level of understanding of the optimization problems before attempting to solve them. This effort is an attempt toward achieving that goal.

References

1. M.A. Amouzegar and K. Moshirvaziri. A penalty method for linear bilevel programming problems. In A. Migdalas, M. Pardalos, and P.Varbrand, editors, *Multilevel Optimization: Algorithms, Complexity and Applications*, chapter11. Kluwer Academic Publishers, 1997.
2. K. Moshirvaziri and M.A. Amouzegar. A Deep-Cutting-Plane Technique for Reverse Convex Optimization, IEEE Transactions on Systems, Man, and Cybernetics Part B: Cybernetics, Vol.41, No.4, 2011
3. M.A. Amouzegar, "A global optimization method for nonlinear bilevel programming problems, IEEE Transaction on Systems, Man, and Cybernetics Part B: Cybernetics, Vol. 29, No. 6, pp. 771–777, 1999.
4. K. Moshirvaziri and M. A. Amouzegar, "A cutting plane algorithm for linear reverse convex programs," Annals of Operations Research, vol. 105, no. 1–4, pp. 201–212, 2001.

■

46th Annual Meeting
SEATTLE
November 20 - 23, 2015

The 2015 Annual Meeting of the Decisions Sciences Institute (DSI) in Seattle

The upcoming DSI Annual Meeting in Seattle is organized around two conference pillars: (1) Research, and (2) Education and Professional Development. The theme of the conference is "Decision Sciences in the 21st Century: Theoretical Impact and Practical Relevance" to highlight the increasing importance of research in the decision sciences that creates and advances knowledge and helps define and influence practice in these fields. The conference will feature many interesting papers and abstracts across a variety of tracks in research as well as education. There will also be a number of award competitions, including a new "Lean Enterprise Paper Award," and a number of professional development events including consortia for faculty and PhD students. For the second year in a row DSI has contracted with a publisher to produce a "Best Papers of the Conference" book to highlight some of the most outstanding papers submitted to the conference. The full breadth conference offerings can be viewed at www.dsi-annualmeeting.org.

A number of special events will be held to provide great opportunities for socializing and networking with old and new colleagues. For some of the events, capacity is limited (*), so conference attendees interested in participating will need to register as soon as possible. Many of these events were made possible by donations given by faculty members and/or their universities. A full list of the generous sponsors of this conference will appear in the next issue of Decision Line. These exciting events are described next in chronological order.

Friday, November 20th, 6 pm:
The Underground Seattle Tour*

DSI attendees and guests can enjoy a walking tour through the aging remnants and ruins of Seattle's original street level

— situated below the current streets. Step back in time and experience life as it was in the 1800s! Registration is limited to the first 40 guests, so make sure you reserve a spot ASAP! Price per person for the tour is $21.50 and you need to reserve by October 1. Please call 206-682-4646 between the hours of 8:30am and 5pm pacific time to make your reservation. The starting point of the tour is an easy 15-20 minute walk from the conference hotel.

Saturday, November 21st, 6:30 – 8:30 pm:
The Welcome Reception

A gala welcome reception will be held at

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SEATTLE
November 20 - 23, 2015

the renowned Museum of Flight in the Personal Courage Wing of the museum for all DSI attendees and their spouses. Private buses will be leaving from the conference hotel starting at 5:30 pm to transport conference attendees to the museum throughout the evening (and back to the conference hotel later on). Food and drinks will be served starting at 6:30 pm catered by the renowned McCormick & Schmick. The Personal Courage Wing is an amazing and enjoyable venue for touring, visiting, and networking.

Sunday, November 22nd, 12:00 noon:
Annual Meeting Luncheon

The annual meeting luncheon, a great networking opportunity, will feature our Industry Keynote Speaker, Mr. Marco Benvenutti. Marco Benvenuti is Chief Analytics & Product Officer and Co-Founder at Duetto, where he directs product vision, direction and implementation. Marco was formerly Executive Director at Wynn and Encore where he founded and managed the Enterprise Strategy Group, in which he led revenue management, data analytics, direct marketing and online channels. Prior to Wynn, Marco worked for Caesars Entertainment, Expedia, and Four Seasons. Marco has patented two unique inventions: the Pricing Engine for one-to-one dynamic pricing and the Enterprise Value Algorithm for calculating the value of every customer.

Sunday, November 22nd, 6:00 – 7:30 pm:
The International Networking Reception at the Space Needle* and visit to Chihuly Garden and Glass Exhibit

The International Networking Reception at the Space Needle is designed to provide a special night at the world famous Space Needle for DSI attendees and guests. The price per person for this event is $20.00 which includes mono-rail transportation, the Space Needle entrance fee, Chihuly Garden and Glass Exhibit entrance fee, and a private reception including drinks and hor d'oeuvres. The International Networking Reception is focused on providing a social networking forum for conference participants from all over the globe to connect in a relaxed setting to explore opportunities to collaborate in research and education oriented initiatives. The emphasis is on enabling scholars to connect with colleagues from other countries to facilitate research activities such as data collection from different global regions and joint educational initiatives. Capacity is limited so conference attendees will need to register as soon as possible for this event.

Monday, November 23rd, 6:30 – 9:15 pm
Closing Reception and Awards Dinner Banquet

DSI attendees will be treated to a stellar closing reception and dinner awards banquet at the conference hotel. The reception will provide an opportunity to relax with colleagues over drinks in a luxurious setting, listening to musical entertainment prior to dinner. This is a "dress-up" affair that will be a fun and rewarding experience for all participants.

Registration and Hotel Reservation:

The conference will take place in Seattle, WA at the Seattle Sheraton Hotel. Reservations can be made by individual call-in (888-627-7056) or by following the following link (www.starwoodmeeting.com/events/start.action?id=1502026108&key=2BCDDA5B). The cut-off date for reserving rooms in the room block is 5:00 p.m. PST on October 20, 2015.

This year there will be four different registration periods for the conference that will result in increased registration costs. Please see below for more information on registration timeline and costs, or go to http://www.decisionsciences.org/Meetings/2015-Annual-Meeting/Registration to register.

We look forward to seeing you in Seattle.

	Early Bird Registration	Advanced Registration	Intermediate Registration	Late/Onsite Registration
	Cutoff: 9/15/15	*Cutoff: 10/15/15*	*Cutoff: 11/2/15*	*Cutoff: 11/24/15*
Member	$395	$470	$545	$620
Non-Member	$555	$630	$705	$780
Emeritus	$200	$225	$250	$275
Student	$100	$125	$150	$175

PAST DSI PRESIDENTS

2014-2015 - Marc Schniederjans, University of Nebraska-Lincoln
2013-2014 - Maling Ebrahimpour, University of South Florida-St. Petersburg
2012-2013 - E. Powell Robinson, Jr., University of Houston
2011-2012 - Krishna S. Dhir, Berry College
2010-2011 - G. Keong Leong, University of Nevada, Las Vegas
2009-2010 - Ram Narasimhan, Michigan State University
2008-2009 - Norma J. Harrison, Macquarie Graduate School of Management
2007-2008 - Kenneth E. Kendall, Rutgers University
2006-2007 - Mark M. Davis, Bentley University
2005-2006 - Thomas E. Callarman, China Europe International Business School
2004-2005 - Gary L. Ragatz, Michigan State University
2003-2004 - Barbara B. Flynn, Indiana University
2002-2003 - Thomas W. Jones, University of Arkansas-Fayetteville
2001-2002 - F. Robert Jacobs, Indiana University-Bloomington
2000-2001 - Michael J. Showalter, Florida State University
1999-2000 - Lee J. Krajewski, University of Notre Dame
1998-1999 - Terry R. Rakes, Virginia Tech
1997-1998 - James R. Evans, University of Cincinnati
1996-1997 - Betty J. Whitten, University of Georgia
1995-1996 - John C. Anderson, University of Minnesota-Twin Cities
1994-1995 - K. Roscoe Davis, University of Georgia
1993-1994 - Larry P. Ritzman, Ohio State University
1992-1993 - William C. Perkins, Indiana University-Bloomington
1991-1992 - Robert E. Markland, University of South Carolina
1990-1991 - Ronald J. Ebert, University of Missouri-Columbia
1989-1990 - Bernard W. Taylor, III, Virginia Tech
1989-1990 - Bernard W. Taylor, III, Virginia Tech
1988-1989 - William L. Berry, Ohio State University
1987-1988 - James M. Clapper, Aladdin TempRite
1986-1987 - William R. Darden, Deceased
1985-1986 - Harvey J. Brightman, Georgia State University
1984-1985 - Sang M. Lee, University of Nebraska-Lincoln
1983-1984 - Laurence J. Moore, Virginia Tech
1982-1983 - Linda G. Sprague, China Europe International Business School
1981-1982 - Norman L. Chervany, University of Minnesota-Twin Cities
1979-1981 - D. Clay Whybark, University of North Carolina-Chapel Hill
1978-1979 - John Neter, University of Georgia
1977-1978 - Charles P. Bonini, Stanford University
1976-1977 - Lawrence L. Schkade, University of Texas-Arlington
1975-1976 - Kenneth P. Uhl, Deceased
1974-1975 - Albert J. Simone, Rochester Institute of Technology
1973-1974 - Gene K. Groff, Georgia State University
1972-1973 - Rodger D. Collons, Drexel University
1971-1972 - George W. Summers, Deceased
1969-1971 - Dennis E. Grawoig, Deceased

CURRENT DSI FELLOWS

Adam, Everett E., Jr.
Anderson, John C.
Benson, P. George
Beranek, William
Berry, William L.
Bonini, Charles P.
Brightman, Harvey J.
Buffa, Elwood S.*
Cangelosi, Vincent*
Carter, Phillip L.
Chase, Richard B. C
hervany, Norman L.
Clapper, James M.
Collons, Rodger D.
Couger, J. Daniel*
Cummings, Larry L.*
Darden, William R.*
Davis, K. Roscoe
Davis, Mark M.
Day, Ralph L.*
Digman, Lester A.
Dock, V. Thomas
Ebert, Ronald J.
Ebrahimpour, Maling
Edwards, Ward
Evans, James R.
Fetter, Robert B.
Flores, Benito E.
Flynn, Barbara B.
Franz, Lori S.
Ghosh, Soumen
Glover, Fred W.
Gonzalez, Richard F.
Grawoig, Dennis E.*
Green, Paul E.
Groff, Gene K.
Gupta, Jatinder N.D.
Hahn, Chan K.
Hamner, W. Clay
Hayya, Jack C.
Heineke, Janelle
Hershauer, James C.
Holsapple, Clyde
Horowitz, Ira
Houck, Ernest C.*
Huber, George P.
Jacobs, F. Robert
Jones, Thomas W.
Kendall, Julie E.
Kendall, Kenneth E.
Keown, Arthur J.
Khumawala, Basheer M.
Kim, Kee Young
King, William R.
Klein, Gary
Koehler, Anne B.
Krajewski, Lee J.
LaForge, Lawrence
Latta, Carol J.*
Lee, Sang M.
Luthans, Fred
Mabert, Vincent A.
Malhotra, Manoj K.
Malhotra, Naresh K.
Markland, Robert E.
McMillan, Claude
Miller, Jeffrey G.
Monroe, Kent B.
Moore, Laurence J.
Moskowitz, Herbert
Narasimhan, Ram
Neter, John
Nutt, Paul C.
Olson, David L.
Perkins, William C.
Peters, William S.
Philippatos, George C.
Ragsdale, Cliff T.
Raiffa, Howard
Rakes, Terry R.
Reinmuth, James R.
Ritzman, Larry P.
Roth, Aleda V.
Sanders, Nada
Schkade, Lawrence L.
Schniederjans, Marc J.
Schriber, Thomas J.
Schroeder, Roger G.
Simone, Albert J.
Slocum, John W., Jr.
Smunt, Timothy
Sobol, Marion G.
Sorensen, James E.
Sprague, Linda G.*
Steinberg, Earle
Summers, George W.*
Tang, Kwei
Taylor, Bernard W., III
Troutt, Marvin D.
Uhl, Kenneth P.*
Vakharia, Asoo J.
Vazsonyi, Andrew*
Voss, Christopher A.
Ward, Peter T.
Wasserman, William
Wemmerlov, Urban Wheelwright, Steven C.
Whitten, Betty J.
Whybark, D. Clay
Wicklund, Gary A.
Winkler, Robert L.
Woolsey, Robert E. D. Wortman, Max S., Jr.*
Zmud, Robert W.

* **Deceased**

In order for the nominee to be considered, the nominator must submit in electronic form a full vita of the nominee along with a letter of nomination which highlights the contributions made by the nominee in research, teaching and/or administration and service to the Institute. Nominations must highlight the nominee's contributions and provide appropriate supporting information which may not be contained in the vita. A candidate cannot be considered for two consecutive years.

Send nominations to:

Chair of the Fellows Committee
Decision Sciences Institute
C.T. Bauer College of Business
334 Melcher Hall, Suite 325
Houston, TX 77204-6021

info@decisionsciences.org

INSTITUTE CALENDAR

■ May 2015

May 31 - June 3 2015
EDSI 2015 Conference
DECISION SCIENCES FOR THE SERVICE ECONOMY
Taormina (Italy)

DECISION SCIENCES JOURNAL OF INNOVATIVE EDUCATION

■ June 2015

June 15
Call for Paper: Special Issue on "Identifying and Managing Critical Success Factors of Online Education."
Submission deadline: June 15, 2015

July 19-24, 2005
The 20th Asia Pacific Decision Sciences Institute Conference in conjunction with The 2nd International Conference of Supply Chain for Sustainability & A Special Issue of the Journal of Management Systems
Hong Kong, China

■ OCTOBER 2015

October 25
All papers and proposals must be submitted electronically on or before this date for the 2015 NEDSI conference in March

■ NOVEMBER 2015

November 21 - 24
The **46th Annual Meeting of the Decision Sciences Institute will be held in Seattle, Washington** at the Sheraton Seattle Hotel

Decision Sciences Institute
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Based on the DGP per Capita (PPP)

Rates Effective June 1, 2014

All Dues amounts are in United States Dollars

Member Type	Greater than 75th Percentile	50th - 75th Percentile	Less than 50th Percentile				
Regular	$160	$80	$40				
Emeritus	$80	$40	$20				
Student	$0	$0	$0				
	Australia, Austria, Bermuda, British Virgin Islands, Brunei, Canada, Cayman Islands, Falkland Islands (Islas Malvinas), Gibraltar, Guernsey, Hong Kong, Iceland, Ireland, Isle of Man, Jersey, Kuwait, Liechtenstein, Luxembourg, Macau, Monaco, Netherlands, Norway, Qatar, Singapore, Sweden, Switzerland, United States,	Andorra, Bahamas, Bahrain, Belgium, Denmark, Faroe Islands, Finland, France, Germany, Greenland, Guam, Israel, Italy, Japan, Korea, South Malta, New Caledonia, New Zealand, Oman, Saint Pierre and Miquelon, Saudi Arabia, Slovenia, Spain, Taiwan, Turks and Caicos Islands, United Arab Emirates, United Kingdom,	Afghanistan, Albania, Algeria, American Samoa, Angola, Anguilla, Antigua and Barbuda, Argentina, Armenia, Aruba, Azerbaijan, Bangladesh, Barbados, Belarus, Belize, Benin, Bhutan, Bolivia, Bosnia and Herzegovina, Botswana, Brazil, Bulgaria, Burkina, Faso, Burma, Burundi, Cabo Verde, Cambodia, Cameroon, Central African Republic, Chad, Chile, China, Colombia, Comoros,	Republic of the Cook Islands, Costa Rica, Cote d'Ivoire, Croatia, Cuba, Curacao, Cyprus, Czech Republic, Djibouti, Dominica, Dominican Republic, Ecuador, Egypt, El Salvador, Equatorial Guinea, Eritrea, Estonia, Ethiopia, Fiji, French Polynesia, Gabon, Gambia, Georgia, Ghana, Greece, Grenada, Guatemala, Guinea, Guinea-Bissau, Guyana, Haiti, Honduras, Hungary, India, Indonesia, Iran,	Iraq, Jamaica, Jordan, Kazakhstan, Kenya, Kiribati, North Korea, Kosovo, Kyrgyzstan, Laos, Latvia, Lebanon, Lesotho, Liberia, Libya, Lithuania, Macedonia, Madagascar, Malawi, Malaysia, Maldives, Mali, Marshall Islands, Mauritania, Mauritius, Mexico, Federated States of Micronesia, Moldova, Mongolia, Montenegro, Montserrat, Morocco, Mozambique, Namibia, Nauru, Nepal,	Nicaragua, Niger, Nigeria, Niue, Northern Mariana Islands, Pakistan, Palau, Panama, Papua, New Guinea, Paraguay, Peru, Philippines, Poland, Portugal, Puerto Rico, Romania, Russia, Rwanda, Saint Helena, Ascension, and Tristan da Cunha, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Samoa, San Marino, Sao Tome and Principe, Senegal, Serbia, Seychelles, Sierra Leone, Sint Maarten (Saint Martin), Slovakia, Solomon Islands, Somalia,	South Africa, South Sudan, Sri Lanka, Sudan, Suriname, Swaziland, Syria, Tajikistan, Tanzania, Thailand, Timor-Leste, Togo, Tokelau, Tonga, Trinidad and Tobago, Tunisia, Turkey, Turkmenistan, Tuvalu, Uganda, Ukraine, Uruguay, Uzbekistan, Vanuatu, Venezuela, Vietnam, Virgin Islands, Wallis and Futuna, West Bank, Western Sahara, Yemen, Zambia, Zimbabwe,