

sdm pulse



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SDM Announces Academic and Operational Evolutions

By Pat Hale, MIT SDM Executive Director

All successful organizations know that it's not just risky but dangerous to rest on their laurels. Whether it's IBM or SDM, no matter what the industry, the key to success is innovation.

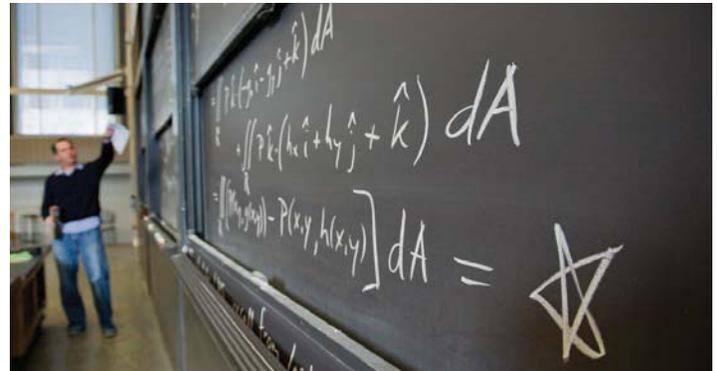


Photo by Christopher Harting

This is especially true at MIT, where some of the world's leading thinkers set the pace for leadership, innovation, and systems thinking. For example:

- Professors Ed Crawley and Tom Magnanti developed and designed SDM in response to industry's need to educate future leaders in 1996;
- SDM has since led the Institute in developing a career-and-family-compatible degree-granting graduate program; and
- SDM is jointly offered by the MIT School of Engineering and MIT Sloan School of Management and offers an interdisciplinary master's degree in engineering and management.

A testament to SDM's success is the fact that similar programs have been formed in Japan, Mexico, and other countries around the world.

Over the past 17+ years, SDM has continued to evolve and innovate to provide:

- full-time, part-time, and distance options; and
- an ever-widening range of academic offerings.

However, there's more.

In 2014, SDM will initiate significant academic and operational innovations that will better meet the needs of industry and our students. For example:

- Beginning in August, all of SDM's cohort-building on-campus "boot camps" will be held immediately before the start of the fall semester. The last traditional boot camp will run this coming January, and another will be offered in August for the 2014 cohort that will matriculate that month. This operational change was made to give SDM students the opportunity to matriculate as a cohort in the fall semester when most other new students arrive at the Institute. This will enable SDMs to foster relationships with a wider number of their peers across MIT.

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Welcome

sdmpulse

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For further information, visit
sdm.mit.edu

Welcome to the fall edition of the *SDM Pulse*. As we begin the new academic year, we are celebrating the innovations of SDM alumni, students, and the program itself—and inviting you to get involved. In this issue, you will find articles about:

SDM evolutions. In the spirit of innovation, SDM is initiating strategic academic changes so that the curriculum continues to meet (and exceed) the needs of SDM fellows and their current or future employers. Operational changes, which will enhance the MIT experience for new cohorts, will formally begin in August 2014. For details, see Pat Hale's article on page 1.

Complex data, corporate strategy, and systems thinking. This year's SDM conference on October 10 will focus on using systems thinking to manage complex data in developing corporate strategy. We hope you will join us at the Institute for the live event or watch the videos at sdm.mit.edu, which will be available in mid-November on demand and free of charge. See page 16 for more information.

We've also included articles on cutting-edge research by SDM fellows on using systems thinking to address critical business issues, such as:

- cybersecurity;
- risk management for the supply chain; and
- patient wait time.

We believe that what goes on in the SDM community is exciting and we invite you to get involved. Beginning on page 10, you'll find several examples of activities in which you can participate, including:

- SDM clubs that focus on specific topics, such as big data, product management, international shipping and mining, and oil and gas;
- SDM's spring Tech Trek; and
- innovative product design and development projects by SDM students.

Information on additional ways to participate are in SDM's industry involvement brochure. See page 11 for details on how to get a copy—or feel free to contact me directly.

We hope you enjoy this issue of the *Pulse* and that it inspires you to get more involved with SDM. As always, I welcome your feedback and look forward to hearing from you.

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John Deere Convenes In-house Systems Engineering Conference



On August 20, 2013, John Deere held an important one-day conference to energize the company's systems engineering efforts, many of which are led by Deere's 100+ graduates of SDM's master's and certificate programs.

Developed to strengthen Deere's systems thinking capabilities, the event emphasized common challenges faced by SDM alums in their work across broadly different divisions around the world. It also helped to reconnect geographically distant SDM alumni and to build and strengthen Deere's in-house networks.



Howard Gerwin, SDM '98, convened the event in collaboration with Hank Roark, SDM '10.

"Although Deere has a decentralized management structure, there has been widespread support for the company's developing a systems engineering capability," said Gerwin, manager of advanced systems engineering in John Deere's Technology and Innovation Center. "Over the years, Deere employees from all facilities, including those in Germany and India, have participated in SDM. Now, 15 years later, systems engineering has a wide reach across the entire company, through employees who use a common language and set of methodologies to work together on projects at the grass-roots level."

In addition to recognizing those who have completed SDM's master's or certificate program (or both), the event also introduced attendees to the work of Deere's Technology and Innovation Center in Champaign, IL.

Speakers included:

- Mike Weinert, vice president, engineering and manufacturing, John Deere Power Systems, who discussed Deere's big challenges as systems challenges;
- Bruce Cameron, lecturer, MIT Engineering Systems Division, who delivered a keynote on the challenges and opportunities of global product variety;
- Roark, senior staff engineer, advanced decision analysis, John Deere, who provided an overview of the state of advanced systems engineering at the company;
- K.C. Ting, professor and department head, Agricultural and Biological Engineering, University of Illinois at Urbana-Champaign, who gave a presentation titled "WHAT-IFS—World Hunger Abatement Tasks—Intelligent Food Systems." He offered an important perspective on the continuing imperative of employing systems engineering and thinking in feeding the world; and
- J. Bradley Morrison, Ph.D., senior lecturer, MIT Engineering Systems Division, and associate professor of management, International Business School, Brandeis University, who delivered a talk titled "Bathtub Management, Toward Refocusing Our Attention," in which he discussed the system dynamics of continuous improvement processes in a company.

In addition, Roark moderated a panel that debated whether systems engineering should be applied beyond product engineering. Participants included SDM Executive Director Pat Hale and several Deere employees: Genevieve Flanagan, Certificate '08 and SDM '10, Mark Moran, SDM '09, and Kyle Ressler, Certificate '11 and SDM '13.

Gerwin, Hale, and SDM Industry Codirector Joan Rubin provided a wrap-up of the day's discussions. The event culminated in a tour of Blue Waters, the University of Illinois' state-of-the-art 88,000-square-foot National Petascale Computing Facility.

The conference was timed to celebrate and mark the fact that more than 100 Deere employees have earned an MIT master's of science degree in engineering and management through SDM and/or a certificate through SDM's graduate program in systems and product development.

Gerwin summed up the day as follows: "The combination of different speakers with different backgrounds and perspectives provided some of the magic of SDM's annual conference and helped link our systems thinkers from around the globe," he said. "The next step is to find more ways to connect the SDM experience to Deere's product space."

Supply Chain and Risk Management: Making the Right Decisions to Strengthen Operations Performance

The challenge: On March 11, 2011, Nissan Motor Company Ltd. and its suppliers experienced a 9.0-magnitude earthquake as it struck off the east coast of Japan. Nissan's production capacity was perceived to have suffered most from the disaster compared to that of its competitors. Despite this devastation, Nissan's recovery was not only remarkable but the company ended 2011 with an increase in production of 9.3 percent. How do manufacturing companies with global footprints and highly mature capabilities in both supply chain management and risk management—such as Nissan—effectively address supply chain disruptions, outperform the market, and even gain competitive advantage? This research study addresses this question.

About the Project

This MIT research study was sponsored by PricewaterhouseCoopers (PwC).

The overall thesis was supervised by David Simchi-Levi, MIT professor of engineering systems. Dr. Costas Vassiliadis (PwC) was also a member of the research study group.

For a copy of Ioannis M. Kyrtzoglou's thesis, please contact SDM Industry Codirector Joan S. Rubin at jsrubin@mit.edu.

Background: When a company expands from a regional presence to a more global one, its operations strategy needs to be adjusted to align with the changes. Due to the increase in demand and competition for many products and services, companies are changing strategies, seeking alternate global markets. Pressure is intensifying to reduce supply chain costs. Operations therefore become more complex. Transportation and logistics become more challenging, lead times lengthen, costs increase, and end customer service can suffer. With a more global footprint, different products are directed to more diverse customers via different distribution channels, which require different supply chains. Hence the global presence leads to an increase in the level of risk faced by the company.

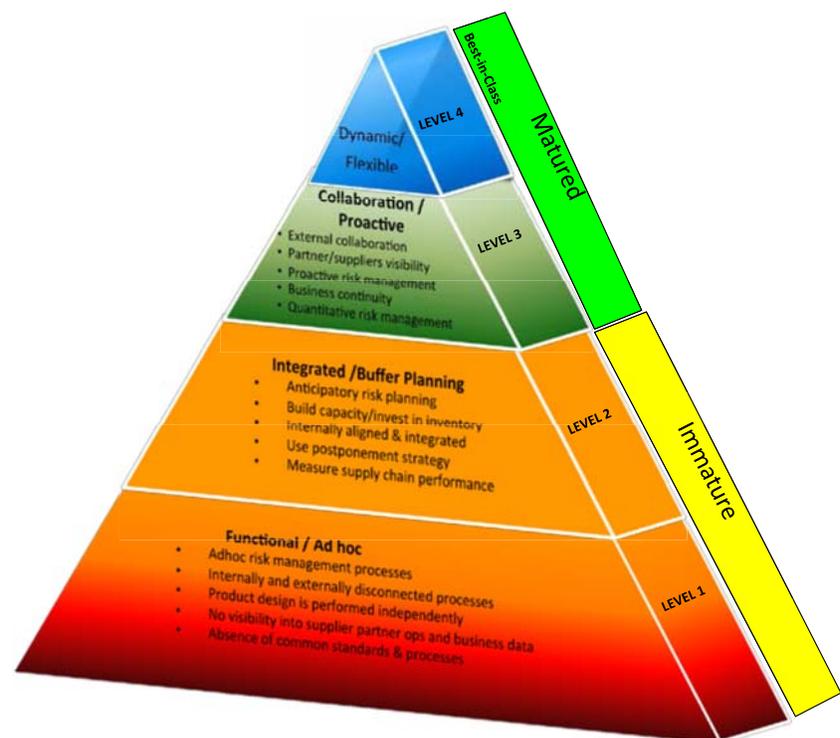


Figure 1. The four-level supply chain and risk management Capability Maturity Model.

About the Author



Ioannis M. Kyrtzoglou,

SDM '11, has extensive experience in large-scale software systems management with The MITRE Corporation. He earned an S.M. in system design and management through SDM, and he holds an S.M. and an M.E. in mechanical engineering from MIT. He can be reached at ioannis@mitre.org

Approach: Conduct an in-depth research study using a Global Supply Chain and Risk Management Survey. Use the data to develop a Capability Maturity Model—an empirical framework—across two dimensions: (a) supply chain and (b) risk management (see Figure 1). Then, apply data analytics to gain insight into whether supply chain disruptions and risks will have a significant impact on company business and financial performance.

Findings: In total, 209 companies with global footprints completed the survey. As globally operating companies, all are exposed to high-risk scenarios ranging from controllable risks—such as raw material price fluctuation, currency fluctuation, market changes, or fuel price volatility—to uncontrollable ones such as natural disasters. The findings validate a number of key principles, something that companies' CEOs and CFOs can learn from to better manage today's supply chain challenges and prepare for future opportunities.

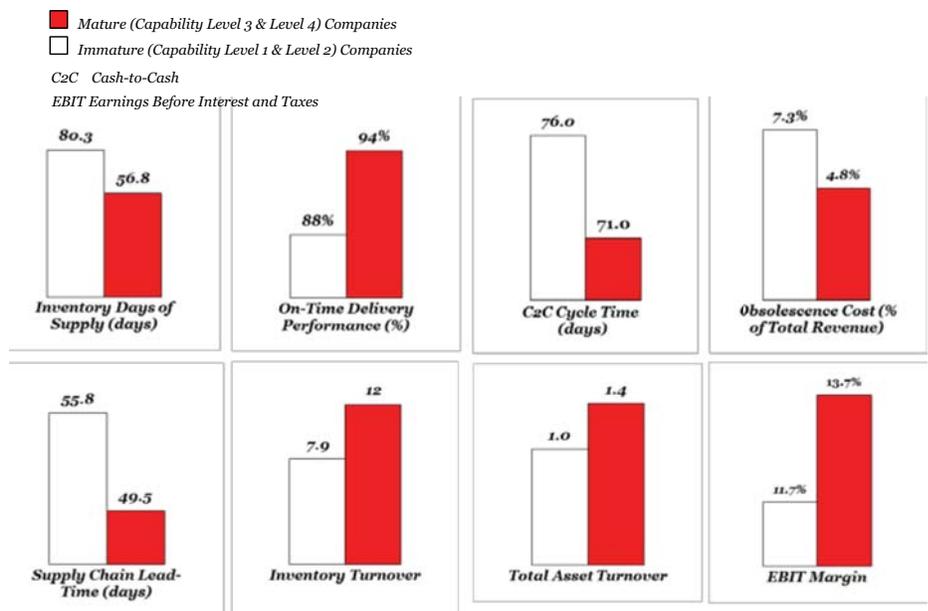


Figure 2. This chart shows the business and financial performance difference between companies with mature and immature risk processes.

According to the survey results, as many as 60 percent of the companies pay only marginal attention to risk reduction processes. These companies are categorized as having immature risk processes. They mitigate risk either by increasing capacity or by strategically positioning additional inventory. The remaining 40 percent, such as Nissan, do invest in developing advanced capabilities for reducing risk and are classified as having mature processes. The data validated the theory that companies with mature risk processes perform operationally and financially better than others (see Figure 2).

The survey also indicates that companies that invest in supply chain flexibility are more resilient to disruption than mature companies that don't. Flexibility is critical to a company's ability to adapt to change, enabling companies to respond better to demand changes, labor strikes, technology changes, currency volatility, and volatile energy and oil prices.



To read Kyrtzoglou's entire article, visit:

sdm.mit.edu/pulse/kyrtzoglou

http://

About the Authors



Ali Kamil is an SDM fellow. Prior to MIT, he was a manager at Deloitte Consulting.



Dmitry Lyan is an SDM alumnus and a senior product manager of technical products, at Amazon Web Services.



To read Kamil and Lyan's entire article, visit:

sdm.mit.edu/pulse/lvpei

http://

Understanding Patient Wait Times at the LV Prasad Eye Institute

The challenge: Reducing patient wait times and variability at the LV Prasad Eye Institute (LVPEI) in Hyderabad, India.

Since its inception, LVPEI has served more than 15 million patients, of whom more than 50 percent were seen at no charge. Each outpatient department (OPD) clinic sees 65 to 120 patients in a given day with the average wait time ranging from 45 minutes to 6 hours. This variability in service time and associated delays is a source of angst for patients, stress for hospital staff—who consistently work overtime, and damage to the reputation of the clinic in the region (see Figure 1). The MIT Sloan team was tasked with applying management and engineering principles to investigate the source of the variability and delays at LVPEI.

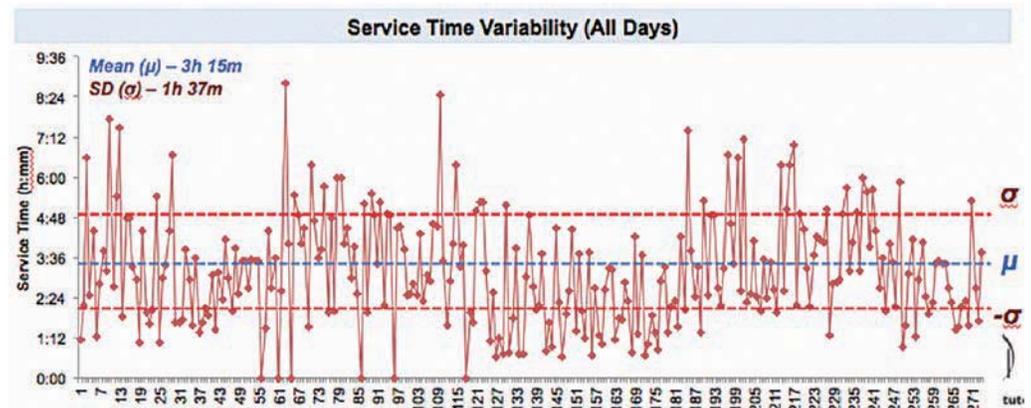


Figure 1. Service time variability at LVPEI.

The process: To understand the problem holistically, the team attempted to build a reference model of the problem experienced at LVPEI. From January through March 2013, the team:

- Communicated with the leads from LVPEI's clinical and administrative operations staff;
- Conducted interviews with key stakeholders to understand patient flow dynamics; and
- Focused on qualitative metrics, due to constraints in accessing actual data points.

To identify existing best practices in managing patient flows and reducing variability, the team also conducted research at Boston-area eye clinics—Massachusetts General Hospital, Massachusetts Eye and Ear Hospital, and Mount Auburn Hospital.

The team traveled to Hyderabad, India, in March 2013 to conduct on-the-ground research and collect quantitative metrics for patient service and wait times. Operating from the hospital, the team:

- Conducted time and motion studies in four of LVPEI's OPD clinics, including two cornea and two retina clinics;
- Collected time stamps as patients and corresponding medical folders moved through the clinics;
- Interviewed stakeholders, including faculty ophthalmologists in each of the studied clinics, administrators who oversee appointment scheduling and resource allocation, and operations professors from the Indian School of Business in Hyderabad, to understand their prior work on patient wait time trends at LVPEI;
- Conducted patient surveys at walk-in counters to understand the motivation for choosing the walk-in option and surveyed patients at the checkout counter to gauge patient satisfaction levels and concerns with their LVPEI experience;

- Constructed a system dynamics model—based on the qualitative data gathered from numerous interviews and observations—that reflects the core structure of LVPEI OPD operations and simulates patient flow in a given day; the model was then validated by key stakeholders and calibrated to the data collected on site (see Figure 2); and
- Worked with key stakeholders to validate and calibrate the data collected on site.

The findings: Based on our work on the ground and the subsequent application of system dynamics to determine the cause for variability and long service times, we showed that:

- Given a fixed OPD capacity, patient wait times are largely a function of service demand, scheduling, and resource-specific factors;
- Demand and scheduling factors include the complexity of patient cases, their volume, and the way they are scheduled in a given day; factors impacting resource allocation and utilization include patient workup time, patient investigation time, and the operating hours of the OPD clinic;
- To accommodate larger daily volumes of patients, providers reduce the time they spend with each patient, thereby undermining the quality of care provided and increasing the likelihood for medical errors; and
- Walk-in patients are the source of variability in the system and cause the established schedule at LVPEI to deviate.

Given the fixed OPD capacity and staff, we recommend that LVPEI consider allocating blocks of time in the day specifically for walk-in patients and follow-up patients. Increasing awareness and enforcing adherence to an appointment-based scheduling system will make patient wait and service times more predictable.

Next steps: Further analysis is needed to study the relationships among the volume of patients, the number of incorrect diagnoses, and the number of patients that return to the clinic to receive additional treatment as a result of error. The team is continuing its work with LVPEI to obtain additional data on patient check-in and checkout times. Additionally, the team is working to make the system dynamics model robust under extreme scenarios and able to delineate among patient types—i.e. walk-in, appointment-based, or follow-up patients.

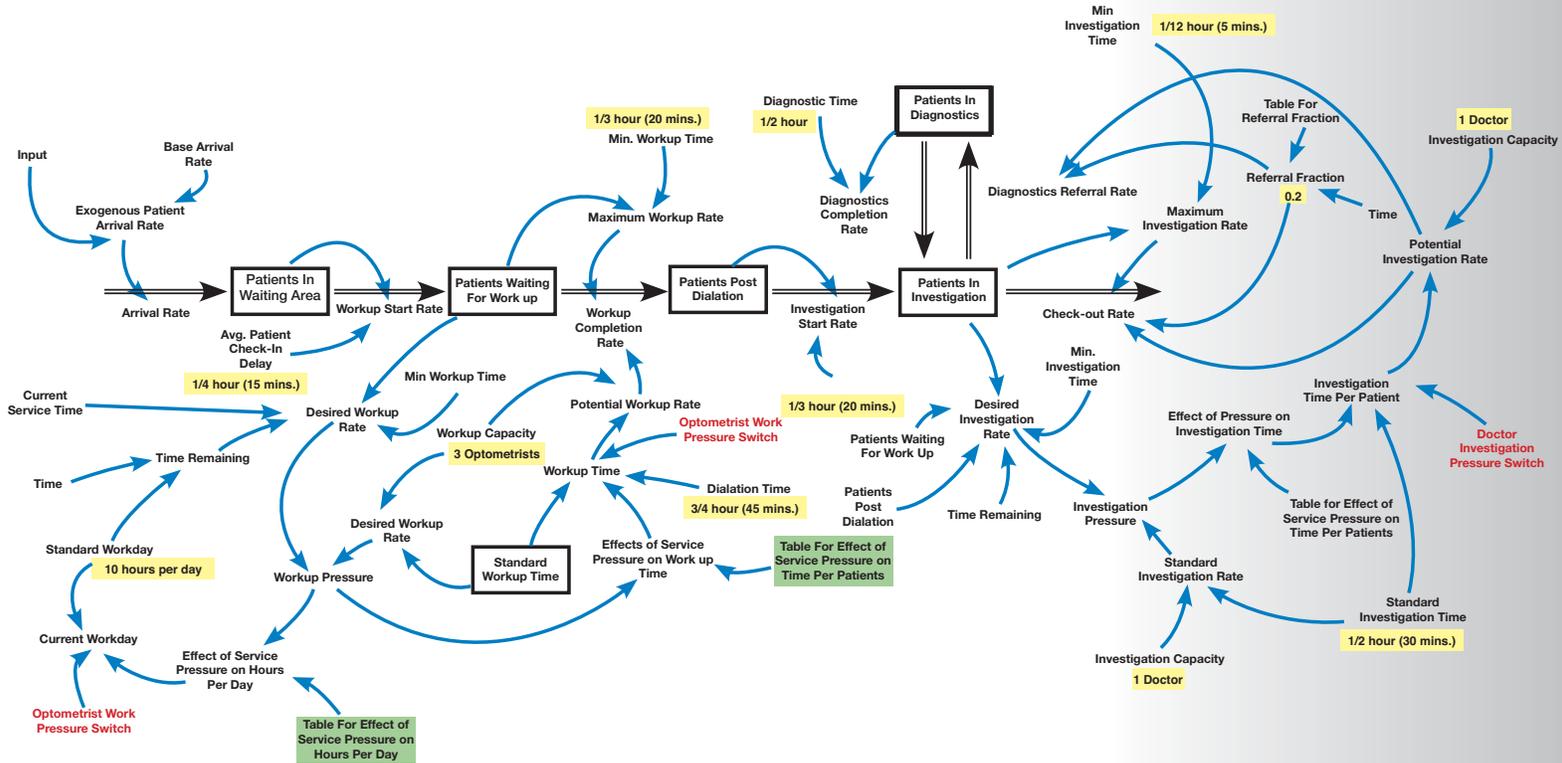


Figure 2. System dynamics-based model of the retina clinic at LVPEI.

About the Author



Asif Iqbal is an SDM alumnus and a senior program manager at Apple. While at MIT, he received the Dr. Mikio Shoji Award for Innovation in Information Technology for this research on cyber security.

Addressing Security Threats to Integrated Circuits

The growing challenge: Because digital hardware/software-based platforms are in everything from military and financial systems to smart grids, healthcare systems, and public records, security is a matter of increasingly grave concern not only in software systems but also in hardware systems. The problem we are facing today is twofold: the impact of the threat and the level of sophistication required to perform an attack are both trending in the wrong direction. The impact is increasing, and it takes less expertise than ever to carry out an attack. Figure 1 shows the growth of the threat and the declining sophistication required of the actors.

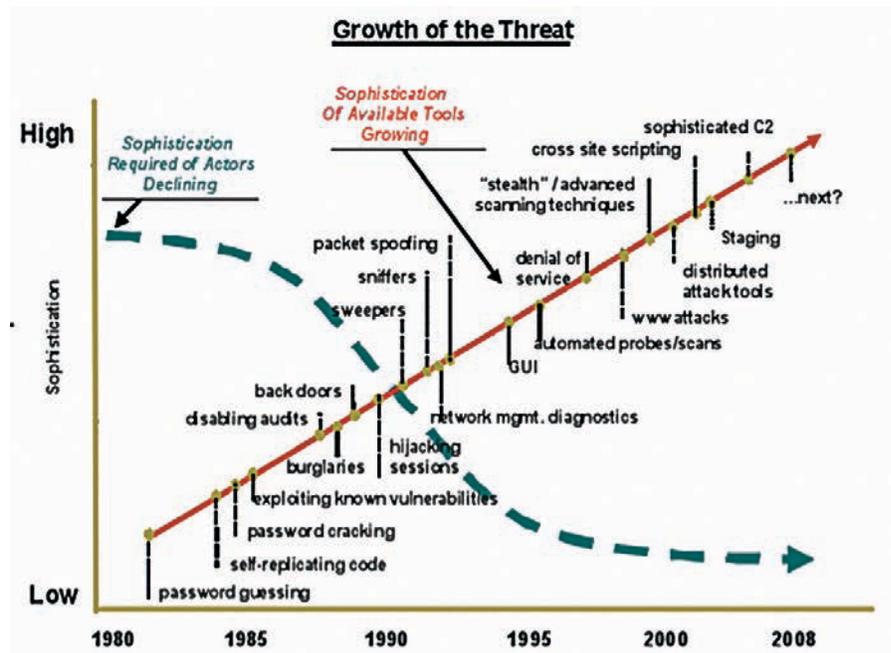


Figure 1. Evolution of cyber security threats over time.¹

The enemy: Recently, security breaches have been uncovered in the hardware of several critical systems in telecommunications, aviation, banking, and the military. Frequently, a hardware attack involves physical access to the facility where the hardware systems are manufactured or installed. Integrated circuits are the lowest level of the system's hierarchy: An attacker can insert additional circuitry to perform malicious functions along with the chip's intended functions. This additional circuit is difficult to detect with conventional design-time verification and post-manufacturing testing due to its stealthy nature, extensive number of possible instances, and large variety of potential structures and operating modes. Because such circuits are both stealthy and have the potential to kill the entire system when activated, they are known as "hardware Trojan horses" or HTH in current integrated circuit (IC) security literature.

A hardware Trojan has two distinct parts:

1. a trigger that determines its stealth property; and
2. a payload that contains its destructive function.

Figure 2 illustrates the taxonomy of a hardware Trojan based on triggers and payloads.



To read Iqbal's entire article, visit:

sdm.mit.edu/pulse/ic-security-threat

http://

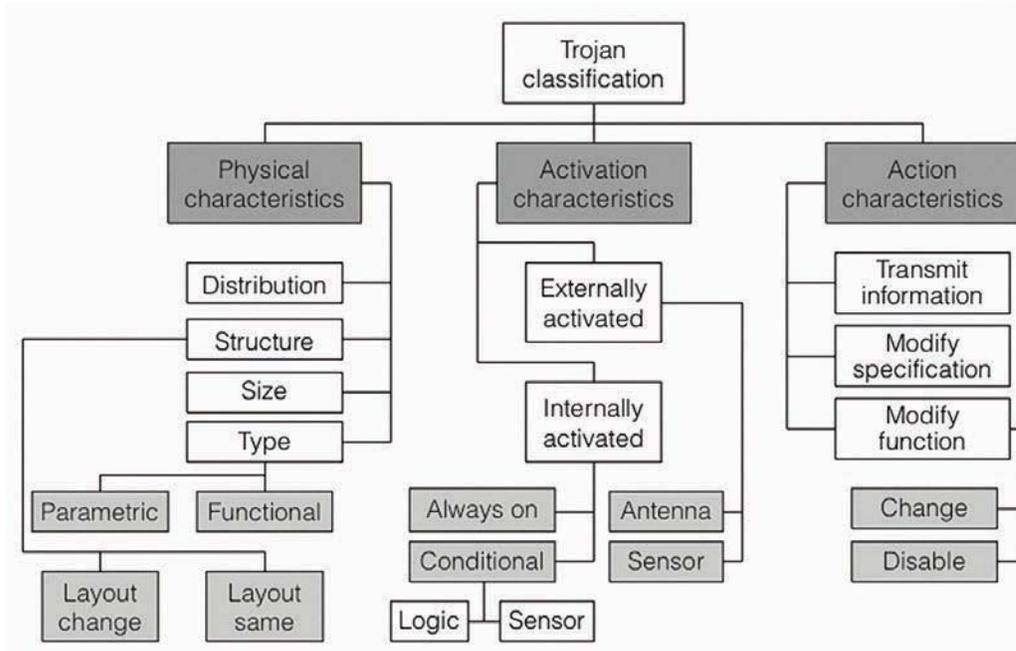


Figure 2. Detailed taxonomy of a hardware Trojan².

Many kinks in the armor: ICs can be vulnerable at virtually every phase of IC development, from design and manufacture to testing and delivery. Figure 3 shows the vulnerabilities that exist in the various phases.

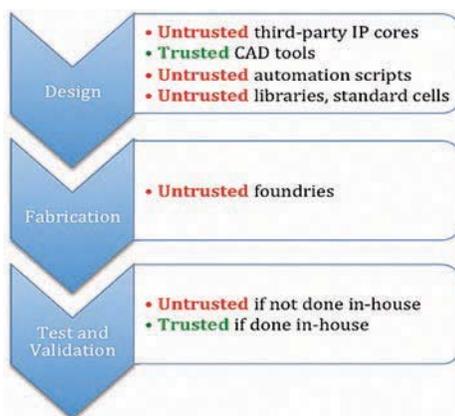


Figure 3. Vulnerabilities that arise at different phases of integrated-circuit.

Semiconductor manufacturing is a capital-intensive business and therefore unsustainable for companies that do not operate at large scale. Small and even mid- to large-sized companies are forced to choose a fabless model wherein the design is done in-house and manufacturing is outsourced to a specialized foundry in China or some other low-cost manufacturing location. Outsourcing manufacturing reduces control and makes a company's silicon susceptible to changes by unscrupulous agents.

Even the design phase is not secure. Rapid commoditization of hardware means companies must innovate continuously and quickly to find new applications for current designs. This time-to-market pressure forces designers into a lot of reuse and leveraging of third-party intellectual property (IP). Automation scripts that are run on the tools are often exchanged or obtained through unsecured channels. An untrusted script can easily insert a gate or two in a chip, which is enough to kill the chip based on an internal or external trigger. Such a modification is impossible to detect in a sea of a billion gates in a typical chip.

In the current scenario, semiconductor economics do not allow complete vertical integration of design and manufacturing. Time-to-market pressure cannot be alleviated and hence the reuse and untrusted IP will exist. One viable option is to ensure the authenticity of ICs and build tamperproof, failsafe circuitry into the design before including ICs in critical infrastructure systems.

Options and costs for ensuring authenticity: There are two main ways to ensure that a chip used by the client is authentic, i.e., that it performs only those functions originally intended and nothing more:

1. Make the entire fabrication process trusted. This option is expensive and difficult given current business models and trends in global distribution of IC design and fabrication.
2. Verify the trustworthiness of the manufactured chips upon return to the clients. This requires that testing and validation be tightly controlled to ensure the chip conforms with the original functional and performance specifications.

Lessons for all: Although designs are inherently made secure each day, the hacker is always one step ahead! Engineers are reacting to changing security needs and they must proactively design in trust-“ability” and make designs more secure from the onset. To do so, companies must be aware of the nature of physical threats.

1 Source: Booz Allen Hamilton. www.boozallen.com

2 Source: X. Wang, M. Tehranipour, and J. Plusquellic, “Detecting Malicious Inclusions in Secure Hardware: Challenges and Solutions,” Proc. IEEE Int’l Workshop Hardware-Oriented Security and Trust (HOST 08), IEEE CS Press, 2008, pp. 15-19.

opportunities for involvement

SDM Clubs

By founding special interest clubs, SDM fellows contribute to the program, the MIT community, and in many cases to industry and the world at large. Here is a sampling of SDM clubs—many are open to everyone, and all are interested in building links between MIT and industry.

For further details, see individual contacts and urls below.

MIT International Shipping Club



Mission: To promote interest in the maritime and offshore oil industry by providing opportunities for members to interact with professional ship owners and operators, shipping financiers and investors, shipbrokers and analysts, shipbuilders, and naval architects.

Membership: Open to students, faculty, and alumni of MIT and other academic institutions, as well as to industry practitioners.

Upcoming events:

- Piracy—Nicky Papadakis, chairman, Intercargo
- Shipping and Finance—Gary Wolfe, partner, Seward & Kissel LLP
- TBA—Harris Vafias, founder and president, Stealth Maritime Corp.
- The Role of Salvage Companies in the Shipping Industry—Mauricio Garrido, president, C&C Salvage

Past events:

- Risk Pricing in the Shipping Industry—Dr. Arlie Sterling, president, Marsoft Inc.
- The Future of Global Maritime Ports—Gerhardt Muller, president, Sansail Institute

Contact: Vasilis Georgiadis, SDM '12, georgiad@mit.edu

URL: www.linkedin.com/groups?gid=3809030

MIT Mining, Oil, and Gas Club



Mission: To catalyze interest in the mining, oil, and gas (MOG) industries within the MIT community; to foster linkages between industry and academia; and to add value to MOG industries by introducing a systems thinking approach that leverages MIT's technological expertise.

Membership: Open to mining, oil, and gas companies; industry practitioners; nongovernmental organizations; and students and faculty throughout the world.

Upcoming events:

- Biweekly lectures
- Natural resources trip to Chile (in partnership with MIT International Science and Technology Initiatives/MISTI and MIT-Chile)
- Natural resources trip to East Africa

Past events:

- Entrepreneurship for the Mining Industry: Tranzact's Perspectives—Silvio Casco, vice president, international operations, Tranzact Energy & Mining
- Flexibility in Engineering Design for Oil Platforms—Professor Richard de Neufville, MIT
- Gas Shale and Tight Oil: Environmental and Regulatory Issues—Robert Kleinberg, fellow, Schlumberger
- Vale: Global Expansion in the Challenging World of Mining—Eduardo Bartolomeo, Sloan Fellow 2013, former executive director of the board, Vale

Contact: Jorge Le Dantec, SDM '12, ledantec@mit.edu

URL: web.mit.edu/~Miningoilgas/

BigDataExplorers@MIT



Mission: To create a platform to enhance the understanding of various aspects of big data, explore its application in a variety of fields, and network with big data experts and enthusiasts from MIT and industry.

Membership: Open to students, faculty, alumni, staff, and researchers from MIT and other universities worldwide; industry experts; and recruiters.

Upcoming events:

To be announced. Check url below for further event details.

Past event:

- COOLHUNTING: Tracking the Emergence of New Ideas through Individual, Organizational, and Social Network Analysis—Peter A. Gloor, research scientist, MIT Sloan School of Management

Contact: Rohan Kulkarni, SDM '12, rohank@mit.edu

URL: mitbigdata.scripts.mit.edu/wp/

Interaction with industry is vital to SDM's evolution and continued success. This can take many forms, including sponsoring internships and thesis research, as well as recruiting SDMs for employment. These pages outline just a few of the opportunities available to industry—participating in SDM clubs, the SDM Tech Trek, and the annual MIT SDM systems thinking conference. To learn more about these opportunities and others, contact Joan S. Rubin, SDM industry codirector, at 617.253.2081 or jsrubin@mit.edu, or access the SDM industry opportunities brochure at sdm.mit.edu/docs/industry_engagement.pdf.

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MIT Product Management Club



Mission: The mission of the MIT Product Management Club, which is the first SDM-founded club to be cosponsored by MIT Sloan, is to: increase connections between the community and leaders and experts in product management across industries; promote discussion regarding product management; and strengthen understanding of the product management discipline among students, while helping them become leaders in this arena.

Membership: Open to MIT students and faculty, product management professionals, and others interested or engaged in product management.

Upcoming event:

- Making Ideas Real: Practical Prototyping Techniques, a practitioner's workshop cosponsored with the Boston chapter of the Product Management Association (BPMA)—Jim O'Neill, creative director, Above the Fold Designs

Check url below for further event details.

Past events:

- Sarela Bliman-Cohen and Ray Trevisiani, copresidents, BPMA
- Bill Morein, program director manager, Microsoft Sharepoint
- Chris Cummings, vice president, operations, LuckyLabs Inc.

Contact: Suzie Livingston, SDM '13, suzie@mit.edu

URL: pmclub.scripts.mit.edu/wp

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opportunities for involvement

MIT SDM Entrepreneurship Club



Mission: To develop a new generation of entrepreneurs through the application of systems thinking and to enable and support the SDM cohort by providing resources for cultivating their startup ideas.

Membership: Open only to SDM students and alumni, as well as MIT faculty.

Upcoming events:

- Day trips to Boston-area startups
- Entrepreneurship Speaker Series
- Pitch Deck 101: How to Build and Deliver a Pitch Deck
- Member presentation and brainstorming session

Contact: Alex Pina, SDM '13, alex.pina@mit.edu

Women in System Design and Management



Mission: To empower female leaders and enhance the SDM network.

Membership: Open to SDM women students, alumni, and industry practitioners.

Upcoming events:

- Breakfast events
- Joint conference with Sloan Women in Management club

Past events:

- The WiSDM Symposium: Creating Value in Your Organization Using Systems Engineering
- Women in Technology Management—Bettina Hein, CEO and founder, Pixability
- Breakfast with Engineering Leaders—MIT Professor of the Practice Deborah Nightingale
- Mentoring panel with Society of Women Engineers/Graduate Women at MIT

Contact: Marianna Novellino, SDM '13, wisdm@mit.edu

URL: sdm.mit.edu/voices/wisdm.html



Annual MIT SDM Conference on Systems Thinking for Contemporary Challenges

The MIT SDM systems thinking conference offers sponsorship and speaking opportunities to companies committed to building and promoting a systems thinking capability within their organizations. Because of the large number of attendees expected from industry, government, and academia, sponsorship offers an excellent means for your company to gain visibility as a leader in systems thinking.

Conference audiences generally consist of industry representatives from big data, finance, media, high tech, healthcare, energy/sustainability, transportation, aerospace, defense, equipment, services, government agencies, and others. The professional roles of attendees typically include new product/business development, manufacturing, supply chain, engineering, organizational development, and leadership. MIT faculty, alumni, and students also attend.

Sponsorship provide opportunities for a company's employees to attend the event, learn about best practices for applying systems thinking, and strengthen the organization's systems thinking capability.

The 2013 conference, A Systems Approach to Big Data: Going Beyond the Numbers, will open with a "back-to-the-classroom" session on system dynamics, presented by SDM Senior Lecturer J. Bradley Morrison, Ph.D. This will be followed by presentations delivered by big data experts from a wide range of industries, including finance, cyber security, and high tech. Details on this year's event can be found in the SDM calendar on page 16.

Annual SDM Tech Trek

The annual MIT SDM Tech Treks provide opportunities for SDM fellows to visit leading companies from various industries, meet with senior managers to learn about their complex technical and business challenges, and discuss how these managers address such challenges from strategic, operational, and tactical perspectives.

Companies visited over the years include Cisco, Google, Twitter, Intuitive Surgical, E&J Gallo Winery, and more. Treks are held in California's Silicon Valley and around New England. Planning for the March 2014 trek is currently in progress. If your company would like to learn about hosting an SDM visit, please contact Joan Rubin, SDM industry codirector, at jrubin@mit.edu or 617.253.2081.

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SDM Announces Academic and Operational Evolutions

- SDM's core curriculum in system architecture, systems engineering, and system and project management will evolve. Beginning in fall 2014, these three separate courses will be integrated into a single "SDM Core" course offered over the fall and spring semesters and taught by a team of SDM faculty. This effort is being led by Professor Olivier de Weck and a team of key stakeholders, including faculty, alumni, and industry sponsors. The intent is to provide a more integrated approach to systems engineering processes as applied in real-time across multiple industry domains.

All of us here at SDM are excited about these changes because we believe they will help the program continue to serve students and industry by offering education at the cutting edge of engineering and management, combined with leadership, innovation, and systems thinking. We look forward to celebrating these milestones as we continue our work to ensure SDM is the world's premier program of its kind.

Product Design and Development

SDMs Win Top Three Places in Competition

Editor's note: One of the many highlights of SDM is the annual competition in ESD.40 Product Design and Development. In this semester-long class, which includes students from across MIT, as well as from the Rhode Island School of Design, students form teams that conceive, design, and prototype new products.

Using state-of-the-art and tried-and-true methodologies, they:

- identify customer needs;
- generate and select concepts; and
- develop product architectures, industrial designs, concept designs, and designs for manufacturing.

At the end of the term, each team presents its concept and prototype in an all-class competition; judges from the MIT faculty and industry determine the top three teams. This year's winners included two teams tied for first place and another team that placed third. Each consisted solely or mostly of SDMs.

The Child Rescue Bag™ — Helping Save Kids' Lives



Team left to right: Scott Albrecht, SDM '12; Wilfredo "Alex" Sanchez, SDM '13; Faheem Faheem, Ph.D., QinetiQ-NA; Brandon Hopkins, Ph.D. candidate, mechanical engineering; Robert Zima, SDM '13.

Our team began by investigating how to "build a better ladder" for egress from home fires. Because children ages 5 and under are the most likely to be injured or perish in a fire, our product was designed for their use.

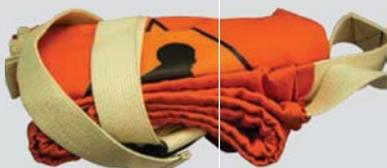
Market research confirmed that existing solutions were insufficient and quite possibly dangerous for young children, but we quickly found that our ladder concept, though marginally acceptable for a full-grown adult, would be almost impossible for a child to use, even with assistance. We therefore took an entirely different approach, keeping the primary focus on safety, speed, simplicity, and cost while developing our product. The methods we used included:

- TRIZ contradiction matrices;
- House of Quality; and
- user surveys, interviews, and extensive testing.

We iterated through dozens of concepts, designs, and prototypes before arriving at our patent-pending product design—the Child Rescue Bag™. Thanks to the design iterations and methodologies we applied, the product exceeded our intended goals and performance parameters.

Our sincerest hope is that when the Child Rescue Bag™ is on the market, it will enable parents to make critical and urgent decisions in the event of a fire more easily, safely, and quickly—and consequently save lives.

1st
place tie



CalcuWait—Reducing Wait Times for Restaurant Patrons



Team left to right: Greg Wilmer, Kumar Abhinav Srivastava, Anton Wirsch, Adeyemi Adepetu, and Thomas Casselman, all SDM '13.



Most of the more than 500,000 restaurants in the United States do not take reservations. In the case of those that do, the maître d' estimates wait times, generally adding an extra 15 minutes to ensure reasonably accurate timing. However, many patrons have an upper limit on how long they will wait, so chances are good they will walk away if their threshold is exceeded. For the restaurant, this means loss of revenue and, potentially, customer loyalty. Although a variety of reservation-related applications and tools already exist, none has solved this problem.

Our team began with first-person research, meeting with restaurant personnel and conducting a customer survey. (We were fortunate to work with the owner of Café Luna throughout the project.) We then brainstormed necessary features and functionality and developed a prototype in Java that we subsequently tested and reviewed.

CalcuWait uses historical data and data analytics to more accurately estimate patrons' wait times. As more history is gathered, accuracy improves. Moreover, patrons can sign up for a restaurant's waiting list electronically via home computer or phone and monitor the remaining wait time. CalcuWait is a win/win solution for both restaurants and patrons!

LuggEasy—Happier, Easier Travel



Team left to right: Jonathan Cuata, Juan Quezada, Rodrigo Sotomayor, Alhely Almazán, Rodolfo Reyes, Juan Romeu, and Daniel Camacho. Photo by Karen Castro



Our team observed that airport travelers often struggle with luggage, especially when carrying two or more bags. We defined this segment as the bulky traveler and decided to improve the luggage-carrying experience by developing a check-in bag that would smoothly integrate simple and already available features.

We used the following concepts from the Product Design and Development class:

- iterating several throw-away prototypes and testing desired requirements;
- including customer clinics and voice-of-customer feedback into design iterations;
- learning as much as we could from each iteration and then bringing a “works-like and looks-like” prototype to real users; and
- incorporating Real Options for Product and System Design into our business model to address uncertainty in the luggage manufacturing business and lower risk.

Our resulting product, LuggEasy has the following features:

- maneuverability—it can be used in either the vertical or horizontal position;
- versatility—it can transform into a platform cart using a pair of wheels on the back and a second telescopic handle; and
- robustness—it can carry its own weight plus two additional check-in bags.

fall

2013

sdmcalendar

October 10, 2013**Systems Thinking and Big Data: Going Beyond the Numbers**

SDM's annual systems thinking conference will feature best practices for using systems thinking and big data to strategically deploy technical and managerial resources. Highlights include:

A "back-to-the-classroom" session on system dynamics by SDM Senior Lecturer J. Bradley Morrison, Ph.D.

Presentations by:

- Troy Hamilton, SDM '97, CIO, NYSE Technologies Infrastructure Solutions, NYSE Euronext
- Brian J. Ippolito, SDM '98, president and CEO, Orbis Technologies
- John Baker, SDM '07, founding member, The Data Sciences Group
- Sandro Catanzaro, SDM '04, senior vice president of analytics and innovation, DataXu

A panel discussion on leveraging big data for business value, moderated by Irving Wladawsky-Berger, Ph.D., vice president emeritus, IBM, and visiting lecturer, MIT Sloan and ESD. Panelists include:

- Mona Vernon, SDM '09, senior director, emerging technologies, Thomson Reuters
- David Deitrich, advisory technical education consultant, Global Education Services, EMC
- Puneet Batra, former chief data scientist, Kyruus

Details at sdm.mit.edu

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sdm.mit.edu/voices/webinars.html

Videos:
SDM program offerings and conferences
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MIT SDM Information Evenings

Learn about MIT's master of science degree in engineering and management, discuss career opportunities, and network with SDM alumni, faculty, students, and staff.

October 10

Bush Room, MIT

December 4

Boston Marriott Cambridge

Details/registration: sdm.mit.edu.

MIT SDM Systems Thinking Webinar Series

This series features research conducted by members of the SDM community.

Webinars are held on Mondays, from noon to 1 p.m. (ET), and are free and open to all. Details/registration: sdm.mit.edu.

October 21

How to Secure and Grow Your Islands of Profit

[Jonathan L.S. Byrnes](#), Ph.D., and senior lecturer, MIT

November 4

A Framework to Transform a Complex, Multilevel Healthcare Enterprise

[Elizabeth Cilley Southerlan](#), manager, Oliver Wyman, and SDM alumna

November 18

Startup Dynamics

[Fady Saad](#), entrepreneur and SDM alumnus

December 2

Systems Thinking and the Inevitability of the Dreamliner Delays

[Yao Zhao](#), Ph.D., associate professor, supply chain and project management, Rutgers University

December 16

Lean Health Care

[John E. Billi](#), M.D., professor, University of Michigan Medical School, and associate vice president, medical affairs, University of Michigan

January 13, 2014

Architecting Future Telebehavioral Healthcare in the US Army

[Andrea Ippolito](#), ESD Ph.D. student and SDM alumna

Event information includes all details available at press time. For more current event information, go to sdm.mit.edu and esd.mit.edu.