

Engineering Systems Division

The MIT Engineering Systems Division (ESD) was founded in 1998 to tackle substantial, real-world challenges using new framing and modeling methodologies. Spanning most departments within the School of Engineering, as well as the other MIT schools, ESD integrated approaches from engineering, management, and social sciences. More than 50 faculty members, holding dual or joint appointments within ESD and another MIT unit, were devoted to teaching and research in the field of engineering systems.

Effective July 1, 2015, ESD transitioned into the [Institute for Data, Systems, and Society](#) (IDSS). This new, larger entity brings together the education and research of ESD, the Laboratory for Information and Decision Systems, and a new MIT effort in statistics and data science. The mission of IDSS is to advance education and research in state-of-the-art analytical methods in information and decision systems, statistics and data science, and the social sciences; and to apply these methods to address complex societal challenges in a diverse set of areas such as finance, energy systems, urbanization, social networks, and health.

The recommendation to form this new entity was the result of deliberations of four faculty committees led by Munther Dahleh and Karen Willcox (mission), Emery Brown and David Gamarnik (statistics), Anantha Chandrakasan and Alan Willsky (organizational structure), and Thomas Magnanti and Olivier de Weck (academic programs). The committees included 39 faculty members from all five MIT schools, with substantial participation from ESD faculty, and worked under the leadership of Professor Dahleh. The work of these committees built on that of three prior faculty committees: the Rivest committee, which focused on sociotechnical systems, and the Willcox and Sipser committees, which focused on statistics. Over the past few years, these seven committees have engaged many people from across the Institute. In May 2014, MIT Provost Martin Schmidt sent out the committee's report to the MIT community for comment. In April 2015, the five MIT deans announced the new Institute for Data, Systems, and Society to the MIT community.

Munther Dahleh, the William A. Coolidge Professor in the Department of Electrical Engineering and Computer Science (EECS), is the director of IDSS (Professor Dahleh had been acting director of the Engineering Systems Division). Professor Asuman Ozdaglar (also director of the Laboratory for Information and Decision Systems) and Professor Ali Jadbabaie (also director of the Sociotechnical Systems Research Center) are associate directors.

ESD awarded 170 degrees in AY2015. Academic programs included the [ESD PhD program](#), the [ESD SM program](#), [Leaders for Global Operations \(LGO\)](#), [Supply Chain Management \(SCM\)](#) (which awards the master of engineering in logistics degree), [System Design and Management](#) (SDM), and the [Technology and Policy Program \(TPP\)](#). More details about these master's programs are provided below.

Research

ESD encompassed several major research programs, including the [Sociotechnical Systems Research Center \(SSRC\)](#), the [MIT Center for Transportation and Logistics \(CTL\)](#), the [Center for Biomedical Innovation \(CBI\)](#), the [Center for Engineering Systems Fundamentals \(CESF\)](#), and the [Center for Complex Engineering Systems \(CCES\) at KACST and MIT](#). These programs are described later in this report. Also, a number of ESD faculty and staff members were involved in the [MIT Portugal Program \(MPP\)](#). For more details, see the MPP report to the president.

Achievements

Below are some ESD faculty and teaching staff highlights for AY2015:

- Noelle Selin was promoted to associate professor without tenure (effective July 1, 2015).
- Maria Yang was promoted to associate professor with tenure (effective July 1, 2015).
- Joseph Sussman was inducted into the Intelligent Transportation Society of America Hall of Fame.
- Olivier de Weck gave the keynote address at the second Google Ara Developer's Conference in Singapore on January 21, 2015.
- Daniel Whitney was selected to receive the IEEE (Institute of Electrical and Electronics Engineers) Robotics and Automation Society Pioneer Award for "his fundamental pioneering contributions to robotic assembly and its integration into product development."
- David Simchi-Levi received the Daniel H. Wagner Prize for Excellence in Operations Research Practice at the INFORMS (Institute for Operations Research and the Management Sciences) annual meeting.
- Richard Larson received a 2014 IBM Faculty Award.
- Don Lessard was presented the Pathfinder Award at the annual Engineering Project Organization Society meeting in Winter Park, CO.
- Munther Dahleh was appointed to the William A. Coolidge Professorship (effective July 1, 2014).
- Jessika Trancik was named the Atlantic Richfield Career Development Professor in Energy Studies (effective July 1, 2014).
- John Fernandez was promoted to full professor (effective July 1, 2014).

Faculty Books

- *System Architecture: Strategy and Product Development for Complex Systems*, Edward Crawley, Bruce Cameron, and Daniel Selva
- *Why Information Grows: The Evolution of Order, from Atoms to Economies*, Cesar Hidalgo

Alumni Honors

Honors received by ESD PhD alumni (some in collaboration with ESD faculty/teaching staff) include the following:

- PhD alumnus Joseph Bailey (technology, management, and policy) has been selected as an Edison Scholar with the US Patent and Trademark Office.
- SDM and ESD PhD alumna Andrea Ippolito was selected as a Presidential Innovation Fellow and will work with the US Department of Veterans Affairs.
- ESD PhD and TPP graduate Sgouris Sgouridis is now an associate professor at the Masdar Institute of Science and Technology.

Major Meetings

Statistics Conference

MIT hosted the “21st-Century Statistics at MIT” symposium on May 14 and 15, 2015. The two-day symposium offered technical presentations by thought leaders in mathematical statistics, machine learning, econometrics, and biostatistics. The symposium also provided the MIT community with a forum for discussing some of the challenges and opportunities that are redefining statistics and data science. Conference organizers included Emery Brown, Munther Dahleh, and Anna Mikusheva of MIT and Michael Jordan of Berkeley.

Alumni Advisory Council and Visiting Committee Meetings

ESD hosted meetings for its Alumni Advisory Council and Visiting Committee in fall 2014. The meetings focused on both discussing ESD and looking ahead to the transition to the Institute for Data, Systems, and Society (the name and full details of which had not been determined at that time).

Council for Engineering Systems Universities

The annual meeting of the Council for Engineering Systems Universities was held in April 2015 at the Navy Yard in Philadelphia, PA (hosted by Pennsylvania State University and Virginia Tech).

Munther Dahleh

Acting Director, MIT Engineering Systems Division

Interim Director, MIT Laboratory for Information and Decision Systems

William A. Coolidge Professor

Professor of Electrical Engineering and Computer Science

Leaders for Global Operations

The MIT [Leaders for Global Operations](#) program, now in its 27th year, is a partnership of the MIT Sloan School of Management, the MIT School of Engineering, and major companies that support the program’s commitment to excellence in manufacturing and operations. LGO offers an MBA or an SM from the Sloan School of Management and an SM from the School of Engineering.

Governance and Leadership

LGO is run by a governing board of senior officers from the managing partner companies, program co-directors, and MIT deans and is co-chaired by Jeff Wilke (LGO '93) of Amazon.com and Mick Maurer of United Technologies–Sikorsky. The operating committee, chaired by industry co-director Vah Erdekian, handles ongoing program management. The program's executive director is Thomas Roemer, who succeeded LGO founding program director Don Rosenfield in 2014.

Academic Program

The LGO curriculum offers a mix of management, engineering, and leadership courses. Students can earn their SM from one of seven engineering programs: Aeronautics and Astronautics, Biological Engineering, Chemical Engineering, Civil and Environmental Engineering, Electrical Engineering and Computer Science, Engineering Systems Division, or Mechanical Engineering. Within some of these engineering departments, students can focus on topics related to manufacturing and operations in tracks such as biomechanics, energy and environmental sustainability, information and decision systems, manufacturing systems and supply chains, ocean engineering systems management, systems engineering, and transportation.

Academic Activities

China Leaders for Global Operations

LGO students worked in China with students from China Leaders for Global Operations (CLGO), LGO's sister program at Shanghai Jiao Tong University, on two successful Lion Teams. The Verizon team provided valuable assessments of side-by-side automation and was able to deliver value to Verizon and its contract manufacturing partner, while the Apple team helped provide an assessment method for a contract manufacturing partner to select tools required for next-generation products. Students from CLGO also visited MIT in July 2015 for several days of tours, classes, meetings, and social events.

Plant Tours

Local plant tours for first-year students took place in summer 2015 at Amgen in West Greenwich, RI; National Grid in Northboro and Whitinsville, MA; Raytheon IDS and Pfizer in Andover, MA; Amazon Robotics in North Reading, MA; Quest Diagnostics in Marlborough, MA; and New Balance in Lawrence, MA.

Students on the annual two-week [Domestic Plant Trek](#) in January 2015 visited Boeing and Amazon in Seattle, WA; Nike in Portland, OR; SanDisk and Danaher in San Francisco, CA; PG&E in San Luis Obispo, CA; Raytheon in Tucson, AZ; General Motors in Detroit, MI; and Amgen in Juncos, Puerto Rico.

The weeklong [International Plant Trek](#) in March 2015 included stops in Shanghai, where students visited Caterpillar, WNC, SanDisk, and Shanghai International Port Group, and also Hanoi, where they toured Piaggio and Converse.

Global Operations Leadership Seminars

LGO students attend weekly on-campus seminars with faculty and industry experts to explore local, national, and international manufacturing, leadership, and business issues. There were 28 speakers in fall 2014 and spring 2015 (more than double the number from the previous year), including a special visit by Felipe Calderón, former president of Mexico, who spoke to selected MIT Sloan community members in a full auditorium.

Other Global Operations Leadership Seminar speakers included Cathy Arledge, vice president of business transformation at Dell Inc., and Patrick Poljan, Dell's vice president of supply chain operations; Jamie Bonini (LGO '92), vice president of the Toyota Production System Support Center; Laura Bogusch, 747 fleet chief at Boeing; Jorge Calzada, director of National Grid; Marla Kelly, director of corporate quality and Lean Six Sigma at Corning; Mick Maurer, president of Sikorsky Aircraft Corp.; Paul McKenzie, vice president of operations at Johnson & Johnson; Jim Miller, vice president of worldwide operations at Google; Mick Mountz, founder and CEO of Kiva Systems; Rory Sexton, vice president of China operations for Apple; and Kris Willburn, director of purchasing for SanDisk.

Admissions

Forty-five new students in the LGO Class of 2016 matriculated and began an intensive summer session in June. The class has an average of five years of work experience. The entering class, broken down by engineering discipline, is as follows:

- Aeronautics and Astronautics: 5
- Biological Engineering: 1
- Chemical Engineering: 1
- Civil and Environmental Engineering: 1
- Electrical Engineering and Computer Science: 3
- Engineering Systems Division: 25
- Mechanical Engineering: 15

LGO received 277 applications. Twenty-one percent of applicants were admitted, and 78% of admitted candidates accepted a place in the program.

Class of 2015 Graduates

The LGO Class of 2015 had 47 graduates in June. Each student completed a six-month internship at a partner company, leading to a master's thesis. The 2015 class had international internships in locations including Hong Kong; Shanghai; Melbourne, Australia; and La Coruña, Spain.

To date, 68% of the Class of 2015 graduates have accepted a position in a manufacturing and operations company; 88% of these positions are at LGO partner companies.

Alumni

LGO held its annual alumni conference in Austin, TX, from April 30 to May 1 with a roster of prestigious speakers from industry and academia, including several LGO alumni.

Aaron Raphel (LGO '06) continues as the official alumni voice on the LGO operating committee. An alumni advisory board headed by Kristin Toth Smith (LGO '03) continues to oversee fundraising, the annual conference, operating committee representation, and networking events. Through an organized fundraising effort, alumni contribute to three funds: the William C. Hanson, Don W. Davis, and Jan Klein Leadership Fund; the Alumni Annual Fund; and the Endowed Discretionary Fund. Portions of the funds were used for immediate needs and were distributed to support student scholarships and plant tour expenses. The alumni fundraising total was approximately \$172,000.

Partner Companies

An active student, staff, and company committee has succeeded in bringing new partners to LGO. American Industrial Partners and Bell Helicopter have joined in the past year, and other companies are in discussions to join the partnership in the coming year. As of July 2015, LGO has 27 partner companies—the largest number of active partners in the program's history—in a wide variety of industries, including pharmaceuticals and medical devices, energy, telecommunications and retail to complement our core of manufacturing firms.

Awards

Awards presented to LGO community members included the following:

- Wendi Rieb and Weng Hong Teh (both LGO '15) shared the LGO Best Thesis Award.
- Ana Garcia (LGO '16) won LGO's Harrison Smith Award.
- Iris Zielske (LGO '16) was awarded a Hugh Hampton Young Memorial Fund Fellowship for 2015–2016.
- Marissa Good (LGO '17) received a Zakhartchenko Fellowship from the Office of the Dean for Graduate Education.
- Shai Ben Nun (LGO '17) was awarded a Noyce Fellowship via the LGO admissions committee.
- A group of MIT Sloan Sports Analytics Conference organizers including Adam Traina and David Jacobs (both LGO '15) won Sloan's Henry Ford Team Award.
- Dimitris Bertsimas, the Boeing Leaders for Global Operations Professor of Management and Professor of Operations Research at MIT Sloan, won Sloan's Jamieson Teaching Award.
- Zeynep Ton, an adjunct associate professor of operations management at MIT Sloan, received a Sloan Outstanding Teacher Award for the second time.

Also of note, longtime LGO faculty member Charles Fine, the Chrysler Leaders for Global Operations Professor of Management, was named president of the newly established Asia School of Business, a collaboration with the MIT Sloan School of Management.

Thomas Roemer
Executive Director, LGO Program

Georgia Perakis
Management Co-Director
William F. Pounds Professor of Operations Research

David Simchi-Levi
Engineering Co-Director
Professor of Civil and Environmental Engineering and Engineering Systems

Vah Erdekian
Industry Co-Director

System Design and Management

[System Design and Management](#) combines cutting-edge courses from the MIT School of Engineering and the Sloan School of Management, enriching the program experience with innovative distance learning, flexible matriculation options, and an interdisciplinary perspective.

AY2015 was a year of intensive work focused on developing SDM's new curriculum. This effort, which resulted in an integrated core, was led by Professor Olivier de Weck and included a team consisting of several SDM faculty: Bryan Moser, Qi Van Eikema Hommes, Matt Kressy, Bruce Cameron, Steven Eppinger, Warren Seering, Joan Rubin, and Pat Hale. Two classes were admitted: one that matriculated in January 2014 and another that started in August 2014. The new start date enabled SDM fellows to matriculate with the majority of on-campus MIT students and afforded them more opportunity to become engaged in the wide spectrum of MIT activities that begin in the fall. Moreover, they took the new core with students in the SDM certificate program, which enabled sponsoring companies multiple pathways to develop a systems thinking capability in their organizations. A new track, Integrated Design & Management (IDM), will begin in fall 2015 and be led by Matt Kressy.

Program Communications, Marketing, and Corporate Sponsorship

SDM's marketing and admissions teams continue to be highly successful despite the challenges of marketing to, and admitting, two new SDM classes in less than one year. SDM continued to hold its highly successful series of live information evenings for local MIT alumni and others interested in SDM. SDM also offered two live virtual information sessions (now available on demand at the program's website) that were attended by more than 100 prospective students from around the world. Additionally, the program continued the MIT SDM Systems Thinking Webinar Series, which has had

several thousand registrants and on-demand viewers since its inception in November 2010. SDM also hosted close to 300 attendees at its annual conference in October 2014. Many prospective applicants and sponsoring companies learn about SDM through the program's conference and webinars.

Distance Learning

Significant upgrades continue to be made to our distance delivery capabilities. WebEx is now the standard delivery mechanism, and we have decreased the number of distance offerings to the SDM core.

Master of Engineering Management Programs Consortium

The Master of Engineering Management Programs Consortium continues to provide benefits through sharing of best practices in admissions, program content and administration, and alumni support. In addition to Stanford, Northwestern, Dartmouth, Duke, and Cornell, the University of Southern California was added as a member during 2014. Also, a new regional group was initiated in Washington, DC, joining the existing groups in Boston, New York City, and Chicago. Over 160 alumni have become members of the consortium's alumni group, and more than 30% participated in the spring national leadership meeting and alumni networking event.

Industry Partners and the MIT Graduate Certificate in Systems and Product Development

The MIT Graduate Certificate Program in Systems and Product Development is now in its 15th year, with a total of 342 students completing the program to date. Company sponsors have included John Deere, Lawrence Livermore National Laboratory, Cummins, Boeing, United Technologies Corporation, Draper Laboratory, Instrumentation Laboratory, and Biomerieux, among others. John Deere has sponsored more than 100 students through either the master's or certificate program.

Student Awards

Elizabeth Cilley Southerlan (SDM '12) won the SDM Best Thesis Award for "Using Enterprise Architecting to Understand and Investigate a Complex, Multi-Level Enterprise and to Create a Framework That Supports Enterprise Transformation."

Jillian Wisniewski (SDM '14) received the SDM Student Award for Leadership, Innovation, and Systems Thinking. Finalists included James Barkley and Gaurav Khanna (both SDM '14).

Staff

Naomi Gutierrez joined SDM as logistics coordinator and assistant career development officer.

Triet Nguyen was named finance officer for SDM and IDM.

Integrated Design and Management

The mission of the Integrated Design and Management track is to enable the learning and development of extraordinary, innovative leaders who will bring new levels of creativity, vision, and integrity to business and society. Matthew Kressy is IDM's director and founder, and Melissa Parrillo, who joined the IDM staff after five years with the SDM program, is associate director. Andrew MacInnis is a technical instructor in materials and methods. He joined the IDM staff after many years in industry designing and developing products.

The inaugural IDM cohort will commence studies in fall 2015. There are 18 students (nine male and nine female), six each with backgrounds in design, engineering, and business. The cohort will participate in a core curriculum known as the Integrated Design Lab, located in MIT's International Design Center. The studio-style course, which consists of lectures, workshops, seminars, and teamwork, meets twice weekly for five hours per day. Requirements for graduation also include completion of engineering and management foundation courses and electives along with a final project and complementary thesis.

Steven Eppinger

Co-Director

General Motors Leaders for Global Operations Professor of Management Science

Professor of Engineering Systems

Warren Seering

Co-Director

Weber-Shaughness Professor of Mechanical Engineering

Joan Rubin

SDM Industry Co-Director

Patrick Hale

Executive Director, SDM Program

Matthew Kressy

Director, IDM Track

Technology and Policy Program

The [Technology and Policy Program](#) is an interdisciplinary graduate program, formed in 1975, that educates students focusing on issues at the interface of technology, society, and the sociotechnical aspects of complex systems. TPP is dedicated to educating engineers and scientists with a desire to lead in the development and implementation of responsible technology strategies and policies to benefit humankind.

Students

TPP offers a two-year master of science program and encourages its students to pursue doctoral research in the areas of technology, management, and policy. TPP's applicant cohort is diverse, with applications coming from students in undergraduate programs around the world. Additionally, several students already taking part in other MIT graduate programs enroll in TPP each year, joining the roughly one third of TPP students concurrently pursuing a second master's or doctoral degree in another department. In AY2015, 32 students graduated with an SM in technology and policy. Approximately 20% of these students will pursue a doctoral degree following the completion of their SM. Other graduates take jobs in industry, government service, start-ups, or consulting.

Research

Many TPP students are affiliated with the MIT Energy Initiative (MITEI), where they study the challenges of energy choices, sustainability policy, and environmental responsibility. TPP students also conduct research for many other labs and centers across campus, including the Tata Center for Technology and Design, the Joint Program on the Science and Policy of Global Change, the Center for Energy and Environmental Policy Research, the Center for Complex Engineering Systems, the Computer Science and Artificial Intelligence Laboratory (CSAIL), the Sloan Sustainability Initiative, and a number of research initiatives connected with IDSS such as the Lean Advancement Initiative and the Sociotechnical Systems Research Center. In addition, a few TPP students funded at least one term with teaching assistantships.

TPP faculty lead the MIT Portugal Program (MPP) in bioengineering systems, sustainable energy and transportation, and design-inspired products, and many TPP students are pursuing collaborative international research projects in engineering systems as part of MPP. TPP students are also working with MIT and Singapore University of Technology and Design (SUTD) faculty in the development of new curricula for SUTD and, in particular, the International Design Centre.

Fellowships

TPP students received several MIT fellowships, including the Legatum, Zakhartchenko, MITEI, Tata, and Lincoln Laboratory fellowships as well as the Office of the Dean for Graduate Education Diversity Fellowship. External fellowships awarded to TPP students included fellowships from the National Science Foundation, the Fulbright Program, and Hertz in addition to fellowships from Japan, Mexico, and Turkey.

Policy Internship Program

Seventeen TPP students representing five countries traveled to Washington, DC, in March 2015. This annual trip gives students an opportunity to build professional networks with others working at the intersection of science, technology, and policy. TPP alumni arranged and hosted presentations at the National Aeronautics and Space Administration (NASA), the World Bank, SRI International, the Science and Technology Policy Institute, the Federal Emergency Management Agency, the Office of Science Technology and Policy, the US Department of Energy, and the office of US congressman Alan Lowenthal of California. During the trip, TPP hosted a networking reception for students and alumni.

During the summer of 2015, TPP funding will support a student interning at NASA. Other TPP students are participating in paid internships at various agencies and corporations including Facebook, Cardinal Wind, Booz Allen Hamilton, the China Development Bank, and Third Way.

Conferences and Workshops

TPP is a founding member of the Technology Management and Policy Graduate Consortium, which includes programs in North America, Europe, and Asia. The annual meetings of this consortium afford TPP students and ESD doctoral students the opportunity to share their research and network with students across the globe. This year's consortium meeting was hosted by Carnegie Mellon University in June 2015. More than 50 students and faculty from 11 universities participated in the event. TPP alumna and current ESD PhD candidate Morgan Edwards received the award for the best presentation. Through the generosity of a private donor, TPP was able to provide travel funds for seven TPP and ESD PhD students along with three TPP researchers and instructors.

The annual MIT Energy Conference and MIT Energy Night leadership teams featured several TPP students. Our students are involved in leadership of a number of organizations and initiatives across the Institute, including the MIT Energy Club, the MIT Clean Energy Prize, the Science Policy Initiative, the Sustainability Initiative, Graduate Women at MIT, LBGT@MIT, MIT house committees, and the Transportation Club.

Student Honors and Awards

TPP students received honors and awards from MIT and beyond. This year, students received MIT Student Leader Awards, placed third in the student case competition at the International Association for Energy Economics conference, and won the Hydro Research Foundation research award. Graduating students Jacob Rosen and Justin Montgomery received Best TPP Thesis honors for their work with Una-May O'Reilly and Francis O'Sullivan, respectively.

Student Society

Among the highlights of the year were the "Culture Nights" and the iAmbassador series, which offer international students an opportunity to give presentations about their culture and technology policy issues in their home countries. The student society introduced "Coffee Talks" this year, events that give students an opportunity to talk to each other about subjects of personal interest to them. Topics over the past year ranged from how to eat well on a graduate student stipend to tax evasion. In April, the student society organized an alumni panel discussion and TPP alumni-student mixer. Additionally, the annual "InterYear Retreat" continues to be one of the biggest events of the year.

Alumni Engagement

With more than 1,100 alumni, TPP continues to foster a strong alumni community. TPP alumni host students at their organizations during annual Washington, DC, visits. In addition, alumni support student and program initiatives, including funding for summer internships, recruitment and outreach, and support for women in technology and policy.

Leadership

Dava Newman, TPP's director for the past decade, was confirmed as NASA deputy administrator during the spring of 2015 and joined NASA in mid-May. IDSS Director Munther Dahleh will serve as interim director while the TPP faculty advisory board seeks a new program director.

Dava Newman

Director

Professor of Aeronautics and Astronautics and Engineering Systems

MIT Sociotechnical Systems Research Center

The [MIT Sociotechnical Systems Research Center](#) is an interdisciplinary research center that focuses on collaborative, holistic, systems-based approaches to complex sociotechnical challenges. SSRC comprises nine research programs, and its total research volume in FY2015 was approximately \$14.4 million.

SSRC brings together faculty, researchers, students, and staff from across MIT to study complex enterprises that span government, industry, the service sector, and health care. SSRC's partners include the following:

- Center for Biomedical Innovation (CBI)
- Consortium for Engineering Program Excellence (CEPE)
- Ford-MIT Alliance
- Geospatial Data Center (GDC)
- Materials Systems Laboratory (MSL)
- MIT Information Quality Program (MITIQ)
- Project Health
- Systems Engineering Advancement Research Initiative (SEArI)

Center for Biomedical Innovation

The mission of the [MIT Center for Biomedical Innovation](#) is to conduct collaborative research with a real-world impact on our ability to deliver safe, high-quality biomedical therapies to patients worldwide. Major initiatives in the past year included continuing efforts in biotherapeutic manufacturing innovation, risk management of economically motivated adulteration of food and drug products emanating from the global supply chain, regulatory innovation in drug approval processes, and the launch of a new initiative focused on catalyzing the evolution of real-world evidence standards to drive greater value from big data in pharmaceutical innovation. All research at CBI involves multidisciplinary teams from across the Institute working together with manufacturers, regulators, payers, and other members of the global biomedical and health care innovation ecosystem to optimize the creation and implementation of innovative solutions to complex issues that often require consensus by multiple stakeholders.

Biomanufacturing Program

Integrating the expertise of MIT Biology, Chemical Engineering, and EECS faculty, the [Biomanufacturing Program](#) (BioMAN) continued to create new innovations under a two-year \$10.5 million [award](#) from the Defense Advanced Research Projects Agency (DARPA); the aim of this work is to develop a methodology capable of delivering biotherapeutics in a small-scale manufacturing platform in a 24-hour time frame. Research focus areas include new analytical tools that allow for real-time monitoring and release of manufactured biotherapeutics and development of micro-scale manufacturing platforms and processes.

In April 2015, MIT hosted members of DARPA and the Space and Naval Warfare Systems Command for a multi-institutional site visit. The day consisted of program overviews from each collaborator, followed by lab tours and demonstrations, and was the basis for approval of an additional \$10.5 million award for the 2015–2017 option period.

In November 2014, BioMAN and the California Separation Science Society co-hosted a summit meeting, [“Real Time Release: The Path to Efficient Supply of High Quality Biopharmaceuticals?”](#) The program brought together MIT faculty and members of the industrial and regulatory communities to discuss the opportunities and challenges of implementing real-time release in the biopharmaceutical industry.

Educational Activities

The BioMAN program received financial support from the Amgen Foundation to support the Amgen-MIT Biomanufacturing Educational Initiative. The aim of the initiative is to support biomanufacturing educational efforts including the development of a massive open online course (MOOC) focusing on biopharmaceutical manufacturing; 10.03x Making Medicines for Patients: The Principles of Biopharmaceutical Manufacturing will launch on July 14, 2015, with approximately 6,000 students enrolled. This course will connect engineering fundamentals to real-world applications and show real pieces of biomanufacturing equipment in action.

Other educational initiatives include the 10.03/10.53 Advances in Biomanufacturing course. Led by Professors J. Christopher Love and Anthony Sinskey and Dr. Stacy Springs, the course (offered in both fall 2014 and spring 2015) focuses on how biopharmaceutical therapeutics are manufactured and delivered. The class has a blended format, with students learning the principles of biomanufacturing online and then going into depth with guest lecturers, including regulators and subject matter experts from industry.

In addition, CBI co-organized the “Vaccines Bioprocess and Commercialization Workshop” with University College London (UCL) in June 2015. This three-day workshop explored critical issues at the various stages of vaccine development. With contributions from MIT, the Bill and Melinda Gates Foundation, the Biomedical Advanced Research and Development Authority, and international experts, attendees developed an understanding of the research, operational, and regulatory challenges of the vaccine market. With sponsorship from the Gates Foundation and KBI Biopharma, 10 individuals from less economically developed countries were able to attend.

Consortium on Adventitious Agent Contamination in Biomanufacturing

The [Consortium on Adventitious Agent Contamination in Biomanufacturing](#) (CAACB) focuses on mitigating the risk of adventitious agent contamination in biomanufacturing through collaborative research between MIT and sponsors (25 biopharmaceutical manufacturers and technology and service providers). The consortium is currently involved in three major projects: an industry-wide assessment of viral contamination experiences, an examination of best practices in risk assessment, and an evaluation of the most effective and economic options available to harmonize media treatment data.

During the past year CAACB hosted two workshops at MIT, one in December 2014 (“How to Handle a Virus Contamination”) and the other in May 2015 (“The Science and Practice of Decontamination”). Details on research project outcomes were presented at the ISBiotech meeting in October 2014, during Biopharmaceutical Production and Development Week in April 2015, at the Parenteral Drug Association Virus and TSE Forum in June 2015, and at the MIT-UCL Vaccines Bioprocess Development Workshop in June 2015. Two white papers are forthcoming within the next year.

NEW Drug Development ParaDIGmS

The mission of [NEW Drug Development ParaDIGmS](#) (NEWDIGS) is to more reliably and sustainably deliver new, better, affordable therapeutics to the right patients faster. NEWDIGS is continuing its work on pharmaceutical regulatory policy innovation through its role as the only non-European Union participant in a consortium of 22 public and private partners charged with driving relevant research strategies for the EU.

In January 2015, NEWDIGS hosted a multi-stakeholder workshop focused on evaluating and enhancing real-world data systems globally to improve decision making in pharmaceutical innovation. In March 2015, the program hosted “Advanced Analytic Methods in Pharmaceutical Innovation,” an invitational forum on health data that explored emerging research opportunities in the areas of data analytics, decision making, and policy. In October 2014, NEWDIGS co-hosted the “Better Science, Better Health: New Trial Pathways and Better Patient Data” conference in London, which exposed a large global audience to emerging perspectives from NEWDIGS activities.

Sponsored Research Projects

This is the second year of a project, “Addressing Nontraditional Adulteration of FDA-regulated Food and Drug Products and Ingredients Emanating from the Global Supply Chain,” involving a collaboration among faculty, staff, and students from Sloan, CSAIL, and CBI. The project, funded by the Food and Drug Administration (FDA), focuses on China, the third largest source of food imports to the United States. Thus far in phase 1, we have completed a preliminary mapping of potential data sources, assessing their relevance and identifying potential gaps and technical challenges; constructed a large, searchable database of food adulteration incidents; and identified risk drivers for intentional adulteration. Our work suggests that some of these new data sources have the potential to inform or improve sampling strategies for some commonly adulterated products such as shrimp and honey.

Community

Current participants in CBI's research and educational activities include the following.

Industry

Aetna
 Allscripts
 Amgen
 Aquafine BioProcess
 Asahi Kasei
 Baxter
 Biogen
 BioMarin
 bluebird bio
 BlueCross BlueShield
 Boehringer Ingelheim
 Bristol-Myers Squibb
 CSL Behring
 Eli Lilly
 EMD Millipore
 Genentech
 Genzyme
 GlaxoSmithKline
 Histogenics
 KBI Biopharma
 Latham BioPharm Group
 Life Technologies
 MedImmune
 Merck and Co.
 Merck Serono
 Millennium Pharmaceuticals
 Novartis
 Pall Corporation
 Pfizer
 Sanofi
 Sanofi Pasteur
 Shire
 Sigma-Aldrich Fine Chemicals

Government Agencies

Defense Advanced Research Projects Agency
 European Medicines Agency
 Health Canada
 National Institute of Standards and Technology
 National Institutes of Health
 Netherlands National Health Care Institute
 Singapore Health Sciences Authority
 UK Medicines and Healthcare Products Regulatory Agency
 UK National Institute for Health and Care Excellence
 US Food and Drug Administration

Academia (including teaching hospitals)

MIT (School of Science, School of Engineering, Sloan School of Management, and School of Humanities, Arts, and Social Sciences)
 Beth Israel Deaconess Medical Center
 Georgetown University
 Harvard Medical School
 Massachusetts General Hospital
 National University of Singapore
 Northeastern University
 Rensselaer Polytechnic Institute
 Tufts Medical School
 University College London

Other

Bill and Melinda Gates Foundation
 California Separation Science Society
 Canadian Agency for Drugs and Technologies in Health
 European Federation of Pharmaceutical Industries and Associations
 European Network for Health Technology Agencies
 Innovative Medicines Initiative
 Patient-Centered Outcomes Research Institute
 Robert Wood Johnson Foundation

Paula (Gigi) Hirsch

Executive Director, Center for Biomedical Innovation

Consortium for Engineering Program Excellence

The fundamental and collaborative applied research efforts of the [Consortium for Engineering Program Excellence](#) focus on improving program performance by examining the relationships and interactions between diverse functions and stakeholders involved in complex engineering programs. The research is framed through the lenses of the program management, systems engineering and product development, lean management, and organizational change fields. CEPE's strategic partners in this work are the Project Management Institute (PMI) and the International Council on Systems Engineering. In October 2014, CEPE presented findings from its study on the integration of program management and systems engineering at the PMI Global Congress in Phoenix, AZ, and the 122nd American Society for Engineering Education Conference in Seattle, WA. CEPE researchers also completed a global survey on the integration of program management and systems engineering to validate its evolving integration framework. Significant effort was expended over the past year to prepare a book capturing the insights from this ongoing study, with a resulting publication expected in 2016.

Four CEPE-advised master's theses were completed during the past year, contributing to forthcoming presentations. Additional future publications based on the research associated with these theses are planned or under way. Two papers were published in peer-reviewed journals during this reporting period.

Professor Warren Seering is CEPE principal investigator and Dr. Eric Rebentisch is research lead.

Ford-MIT Alliance

The [Ford-MIT Alliance](#), an Institute-wide initiative, was established in 1998. In 2013, the alliance began a fourth phase that will renew automatically each year for the foreseeable future. The alliance is the Institute's longest-running large-scale collaboration with industry. Since 1998, the alliance has funded more than 150 projects across the Institute, with a total investment to date by Ford of more than \$50 million.

The Ford-MIT Alliance research portfolio is managed by an operating committee that includes the initiative's co-directors, Professor Jonathan How and Ed Krause, Ford's global manager for external alliances, research, and advanced engineering. This group reports to an executive committee that includes Karen K. Gleason, associate provost and Alexander and I. Michael Kasser Professor of Chemical Engineering, and Ken Washington, vice president of research and advanced engineering at Ford. The alliance holds executive committee meetings on campus at least once annually.

MIT Information Quality Program

The [MIT Information Quality Program](#) focuses on pragmatic solutions to information quality problems related to the collection, storage, and use of data in enterprise systems. Research continues on the roles, responsibilities, and functions of chief data officers. MITIQ conducts research in the financial, health care, and technology industries and in government and military organizations, focusing on emerging trends, technologies, and policies. Research has also investigated the application of semantic technology to the

integration of unstructured, semistructured, and structured information in trade space decision analyses for defense capability requirements. Research on semantics of data in the financial industry addressed questions of formal semantic information integration in support of systemic risk regulatory mandates. Cybersecurity research builds on MITIQ methods for mapping the flow and control of information through extended enterprises. Issues addressed in these settings parallel concerns in many other areas in government and private industry.

During the year, MITIQ sponsored the 4th Annual Chief Data Officer Forum in Arlington, VA, and (with SSRC) the 8th Annual Chief Data Officer and Information Quality Symposium on the MIT campus. Both events focus on information quality and data science. Dr. Rich Wang is MITIQ director.

Materials Systems Laboratory

The [Materials Systems Laboratory](#) studies the strategic implications of materials and materials processing choices and works jointly with corporate, government, academic, and industrial consortia as research partners. MSL's research seeks to understand the competitive position of materials in specific applications, such as assessments of different candidate materials and process technologies and evaluations of the economic and non-economic consequences of each alternative. MSL also evaluates the promise and limits of materials, processes, and designs; identifies specific areas of improvement for each alternative that will improve its competitiveness; and determines the best-case scenario for each option.

Professor Joel Clark is the faculty director of the Materials Systems Laboratory, Richard Roth is the lab's director, and Dr. Randolph Kirchain (ESD PhD) is the principal research scientist. A list of [current projects](#) and [recent publications](#) is available on the lab's website.

Project Health

[Project Health](#) is an interdisciplinary research program that offers an integrative and holistic approach to and perspective on creating more effective and efficient health and health-related systems.

MIT faculty and researchers collaborate with government and industry to bring a systems approach to civilian and military health care access and treatment. Project Health seeks opportunities to further explore health care challenges and work innovatively across boundaries.

The [MIT Post-Traumatic Stress Innovations \(PTSI\) project](#) is using social science methodologies and strategic analysis of organizations to examine the continuum of care for service members and their families affected by posttraumatic stress. The project focuses on organizational policies, structures, processes, technology, information and resource flows, and stakeholder relationships. PTSI is sponsored by the US Army Medical Research and Materiel Command in cooperation with the leadership of the Military Health System and extends across the leadership and populations of the Army, Navy, and Marines. It completed its third of four years staffed by four faculty, five PhD researchers, and eight student research assistants.

MIT, along with six other universities, is a member of a partnership with the United States Agency for International Development (USAID) to help alleviate poverty in the developing world through the use of science and technology. There are two major components of this partnership, the Comprehensive Initiative on Technology Evaluation (CITE) and the International Development Innovation Network. CITE evaluates technologies to help donors and policymakers pursue the best solutions for challenges in the developing world. SSRC is part of this groundbreaking interdisciplinary effort.

Systems Engineering Advancement Research Initiative

The [Systems Engineering Advancement Research Initiative](#) leads MIT's continuing participation in the Systems Engineering Research Center (SERC), a US Department of Defense University Affiliated Research Center (UARC). Also, SEArI collaborates with other universities involved in the SERC research program, including Georgia Tech, the University of Southern California, the University of Virginia, and Pennsylvania State University. Several research projects continued with government agencies in the United States as well as with the Naval Postgraduate School, Draper Laboratory, Lincoln Laboratory, and NTNU (Norwegian University of Science and Technology). Twelve graduate students (both master's and doctoral level) from several degree programs and one visiting graduate student performed research with the group.

The SEArI team published and presented nine conference papers; published two journal papers, one coauthored book, and one book chapter; and presented three invited talks. SEArI won the annual UARC Best Student Research Paper Award and received the Best Academic Paper Award at the 2015 Conference on Systems Engineering Research.

Olivier de Weck

**Co-Director, Center for Complex Engineering Systems at KACST and MIT
Professor of Aeronautics and Astronautics and Engineering Systems**

MIT Center for Transportation and Logistics

For over 40 years, the [MIT Center for Transportation and Logistics](#) has been a world leader in supply chain management, logistics, and transportation education and research. The center's world-renowned research programs directly involve more than 80 faculty and research staff from a wide range of academic disciplines, as well as researchers in various affiliate organizations around the globe. In education, MIT is consistently ranked first among graduate business programs in logistics and supply chain management. CTL was involved in 102 active research projects in FY2015. Major projects and initiatives are described below.

MIT Global SCALE Network

The [MIT Global SCALE \(Supply Chain and Logistics Excellence\) Network](#) continued to enhance its offerings. CTL is exploring additional centers in China, India, and other global logistics hubs.

Center for Latin-American Logistics Innovation

The [Center for Latin-American Logistics Innovation](#) (CLI) has cultivated deep relationships with 22 top Latin American universities and institutions in the region. It currently has 14 full-time research staff and, as an official national center of excellence, has access to government grants and various thought leadership opportunities.

The flagship CLI academic initiative is the Graduate Certificate in Logistics and Supply Chain Management program. The program's 2016 class includes 42 outstanding students selected from among 52 candidates, most of them proposed directly by members of our network of partner universities throughout Latin America. This seventh cohort has the highest female-to-male ratio so far in the program's history (36%). Represented in the class are a total of 20 universities from nine countries in Latin America: Argentina, Brazil, Chile, Colombia, Ecuador, Mexico, Peru, Uruguay, and Venezuela. In its previous six cohorts, the program has graduated 145 students, hosting them twice at MIT (first in July and then in January, each for a period of three weeks) alongside students from CTL, the Zaragoza Logistics Center, and the Malaysia Institute for Supply Chain Innovation.

The second CLI initiative in education is to "teach the teachers" through a series of English-language academic workshops that take place annually at various venues in the region. The latest workshop took place in November 2014 on the MIT campus following a series of meetings in the United States, Panama, Colombia, Brazil, Ecuador, and Peru. Also available at the faculty level are three- to six-month visiting research fellow positions at CTL. In the past five years, 11 faculty members have taken advantage of this program: three from Mexico; two each from Colombia, Chile, and Brazil; and one each from Panama and Ecuador. Visiting faculty stays are focused around research themes. The next academic workshop will be hosted in Argentina in October 2015, and a larger conference is scheduled for March 2016.

Corporate education is CLI's third educational initiative. The center currently has 13 corporate partners with which it develops a wide range of executive and collaborative research. To date, more than 100 collaborative projects with industry have been successfully completed.

Zaragoza Logistics Center

In AY2015, the [Zaragoza Logistics Center](#) (ZLC) included seven faculty members, nine researchers and doctoral students, and 20 professionals in the areas of finance, marketing, information technology (IT), human resources, and education and research management.

In May, 50 students from 16 countries attended their graduation ceremony at the University of Zaragoza. The students came from the 13th class of the Master en Dirección de Supply Chain (MDSC) program, the 10th class of the MIT-Zaragoza Master of Engineering in Logistics and Supply Chain Management (ZLOG) program, and the MIT-Zaragoza PhD in Logistics and Supply Chain Management program. Three dual-degree agreements have been signed with Feng Chia University in Taiwan, USAT in Peru, and the Institute of Management Technology in Dubai.

In 2015, for the fifth consecutive year, the ZLOG program was ranked first in the field of logistics in *El Mundo's* rankings of the 250 best master's programs in Spain. One ZLOG graduate received the Emerging Leader Award from the Council of Supply Chain Management Professionals for her contributions to and future influence on the industry. The MDSC program has been revamped in terms of its student profile, subjects, and instructors. Graduates of the program won the Foro Pilot Award for the best MDSC master's thesis and the Asociación Empresarial PLAZA Award for the most innovative master's thesis.

The MIT-Zaragoza doctoral program had six students during this academic year. Twenty PhD students from universities all over the globe participated in the seventh edition of ZLC's annual four-week PhD summer academy. The academy's prestigious instructors came from the University of Bologna, Tilburg University, Ohio State University, the University of South Carolina, and the University of Virginia.

More than 250 professionals participated in different executive education programs and workshops in supply chain management designed and taught by ZLC and MIT SCALE faculty, including "From Big Data to Action: Supply Chain Control Towers," an executive course for the Spanish military; the "Planning for a Stronger Supply Chain in Pharmaceutical and Chemical Industries" workshop in Basel; and the Global Supply Chain Research Forum. Highly acclaimed speakers from universities and multinational companies around the globe participated in the MIT-Zaragoza speaker series organized at ZLC. In addition, international representatives visited ZLC, including Vicente Fox, former president of Mexico.

Over the past year, there were 16 ongoing research and development projects at ZLC. Funding sources included the European Commission (nine projects), private companies (six projects), and the Centre for Industrial Technological Development (one project). Moreover, in May 2015, ZLC signed a master collaboration agreement with Procter & Gamble as a benchmark center in logistics education and research. ZLC is now the leader in Spain in terms of research and development projects in the area of logistics and supply chain management. ZLC has continued its participation in the Alliance for Logistics Innovation through Collaboration in Europe (ALICE), the European technology platform in logistics. ALICE provides input to the European Commission to shape the European logistics research agenda. ZLC's director is a member of the group's steering board and participates in four of its five working groups (supply chain security, synchronomodality, collaboration, and urban logistics).

Research at ZLC has resulted in nine articles in peer-reviewed journals, including the *European Journal of Operational Research*, *Production & Operation Management*, and the *Journal of Supply Chain Management*; in addition, several research reports have been submitted, and six other articles have been accepted. ZLC faculty and research staff presented their research findings at key national and international conferences. Also, ZLC was awarded the Badge of Honor from the Zaragoza School of Economics.

In addition, ZLC had a direct financial impact on the local community: it is estimated that, over the past four years, more than five million euros have been spent in Aragón by ZLC visitors and students from outside Spain.

Malaysia Institute for Supply Chain Innovation

The [Malaysia Institute for Supply Chain Innovation](#) (MISI), launched in 2011 by the Malaysian prime minister as a joint initiative with MIT, is now in its fourth operational year as an institute of higher learning.

The full-time master of science in supply chain management (MSCM) program had its third intake of students in August 2014, with 23 students from 11 different countries enrolling. In January the MSCM students, together with two high-achieving students from the part-time master of science in supply chain management (PSCM) program, attended the annual CTL Independent Activities Period (IAP) program in Boston. Student thesis projects were sponsored by Schlumberger, SNT Global, Starbucks, Procter & Gamble, CHR Hansen, Mead Johnson, Ralph Lauren, Hershey, BASF, and Hanes. The PSCM program had its third intake of nine students in January, with a total of 26 students currently in the program. The PhD program proposal is now under review with the Malaysian Qualification Agency, with the expectation of the program beginning in 2016.

The third class of MSCM students successfully graduated in May 2015. Joseph Y. Yun, the American ambassador to Malaysia, inaugurated the convocation; also in attendance were the MISI Board of Governors, representatives from industry, and student families and friends. The graduating class did well on the job market, meeting job placement expectations in terms of both salary and position. Students received job offers from such companies as Cummins, ZF, CGN, BASF, Lazada, PwC, Celcom, and Amazon.

The MISI Supply Chain Leadership and Innovation Program continues to offer training programs in Singapore. Eight senior executives are currently involved in the program, and there are 14 alumni. In January, MISI's Resident Training Program hosted a one-week session for 34 master of science finance students from Kazakh Economic University. In addition, training programs were held for Continental and BASF, and Professor Steve Graves from MIT Sloan offered two seminars for industry representatives, students, and faculty.

MISI hosted a Procter & Gamble Palm External Advisory Panel workshop in February. The Procter & Gamble leadership team explored the complexity of the supply chain for sustainable palm oil and palm kernel oil.

MISI now has eight permanent faculty, two researchers, and an administration support staff of 14. In AY2015, MISI faculty had several articles accepted and published in the areas of supply chain strategy, supply chain risk management, port logistics, and maritime and intermodal logistics.

MISI will co-host the 2015 International Association of Maritime Economists conference, a first for Malaysia and Southeast Asia; the conference will be held in August, and over 300 attendees are expected.

On June 30, CEO and rector Mahender Singh left MISI to pursue new career opportunities. David Gonsalvez, previously executive director of the Zaragoza Logistics Center, was appointed as the new CEO and rector.

Supply Chain Management X-Series

In fall 2014, CTL launched and ran the first of three edX online courses as part of the MITx X-Series in Supply Chain Management. The X-Series consists of three courses: CTL.SC1x Supply Chain and Logistics Fundamentals, CTL.SC2x Supply Chain Design, and CTL.SC3x Supply Chain Strategy. More than 30,000 students registered for CTL.SC1x, which ran for 11 weeks (September to December). A total of 2,200 students successfully completed the course and earned a certificate. There was substantial demand for repeating this course, so it was offered again in summer 2015 with over 20,000 registrants. The plan is to offer SC2x in fall 2015 and the final course, SC3x, in spring 2016, after which the courses will be offered continuously in sequence.

MIT Responsible Supply Chain Lab

Initiated in 2015 as an outgrowth of prior work in sustainable supply chains, the [Responsible Supply Chain Lab](#) (RSC) was formed to examine the multitude of issues surrounding reducing the social and environmental impacts of supply chains.

Existing projects include a forthcoming book on sustainable supply chains, a Procter & Gamble–sponsored project investigating the sustainability and traceability of the palm oil supply chain, and a broad analysis of commodities (existing challenges, current solutions, and future innovations).

The lab is currently initiating research collaborations with other entities across MIT, including the Sloan School of Management and the Abdul Latif Jameel World Water and Food Security Lab. In addition, RSC is cooperating with and hosting visiting students from international universities such as Politecnico Milan in Italy and Instituto Superior Técnico in Portugal. In August, the lab will host a workshop on biodiesel fuel in Mexico City in cooperation with UNAB; the event will be funded by a grant from the MIT International Science and Technology Initiatives (MISTI).

In November, RSC will hold a symposium titled “Supply Chain Traceability: Ensuring Responsible Supply Chains through Technology and Multi-Stakeholder Collaboration.” The symposium will bring together industry, government, nongovernmental organizations, and academics to discuss the issue of traceability with the goal of increasing and verifying sustainability in global and opaque supply chains.

MIT Megacity Logistics Lab

Starting in 2012 as an outgrowth of research activities in logistics and supply chains in emerging markets, CTL created the [Megacity Logistics Lab](#) (MLL) to focus on understanding and transforming the supply chains that interface with megacities.

MLL has secured seed funding from AB InBev, Nanjing Samples Technologies, the New England University Transportation Center, MISTI, the Itaú Foundation, and the International Research Opportunities Program office to support partnerships, workshops, and data collection efforts in a number of cities around the world (Beijing, Bogotá, Casablanca, Kuala Lumpur, Madrid, Mexico City, Rio de Janeiro, Santiago, and São Paulo).

More than 300 people from business, academia, and government have participated in MLL activities. Eighteen MIT students, including 10 undergraduates, have experienced firsthand the challenges of freight movement. MLL has also hosted doctoral students from Portugal, Germany, Mexico, Brazil, and Chile as it builds its research agenda.

In 2013, MLL launched the first “global urban logistics atlas” with the goal of providing policymakers and logistics managers with standardized, detailed, and context-specific information on patterns of logistics intensity in megacities. A second version of the logistics atlas was launched in 2014, including new data collected in Mexico City, Bogotá, Santiago, and Singapore. MLL has also developed partnerships within MIT with other related initiatives such as City Science, the Center for Advanced Urbanism, and the Singapore-MIT Alliance for Research and Technology. MLL continues to work directly with policymakers in Mexico City and Santiago to support urban redesign plans that take into account logistics flows.

MIT Hi-Viz Project

The **Hi-Viz** (high visibility) project seeks to establish an automated system that will create near-real-time, board-ready displays of a company’s end-to-end supply chain and highlight areas of risk or concern on those displays. CTL partnered with Sourcemap.com, a start-up company formed by a recent MIT PhD student, in implementing the initiative. The initial three-year research project, which concluded in March 2014 and was complemented by two master’s theses, succeeded in creating two valuable high-level displays of the supply chain: an interactive map and an interactive material flow diagram. Metrics highlighted atop these displays include inventory levels, recovery times, risk exposure, value at risk, and customer blackout days resulting from the loss of network suppliers. Along with geo-emergency alerts added to the displays, initial progress was achieved in adding geo-based underlying (baseline) natural disaster probabilities to each node in the supply chain. As a result of this project, one large multinational sponsor has launched an internal IT project to build a global working version of the Hi-Viz software for its private internal use.

The current focus of the project is on leveraging the strong actuarial expertise of the property insurance industry and that industry’s modeling efforts to develop methods to determine the probability of future supply chain disruptions. To that end, MIT is working with AIR-Worldwide (a division of Verisk, an analytical firm that calculates natural disaster-based loss probabilities for the insurance industry) to find correlations between natural disaster characteristics and probabilities and supply chain disruption severity and durations. This work will enable the Hi-Viz software to receive a feed of both baseline disaster probabilities and real-time event-driven probabilities.

Supply Chain 2020 Project

The [Supply Chain 2020 Project](#) (SC2020)—launched in 2004 to address the issue of preparing supply chains for future challenges and later refocused to develop a toolkit rethinking supply chain strategies—is reaching its conclusion. The ideas on supply chain strategies generated through the project—and already tested in half a dozen initiatives with several organizations, including Fortune 100 companies, the United Nations, and the federal government—are now being documented in a series of papers for submission to peer-reviewed journals.

MIT Humanitarian Response Lab

The [Humanitarian Response Lab](#) (HRL) completed the second year of its major research project with the [MIT Comprehensive Initiative on Technology Evaluation](#) (CITE), supported by a five-year grant from USAID. CITE published a multidisciplinary evaluation focused on solar lanterns in Uganda, and fieldwork was completed for new evaluations of water filters, malaria diagnostics, and smallholder farmer crop storage in various countries. Putting its research into practice, HRL directly supported the Ebola response in West Africa through the new Academic Consortium to Combat Ebola in Liberia (ACCEL), which included the University of Massachusetts Medical School and Boston Children’s Hospital/Harvard Teaching Hospitals. Leveraging a [\\$7.5 million grant from the Paul G. Allen Family Foundation](#), ACCEL delivered safety training and 80 tons of essential personal protective equipment to more than 2,200 health care and sanitation workers in all 21 government hospitals in Liberia. This intervention allowed the hospitals to safely reopen and offer health services. Information on other HRL projects is available at the lab’s website.

Logistics Clusters

In October 2012, Professor Yossi Sheffi’s book *Logistics Clusters: Delivering Value and Driving Growth* was published by the MIT Press. The book won the Professional and Scholarly Excellence Award from American Publishers and is now in its sixth printing. The Spanish edition that came out in 2014 is selling very well in Latin America, and a paperback edition of the English version was published in 2015. Also, a Chinese version is in the works. Over the past year, book-related events were held in Mexico City, Santiago, Buenos Aires, and Lima. Related research projects are taking place in Iceland, Mexico, Spain, Colombia, and Michigan. Several papers were published on the subject.

Corporate Resilience

Professor Sheffi’s book *The Power of Resilience: How Leading Companies Prepare for the Unexpected* is scheduled to be published in September 2015. The book is a culmination of four years of research extending the work described in Professor Sheffi’s 2005 bestseller *The Resilient Enterprise*, which has been translated into 17 languages and has won several prizes.

MIT FreightLab

The [MIT FreightLab](#) was very productive this year, with more than half a dozen graduate students, postdoctoral candidates, and researchers participating in

various activities. Work was focused on teaching graduate-level courses, advising master's thesis projects, continuing work on long-standing research initiatives, and running executive roundtables. The FreightLab continued to offer ESD.266 Freight Transportation Systems & Analysis, which was attended by 22 students from the Departments of Engineering, Management, and Urban planning.

FreightLab students produced six master's theses on topics that ranged from developing optimal store delivery frequencies, understanding the relationship between rates and level of service, to measuring the volatility of spot rates. The multi-year promotion collaboration project with Procter & Gamble continued and focused on the potential of transportation changes to improve overall promotion performance.

New England University Transportation Center

MIT was competitively awarded the US Department of Transportation's grant for the [New England University Transportation Center](#). This consortium of universities includes MIT as the lead institution along with the University of Connecticut, University of Maine, University of Massachusetts, and Harvard University.

The grant will be used to support students, researchers, and faculty in the further development of a living laboratory in Cambridge, the Massachusetts Avenue Area Living Laboratory (MALL), with an urban landscape from Harvard Square to Memorial Drive. MALL is the first project of its type to create a platform for research and education in technology development and deployment, travel behavior, retail and commercial development, architecture, and design with a special focus on disadvantaged populations.

AgeLab

[AgeLab](#) has grown in the number of students, staff, and faculty from engineering, social and behavioral sciences, and management as well as from Harvard Medical School. AgeLab now enjoys sponsorship from corporations in multiple industry sectors addressing the needs of an aging society (e.g., retail, auto, financial services, pharma, consumer electronics, and consumer products). AgeLab is recognized worldwide as an innovator in understanding the demands of an aging society and its impact on various complex systems including transportation, health, finance, and community development. The lab is now conducting collaborative research projects with colleagues at the Media Lab, CSAIL, and the Departments of Urban Studies and Planning, Brain and Cognitive Sciences, Civil and Environmental Engineering, and Mechanical Engineering. Last year AgeLab conducted experiments and fieldwork that involved nearly 1,200 participants on campus along with approximately 10,000 individuals from five countries who took part in field trials of hardware, surveys, focus groups, and in-depth interviews.

Port Resilience Project

CTL is a funded partner in the [Maritime Security Center](#), a Department of Homeland Security (DHS) Center of Excellence in port and maritime security. The [MIT Port](#)

Resilience Project was initiated to focus on developing resilient and secure ports and has contributed to the DHS initiative since July 2008.

The Port Resilience Project builds upon CTL's deep and continuing research on supply chain resilience, supply chain risk management, and supply chain security. MIT's role in the Center of Excellence is developing the principles and actions for making ports resilient to disruptions.

In FY2015, the Port Resilience Project team maintained the Port Mapper online application and conducted funded studies to create a port resilience decision framework toolkit. The US Coast Guard has used Port Mapper in response to three major hurricanes (most notably Hurricane Sandy in 2012) and, as a result of its use of the application, has suggested modifications that have led to improvements in the tool.

In the upcoming year, the MIT Port Resilience Project team will continue to build out the port resilience decision framework toolkit in addition to studying the current dynamics associated with port resilience in the domestic maritime transportation domain.

Outreach

The foundation of CTL's corporate outreach is the Supply Chain Exchange, believed to be the largest and most active membership program in the supply chain management field.

Corporate Relations

During FY2015, CTL dropped four companies from the Supply Chain Exchange: Amazon, DHL, Limited Brands, and Ralph Lauren. CTL continues to maintain and nurture its relationships with these companies and expects some to resume active membership in FY2016. Eight companies were added as partners to the exchange: B2W, Evergreen, FedEx, Genentech, MHI, OnProcess, Ryder, and Verisk.

Events

The Center for Transportation and Logistics hosted the sixth annual partners meeting on March 25, 2015, which convened key contacts from CTL's partner companies for a review of research and customer feedback and input sessions. This year's CTL Crossroads Conference focused on the innovations driving another decade of revolutionary change in the supply chain world. The conference featured experts from MIT speaking about the technologies that are likely to affect supply chain management in the future.

CTL held two sessions (in January and June) of its major supply chain management executive education course, "Supply Chain Management: Driving Strategic Advantage." In addition, CTL conducted custom scenario-planning workshops at partner locations.

On January 21, CTL held its seventh annual networking night/poster session. Approximately 140 students from the SCALE Network programs (CTL, ZLC, CLI, and MISI) presented over 80 thesis projects to more than 80 representatives from 50 companies.

CTL also hosted the following events for Supply Chain Exchange partners:

- Supply Chain Leadership Workshop, October 15, 2014
- Doing Business Digitally Roundtable, October 16, 2014
- [Improving Containerized Flows Through Information Exchange Teleconference](#), December 3, 2014
- Supply Chain Sustainability at Procter & Gamble Headquarters, January 6–7, 2015
- End to End Visibility Roundtable, May 12, 2015
- Research Fest (student thesis final presentations), May 22, 2015

Personnel

In FY2015, new hires and appointments at CTL included Hillary Abraham, technical associate; Chris Cassa, lecturer; Alex Fridman, postdoctoral associate; Kirsten Greco, academic administrator; Katharina Koenig, postdoctoral associate/fellow; Adam Lovett, administrative assistant I; John Lyons, short-term lecturer; Richard Myrick, research associate; Colin Parmalee, financial assistant I; Anthony Pettinato, technical assistant; Daniel Steeneck, postdoctoral associate; and Gregory Steinbruner, short-term lecturer.

In addition, visitors to CTL included visiting military scholars Lt. Col. Frederick Crist, Lt. Col. Jeffrey Eget, and Col. Eric Robinson and domestic and international visiting scholars Adriana Gabor, Lino Guimaraes Marujo, Marianne Jahre, Gilberto Montibeller, Raul Morales Salcedo, Lourdes Munoz Gomez, Eva Ponce, and Michael Veach.

Departures from CTL included Jennifer Ademi, Daniel Belyusar, Arielle Burstein, Angelina Gennis, Martin Lavalliere, Daniel Munger, Lauren Parikhhal, and Shalom Saar.

Yossi Sheffi

Director, MIT Center for Transportation & Logistics

Elisha Gray II Professor of Engineering Systems and Civil and Environmental Engineering

MIT Supply Chain Management Program

The [MIT Supply Chain Management Program](#) continues to receive six to seven times as many applications as there are available slots in the program. SCM collaboration with other SCALE programs (Malaysia, Latin America, and Spain) continues to increase, with cross-center teams and international travel. All SCALE students congregate at MIT in January for an intense month of team projects, lectures, workshops, and presentations, followed by a one-week trek to Spain, China, or Panama.

SCM has established the MIT Supply Chain Excellence Award at 11 undergraduate programs in nine leading US universities. The award is given annually to the most outstanding graduating supply chain or industrial engineering major in each school

(only US citizens are eligible). To date, 16 students have won the award, and 10 have received honorable mentions. Winners and honorable mention recipients are given a partial scholarship to attend SCM.

2015 Class

In spring 2014, 40 students (8 women and 32 men) were selected from more than 300 applicants to join the SCM program as its Class of 2015. Students came from 20 countries; their average age was 29 (ranging from 24 to 38), and they had an average of five years of professional experience.

A total of 60 companies recruited SCM students in 2014–2015. All of the students who sought employment had received job offers by graduation. SCM students received an average 64% boost in salary, with the average outgoing annual base being \$115,000 (ranging from \$77,000 to \$145,000).

Thesis Partners

Nineteen companies participated as Supply Chain Exchange thesis partners. This year's projects included:

- Portfolio Segmentation to Optimize Agility (medical device company)
- Transportation Strategy (food products company)
- Sourcing Road Map (industrial services organization)
- SKU Clustering for Planning Efficiency (beverage retailer)
- Impact of Complexity on Inventory (consumer goods company)
- Customer Promotion Collaboration (consumer goods company)
- Orderless Supply Chain (consumer goods retailer)
- Risk Mitigation for Shippers and 3PLs (third-party logistics organization)
- Do Higher Truck Rates Mean Better Service? (third-party logistics organization)
- Statistical Sales Forecasting (Batteries) (automobile manufacturer)
- Global Distribution Center Optimization (uniform rental company)
- Creative Logistics Network for Store Props (luxury apparel company)
- Mapping Supply Chain Risks of Tier 2 Suppliers (chemical company)
- Ecommerce Fulfillment (Cold Chain) (chocolatier)
- Supply Chains for Health Access in Africa (pharmaceutical company)
- Assessing Supply Chain Resiliency (computer company)
- Optimal Store Delivery Frequency (big box retailer)
- Translating Forecasts in Operations (drug retailer)
- The Freight Forwarders Bidding Dilemma (freight forwarder)
- US Distribution Channel for Moroccan Artisans (nonprofit organization)

- Inventory & Sourcing x SC Risk (medical device company)
- Primavera Perfect Visibility into SC Flow (food manufacturer)
- Business Continuity Plan for US SC (luxury apparel company)
- Distribution for Southern Africa (pharmaceutical company)
- Certified Receiving Using SPC (major drugstore chain)
- Speed to Market SC Design (apparel and general merchandise retailer)
- Scenario Planning (chemical company)

Alumni Interaction

The SCM program has more than 500 alumni, in addition to 450 alumni from other SCALE centers. SCM alums are working on six continents in myriad industries.

CTL held its 10th annual alumni reconnect event in May 2015; the theme was “The Supply Chain Perspective: Tackling Challenges through the SCM Lens.” Panelists included Raj Narayanaswamy '09, manager of strategic operations at A.T. Kearney; Lauren (Shear) Zinner '09, deputy country director, Clinton Health Access Initiative; Gautam Kuper '07, senior manager at Monitor Deloitte; Kapil Dev Singh '04, founder and CEO of Mishmi Takin SportsGear; and Esme Fantozzi '03, head of maintenance contracts, Kazakhstan Shell.

Our alumni continue to make frequent use of the [SCM/SCALE Alumni Job Board](#), an online database of available positions, and new jobs are posted consistently.

Bruce Arntzen

Executive Director, MIT Supply Chain Management Program