



*Eleventh Annual Workshop on
Supply Chain and Logistics*

June 9, 2017

Bilkent University
Department of Industrial Engineering
Ankara, Turkey

Program Schedule

- 08:50 - 09:10: Registration and coffee/tea
- 09:10 - 09:20: Opening remarks
- 09:20 - 10:10: “Multi-dimensional Decision Making in Operations: An Experimental Investigation of Joint Pricing and Quantity Decisions”
Necati Tereyağođlu, Georgia Institute of Technology
Discussant: Ayşe Kocabıyıkoođlu, Sabancı University
- 10:10 - 10:30: Coffee break
- 10:30 - 11:20: “Buyer and Nonprofit Levers to Improve Supplier Environmental Performance”
Özgen Karaer, Middle East Technical University
Discussant: Murat Kaya, Sabancı University
- 11:20 - 11:40: Coffee break
- 11:40 - 12:30: Tutorial
“Inventory Management”
Ton de Kok, Eindhoven University of Technology
- 12:30 - 13:40: Lunch break
- 13:40 - 14:30: “Crop Planning in Sustainable Agriculture: Dynamic Farmland Allocation in the Presence of Crop Rotation Benefits”
Onur Boyabathl, Singapore Management University
Discussant: Emre Berk, Bilkent University
- 14:30 - 14:50: Coffee break
- 14:50 - 15:40: “Improving the Order Picking Efficiency in a Distribution Center by Solving the Storage Assignment and Picker Routing Problem”
Necati Aras, Bođaziçi University
Discussant: Temel Öncan, Galatasaray University
- 15:40 - 16:00: Coffee break
- 16:00 - 16:30: Practice session
“Digital Supply Chain Transformation”
Yiđiter Çolakoođlu, Supply Chain Wizard
- 16:40 - 19:00: Closing cocktail (Rector’s Residence - Building 49)

Multi-dimensional Decision Making in Operations: An Experimental Investigation of Joint Pricing and Quantity Decisions

Necati Tereyağoğlu, Georgia Institute of Technology

Abstract: Firms in several industries like medicine, apparel and publishing must jointly determine the price and production quantity of their products well in advance of the selling season. Normative prescriptions to solve this problem have generally ignored behavioral aspects of decision-making, while behavioral research has paid limited attention to interdependent, multi-dimensional decisions. In this study, we experimentally examine subjects' performance when they jointly determine price and quantities. We find that subjects systematically deviate from the theoretically optimal price and quantity levels. To explain this deviation, we explore two behavioral models and find that reference-dependence and anchoring explain the subjects' decisions well. When we change the decision process into a sequential, instead of a simultaneous process, we continue to find deviations in subjects' decisions and presence of reference-dependence and anchoring. However, when demand uncertainty is removed, or when information about market demand is provided after pricing decision is made, subjects improve their decisions.

Necati Tereyağoğlu is an Assistant Professor of Operations Management and Business Analytics in Scheller College of Business at Georgia Institute of Technology. Dr. Tereyağoğlu earned an M.A. in Statistics during his Ph.D. studies and received his Ph.D. in 2012 at the Wharton School, University of Pennsylvania. He received a B.S. in Industrial Engineering at Bilkent University, Turkey. The core of his research program lies in unraveling the underlying human behavior which may cause systematic errors in individuals' decisions. In this endeavor, he utilizes economical or probability models to explore decisions both at the customer and organization level, and make operational decisions more effective. His research relies heavily on field data to document how individuals deviate from making rational decisions and identify which factors cause such deviations. In particular, he pays particular attention to the question of what behavioral factors cause deviations in multi-dimensional decisions. So far, he had the opportunity to work on pricing and revenue management problems in luxury industry, in creative industries such as performing arts, and in packaged food industry. Recently, he also looks at how shared work experience between team members affects the performance of the outcome in creative settings, utilizing data from video game industry. His research has been published in journals such as *Management Science*, and *Production and Operations Management*. He has taught Pricing Analytics and Revenue Management and Operations

Management at the Scheller College of Business. He has received the Full-time MBA Elective Professor of the Year Award twice in 2016 and 2017.

Discussant: Ayşe Kocabiyıkoğlu is an Associate Professor of Decision Sciences at Sabancı University in Istanbul, Turkey, and holds a Ph.D. in Decision Sciences from INSEAD, and M.S. and B.S. degrees from Middle East Technical University. Her research is at the interface of decision sciences and behavioral operations, and her research interests include behavioral operations management, pricing and revenue management, and dynamic decision making. Her work has been featured in leading academic journals such as *Management Science*, *Operations Research* and *Production & Operations Management*.

Buyer and Nonprofit Levers to Improve Supplier Environmental Performance

Özgen Karaer, Middle East Technical University

Abstract: Material IQ (MiQ) is a new decision tool designed by GreenBlue to help suppliers safely share sensitive chemical-toxicity data with their customers. As GreenBlue takes MiQ to market, it must determine under what market conditions to promote the use of MiQ and when to recommend that a buyer uses its implementation as an opportunity to work with an existing supplier. We study GreenBlue's problem in two parts. First, we investigate when a buyer can use a wholesale price premium and/or buyer–supplier cost sharing to improve a supplier's environmental performance. Based on our findings, we then develop insights into GreenBlue's strategy. We model both a single-supplier and a supplier-competition setting. We find that in the single-supplier setting, if the buyer's optimal strategy is to offer the supplier a premium, then he also fully subsidizes her investment cost to build quality. By developing the supplier's capabilities, the buyer can increase the impact of the premium he offers. In the supplier-competition setting, although cost sharing is less effective as a lever, cases can occur in which the buyer chooses to share costs and prevent the incumbent supplier from having to compete. From GreenBlue's perspective, promoting the use of MiQ and cost sharing are often viable strategies when there exists a one-to-one relationship between a buyer and a supplier. However, GreenBlue's strategy becomes more restricted when competition exists between suppliers. Only when the relative market awareness of quality is high and there is a dominant party in the supply chain should GreenBlue recommend the use of MiQ.

Özgen Karaer is an Assistant Professor in the Department of Industrial Engineering at METU. She received her B.S. degree (2002) from the Department of Industrial Engineering at METU, and her M.S. and Ph.D. (2008) degrees from the Department of Management Science and Engineering at Stanford University. Prior to joining METU in 2012, she worked as a senior consultant and consequently a manager in the Operating Strategy department at Gap Inc. During her tenure at Gap Inc., she worked on various projects involving replenishment prioritization, promotion hindsighting, demand planning, store inventory allocation, store performance measurement, and RFID. Her research is in strategic interactions in supply chains, retail management, and sustainable operations management.

Discussant: Murat Kaya is currently working as an Assistant Professor at Sabancı University, Industrial Engineering Program. He holds M.S. and Ph.D. degrees from Stanford University, Management Science and Engineering (MS&E) Department, and a B.S. degree from METU Industrial Engineering Department. During his Ph.D. study, Dr. Kaya worked for several projects at Hewlett Packard Research Laboratories in Palo Alto, USA. He is affiliated with Sabancı University Istanbul International Center for Energy and Climate (IICEC). Dr. Kaya's current research focuses on behavioral operations management and decision problems in electricity grids.

Tutorial: Inventory Management

Ton de Kok, Eindhoven University of Technology

Abstract: In this contribution, we aim to provide an overview of research on inventory management, starting from single-item, single-echelon, single-period models and concluding with multi-item, multi-echelon, multi-period models. The leading principle for the overview is to provide results with a proven practical relevance with an emphasis on quantitative empirical validity. The core of the overview is a recent finding that allows for unification of the analysis of inventory systems under linear holding and penalty costs and fixed ordering cost. The finding can be informally stated as “The newsvendor equation always holds”. Furthermore, we discuss the empirical observation that inventory system performance is primarily determined by the frequency an item is ordered and its average inventory. In our view this finding may provide a means to remove the fundamental barrier towards finding optimal policies for multi-item multi-echelon systems: the curses of dimensionality. Though we cannot guarantee optimality of control policies, the insensitivity result identified from empirical studies suggests that policies found from optimizing policy parameters of given policies yield

close-to-optimal policies. As this seems too good to be true we discuss limitations to this hypothesis. Finally, we discuss the implications of our research on the strategic positioning of buffers in supply chains.

Ton de Kok graduated from the Rijksuniversiteit Leiden, The Netherlands in Mathematics and Economics in 1981. After 4 years under the supervision of Prof. Henk C. Tijms he attained the doctorate (Ph.D. degree) in 1985 from the Free University of Amsterdam. Thereafter he joined the Centre for Quantitative Methods (CQM) of Philips Electronics in Eindhoven, The Netherlands as consultant in Operations Research. During 5 years he participated in over 20 client projects in the field of logistics and production management. In 1990 he became Certified Fellow in Production and Inventory Management (CFPIM) of the American Production and Inventory Control Society (APICS). From 1990-1992 he was a teaching professor at Boston University Brussels. In 1990, he was appointed Manager Logistics Innovation of Philips Consumer Electronics. In 1991, he was appointed part-time professor in Industrial Mathematics at Technische Universiteit Eindhoven. Since 1992 he is a full time professor of Operations Management at the same university. He has published over 85 articles in international scientific journals. He is the Director of the European Supply Chain Forum (eSCF). He was a member of the board of VLM (Logistics Management Association) from 1997-2000. From January 1, 2003 till July 1, 2008 he was Scientific Director of the research school Beta. In 2004, he was Edelman Award Finalist as member of the Philips Semiconductors team. In 2006, he received the ISIR Service Award. In September 2008, Ton de Kok became Fellow of the research school Beta. In August 2014, he was granted the honor of being appointed as Fellow of the International Society for Inventory Research (ISIR). He is Academic Director of the TiasNimbas Executive Master on Operational Excellence and member of the TiasNimbas Academic Council. In 2006, he established the supply chain optimization software company ChainScope and is currently CTO. Ton's main research areas are Supply Chain Management and Concurrent Engineering with emphasis on quantitative analysis. His research results have been successfully tested and implemented in a multitude of projects with industry.

Crop Planning in Sustainable Agriculture: Dynamic Farmland Allocation in the Presence of Crop Rotation Benefits

Onur Boyabatlı, Singapore Management University

Abstract: This paper examines crop planning decision in sustainable agriculture - that is, how to allocate farmland among multiple crops in each

growing season when the crops have rotation benefits across growing seasons. We consider a farmer who periodically allocates the farmland between two crops in the presence of revenue uncertainty where revenue is stochastically larger and farming cost is lower when a crop is grown on rotated farmland (where the other crop was grown in the previous season). We characterize the optimal dynamic farmland allocation policy. Using a calibration based on a typical farmer growing corn and soybean in Iowa we provide rules of thumb for the effect of revenue uncertainty. In particular, we show that the farmer always benefits from a higher corn revenue volatility but benefits from a higher soybean revenue volatility only when this volatility is high; otherwise a lower soybean volatility is beneficial. We also show that growing only one crop over the entire planning horizon, as employed in industrial agriculture, leads to a considerable profit loss - that is, making crop planning based on principles of sustainable agriculture has substantial value. We propose a simple sustainable heuristic allocation policy and characterize the periodic allocation decision of this policy in closed form. Using our model calibration, we show that the proposed policy not only outperforms the commonly suggested heuristic policies in the literature, but also provides a near-optimal performance.

Onur Boyabath is Associate Professor of Operations Management at the Lee Kong Chian School of Business, Singapore Management University. He holds a Ph.D. in Technology and Operations Management from INSEAD, France, M.S. and B.S. degrees in Industrial Engineering from Bilkent University, Turkey. His research interests are in the area of integrated risk management in supply chains. His first research stream, operational decision making in commoditized industries with a special focus on agribusiness, primarily focuses on the integration of input risk management (through sourcing decisions) with output risk management (through processing and pricing decisions) in agricultural industries, and studies several operational problems (such as capacity and farmland management, procurement, farm-yield management, product pricing) of supply chain agents (such as farmers and processors) in this setting. His second research stream, technology and capacity management including integration with financing and financial risk management, studies technology and capacity management under financing frictions in capital-intensive industries (such as automotive); and operational and financial hedging in global supply chains. His research papers have been published in *Management Science* and *Manufacturing & Services Operations Management (M&SOM)*. He is the co-editor of "Handbook of Integrated Risk Management in Global Supply Chains." He has served as the Associate Editor for the *M&SOM* journal's special issue on Interface of Finance Operations and Risk Management (iFORM). He was awarded the

Management Science Distinguished Service Award in 2012 and Meritorious Service Award in 2014. He co-organized the iFORM SIG (Special Interest Group) conference in 2012 and 2014, the 5th Mini-conference on Integrated Risk Management in Operations and Global Supply Chains in 2008. He served as the cluster chair for iFORM at the INFORMS conferences in 2012, 2013 and 2015. He teaches courses related to Operations Management (e.g., Decision Analysis, Risk Management in Global Supply Chains, Interdisciplinary Research Topics in Operations Management) at various - executive, graduate (M.B.A. and Ph.D.) and undergraduate - levels.

Discussant: Emre Berk holds a B.S. in Mechanical Engineering from Boğaziçi University, Turkey, an M.S. in Mechanical Engineering from Washington State University, USA, and an M.B.A. from University of Washington, USA. He received his Ph.D. in Business Administration from University of Washington, USA. His research interests include supply chain management, production planning and inventory control, quality management and green operations. His research work has been funded by the National Science Foundation of USA and the Scientific and Technological Research Council of Turkey, and published in Management Science, Operations Research, European Journal of Operational Research, IIE Transactions, Naval Research Logistics and International Journal of Production Economics. He has taught courses at University of Washington, Texas A&M University, Middle East Technical University and Bilkent University. He is currently an Associate Professor in Management at Bilkent University and is serving as the Associate Dean at the Faculty of Business Administration.

Improving the Order Picking Efficiency in a Distribution Center by Solving the Storage Assignment and Picker Routing Problem

Necati Aras, Boğaziçi University

Abstract: This talk is based on a project carried out to improve the order picking system at one of the distribution centers (DCs) of Migros Inc. located in İstanbul, Turkey. In particular, the focus is on savings that can be obtained by reducing the total travel distance traversed by the pickers while picking the items. It is known that order picking contributes to about 50-60% of the time spent in a DC and approximately 50% of an order picker's time is devoted to traveling. In the first part of the talk, we will describe the important problems that arise in the management of a DC. The second part of talk will focus on the aforementioned project to reduce the total travel distance of the pickers. Even though minimization of this measure is related to the order

picker routing problem, which is an operational level problem, it also depends on the addresses or locations of the items within the DC. The latter, on the other hand, is a tactical level problem and tries to determine the assignment of items to storage locations, which is referred to as the storage assignment problem in short. Therefore, these two subproblems are intertwined and for an effective operation of the manual order picking system they must be formulated and solved in an integrated fashion.

Necati Aras graduated from the Department of Mechanical Engineering at Boğaziçi University in 1993. He received his master's and doctorate degree at the Department of Industrial Engineering of the same university in 1994 and 1999, respectively. He worked as a Quality Assurance Engineer at Türk Elektrik Endüstri A.Ş. (now Arçelik Inc.) between 1994-1998 and as a Trainer / Consultant at İdea Inc. between 1998-2000. His expertise was mainly in Total Quality Management, Process Management and EFQM Excellence Model. During the period of 2001-2003 he was a postdoctoral researcher at the Management Science area of the Department of Business Administration, McGill University, Canada. He joined the Department of Industrial Engineering of Boğaziçi University in 2003. His research interest focuses on topics such as solving optimization problems arising in production and service industries using exact and metaheuristic methods, and data analytics techniques. He has published more than 50 papers and book chapters in scientific journals, and his h-index is 20 and 24 based on Scopus and Google Scholar, respectively.

Discussant: Temel Öncan is Full Professor of Industrial Engineering at Galatasaray University. He holds a Ph.D. and a Master's degree in Industrial Engineering from Boğaziçi University, İstanbul, in 2004. He conducted postdoctoral research at University of New Brunswick and at CIRRELT in Canada. His current research interests include Combinatorial Optimization, Network Design, Facility Location, Logistics, and Production Planning & Control. Dr. Öncan's papers appeared in academic journals such as IIE Transactions, Annals of Operations Research, Computer & Operations Research, European Journal of Operational Research, and Journal of the Operational Research Society.

Practice Session: Digital Supply Chain Transformation

Yiğiter Çolakoğlu, Supply Chain Wizard

Abstract: Competition is tremendously growing in each and every industry. Companies are trying to be in this race even if the margins are steadily

decreasing. Operations management helps companies optimize their internal processes like production, procurement, warehouse management as well as external activities like supplier management, customer relations and finally supply chain management. In addition to this ongoing race, legislations all over the world limit the way that companies prefer to operate. Eventually, the companies who survived from this restricted race will have a discipline of operations compliant with the legislations with minimized cost. Thereafter, contrary to what is expected from the companies, the competition gets wilder and companies need to act in a much smarter manner to optimize supply chain. This might be possible by digitizing the parameters through machine learning algorithms and predictive analysis.

Yiğiter Çolakođlu is Senior Manager, Knowledge Management of Supply Chain Wizard. Yiğiter received his M.B.A. in 2007 from Middle East Technical University in Ankara, Turkey and holds a Bachelor's degree in Industrial Engineering from Bilkent University in Ankara, Turkey. Supply Chain Wizard, LLC is a Management Consulting Company serving Pharmaceutical Industry globally in the fields of Supply Chain Management and Supply Chain Optimization. Yiğiter is managing large scale Track & Trace Projects mainly for European pharma companies. In addition, he is responsible of managing corporate library and process flows and ensuring sustainable success. Before he joined to Supply Chain Wizard, Yiğiter worked at Aselsan Inc., which is one of the key players in defense industry in Turkey, as a Project Manager. He was in charge of managing large scale, multi-national, hardware & software projects related to Ground Segment Operations of Reconnaissance and Earth Observation Satellites. He has a proven experience in all phases of a software/hardware project including definition of requirements, design, procurement, production, installation, integration, validation and delivery of final product concerning the monetary impact of each and every activity.

Organization Committee:

Ayşe Selin Kocaman	selin.kocaman@bilkent.edu.tr
Çağın Ararat	cararat@bilkent.edu.tr
Ece Çiğdem	ece.cigdem@bilkent.edu.tr
Büşra Ökten	busra.okten@bilkent.edu.tr



Bilkent University
Department of Industrial Engineering
TR-06800 Bilkent, Ankara, Turkey
Phone : +90-312-290-1262
Fax : +90-312-266-4054
Email : akturk@bilkent.edu.tr

www.ie.bilkent.edu.tr