

First, empowered consumers:

How will the Internet disrupt supply chains next?

Do you remember “You’ve Got Mail”? In the 1998 hit movie, the Internet enables romance to flower between Tom Hanks, who played a big box bookstore owner, and Meg Ryan, an independent bookstore owner. Ironically, that same Internet has now clobbered big box bookstores. It’s been rough on small ones, too. The Internet is fraught with change.

Elliot Rabinovich, professor of supply chain management at the W. P. Carey School of Business, says that the way we now buy media – books, music and video – is a direct outcome of the first phase of the Internet’s impact on supply chain operations. This first phase of Internet disruption, he says, “made the consumer a more integral participant in the supply chain.”

Rabinovich invites us to remember the days of buying books, music and videos before we went online. If you loved a song you heard on the radio, you had to buy a whole album with that one song plus 11 others that, perhaps, weren’t quite as appealing. If you wanted to watch a movie, you went to your local video store and hoped your first choice was in stock. Often it wasn’t.

“Before the Internet, the consumer was a more passive participant in the supply chain,” Rabinovich notes. “You would go to a retail store and buy whatever was available. It was difficult to know what was available until you got to the store.” Now, consumers are more active supply chain participants. We search online for exactly what we want at the best possible price, interact with other consumers to see if they liked what we’re evaluating, then have our purchases delivered to our homes and offices. “That dramatically changed the last mile of the supply chain, which used to end at the retail store. The consumer had to get the product home,” Rabinovich adds.

Since earning his doctorate in 2001, Rabinovich has spent most of his career examining how the Internet impacts retailers and the supply chains they manage. This past April, in conjunction with

JOHN G. BEBBLING PROFESSORSHIP IN BUSINESS

John Bebbling (B.S. Business Administration '71) and his wife, Barbara Bebbling (BAE Elementary Education '71) established the John G. Bebbling Professorship in Business to attract and retain a prominent faculty member of world-class caliber to the W. P. Carey School of Business.

Research by
Elliot Rabinovich
*Professor of Supply
Chain Management
John G. Bebbling
Professorship in
Business*



W. P. Carey School Professor Dale Rogers, Rabinovich began bringing some of those retailers – plus some noteworthy manufacturers – into his investigations directly through the new Internet-edge Supply Chain Management (I-e SCM) Lab. Created as an ongoing research consortium, the I-e SCM Lab was launched to conduct industry-inspired research that advances understanding of innovations, challenges and new SCM possibilities at the edge between the Internet and the physical world.

To that end, Rabinovich et al will center their studies around three different pillars: e-commerce and omni-channel retailing, social production and the sharing economy and the “Internet of Things” (IoT). Each of these areas has impacts for supply chain management. Read on for a look at the backdrop against which the I-e SCM lab operates as well as a few studies that will soon be underway.

Evolutionary phases

As noted earlier, Rabinovich sees consumer empowerment as phase one of the Internet's supply chain impact. Phase two is a change in how we match supply and demand, and it reflects our augmented abilities to interact with each other through means of social production. “Social interaction has had a tremendous influence on consumer demand and collaboration,” Rabinovich says. “Now, consumers are not making purchasing decisions in isolation. There is much reliance on other consumers' behavior.”

He adds that this type of social shopping is the precursor to a new type of supply chain operations that encompass new forms of interactions between consumers and the product or the service providers who have what they want. Rabinovich is talking about the sharing economy represented by services such as Uber or Airbnb, where consumers rent use of assets that are being underutilized: rooms or residences in the case of Airbnb and transportation provided by the car owners themselves in the case of Uber. “It's just a matching of supply and demand,” Rabinovich explains.

Pretty soon, however, people may not always be involved with the supply-and-demand interplay. This is because the IoT will allow us to connect objects to the Internet, such as cars and electric dishwashers, and these objects themselves will use their online connections to send and receive information, including demand for various supplies or services.

Online appliances

Rabinovich sees tremendous supply-chain insight that will stem from “instrumenting objects that consumers use to consume products.” By instrumenting objects, he's referring to the various must-have items for a machine to be part of the IoT. These include the sensors that track or measure activity, the microprocessors that give the object some computing power and the connectivity that links the object to the Internet so it can share information gleaned from its sensors and processors with some other machine or process that's online.

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As an example, Rabinovich uses a household washing machine, which consumes detergent. “If you can instrument that object, you'll be able to know how consumers use the appliance and also how they consume the detergent they buy,” he explains. Moreover, it will be possible to track not only detergent consumption patterns, but also water utilization.

Why is that important? Retail sales of the detergent tell us when the product was plucked off the grocery store shelf, but this information does not equate to product demand. “The Internet of Things allows you to go deeper into how consumers are using a product,”

Rabinovich says. “It's a lot more accurate” to track demand for supply chain professionals.

This consumption also could be tied to auto-replenish mechanisms from a retailer, so that people could get their goods when they actually need them, not merely on a pre-set timetable. In addition, the connectivity would also allow manufacturers of things like washing machines, cars, refrigerators and more to track the durability of product components and schedule maintenance more effectively.

So, if IoT technology is installed in the air conditioner in your house, someone will be alerted if the condenser coils are dirty, the refrigerant level is low or the air filter hasn't been changed in months. “Rather than wait for the air conditioner to break in the middle of the summer, you can do preventative maintenance at more convenient times,” Rabinovich says. Such connectivity would help suppliers of those air filters and refrigerant stay supplied, and it would help consumers save money and headaches. As Rabinovich adds, “It's a lot cheaper to do preventative maintenance than repair maintenance.”

Research in the making

So, what IoT research is currently underway? “We are looking at what kinds of objects should be instrumented and under what conditions and what kind of information should be captured by those objects,” Rabinovich says. IoT isn't the only thing that will come under study by the I-e SCM lab. So will omni-channel retailing, in which merchants draw from inventory across channels to fulfill online customer orders. That means goods you can buy at the store are the same items you can order from the website.

“You can buy online, and they'll have the bags ready for you when you drive up to the store,” Rabinovich notes. “But a problem with omni-channel retailing lies with the execution.”

This is largely due to the environment within retail stores. “Inventory records at stores generally don't reflect accurately the actual inventory at the stores because store environments are very complex. Customers come and go. They grab products and misplace them. They are not controlled environments, so inventory records tend to be inaccurate.”

On top of that, it's a tough environment to efficiently pick and pack items. After all, Rabinovich says, stores aren't warehouses. They're designed to entice consumers to buy impulse items, not for store workers to efficiently pick out items for someone who will be at the store in an hour. **(continued on page 30)**

Informed consumers (continued from page 25)

So, what happens when the customer buys online and drives up for his or her groceries, but not all of the groceries were in the store that day? "It is possible the customer will simply cancel the entire order," Rabinovich says, adding that this could be an enormous drain on retailers who have staff wasting time filling omni-channel orders for online shoppers.

These and other projects are now in planning stages for I-e SCM Lab participants. Some of the studies will be theoretical examinations of issues, while others will involve partnerships among lab participants. But, all of the research will share one underlying element: the Internet. "Obviously,"

Rabinovich says, "It isn't going away."

A key element of Elliot Rabinovich's research is its practical applicability: he has worked with more than a dozen companies studying electronic commerce. His 2011 book, *Internet Retail Operations: Integrating Theory and Practice for Managers* (Taylor & Francis) will be translated into Mandarin for publication in China in 2015. ■ ~ **Betsy Loeff**

The Internet-Edge Supply Chain Management Lab is working with Intel Corp. and JDA Software Group Inc. to understand the challenges and opportunities at the boundary between the

Internet and the physical world. Supply Chain Management Professors Elliot Rabinovich and Dale Rogers are co-directors of the initiative. Affiliated faculty include Timothy Laseter (University of Virginia), Annibal Sodero (University of Arkansas) and Timothy J. Richards, Bin Gu, Craig Carter, Kevin Dooley and John Fowler from the W. P. Carey School of Business.

Software development (continued from page 27)**Surprising conclusions, practical advice**

These findings have important implications for companies looking to outsource software projects, according to Shao.

Because East-West distance has such a strong influence on project success, clients if possible should look for vendors in the same time zone or at least in a time zone where client/vendor work days overlap, Shao said.

"On the other hand, if a vendor is far away and in a different time zone, you have to monitor the

progress of your project more closely to make sure it is on the right track," he said.

The advice Shao would give to clients designing auctions for software development outsourcing projects is clear: keep it short and simple. Descriptions and auction durations should be as brief as possible.

"You want to make sure that the auction goes on no longer than necessary," he said. While longer durations and descriptions attract more bids, they tend to come from less qualified developers and hence have a lower likelihood of project suc-

cess, according to Shao. ■ ~ **Robert Preer**

Based on the working paper "Global Software Sourcing: Longitude, Latitude and Familiarity" by Yili (Kevin) Hong and Benjamin B. M. Shao, W. P. Carey School of Business, Arizona State University, and the working paper "The Effects of Online Auction Designs: Evidence from a Labor Matching Platform" by Yili (Kevin) Hong, Pei-yu Chen and Benjamin B. M. Shao, W. P. Carey School of Business.

Going private (continued from page 29)

that it focused on manufacturers, which, while important, represent a relatively small part of the total U.S. economy. According to the Economic Policy Institute, a Washington, D.C., think tank, manufacturing directly employed about nine percent of U.S. workers and accounted for about 12.5 percent of U.S. GDP in 2013. What's more, the number of manufacturing jobs has been dropping over the last two decades, as plants have moved to lower-wage countries like China

and Mexico and the U.S. economy has become more service-oriented.

"The U.S. has moved away from manufacturing to services – we can't refute that," Bharath said. But the beauty of manufacturing as a study subject is that offers a wealth of data and that financial economists agree on how to measure its productivity.

So while Bharath and his colleagues may be creating a picture of only a part of the economy, they're confident that it's a finely detailed and

accurate one. ■ ~ **Tim Gray**

Based on the paper, "Do Going-Private Transactions Affect Plant Efficiency and Investment?" by Sreedhar Bharath, W. P. Carey School of Business, and Amy Dittmar and Jagadeesh Sivadasan, both of the University of Michigan. Published online in The Review of Financial Studies in July 2014.