Disruptive Technologies Spur Innovation in the Supply Chain

Global supply chains are evolving at a faster rate than at any point in history. We are in the midst of major technological developments, resulting in major innovations. A few examples of the developments that are transforming the supply chain are:

**Big Data Analytics** – changing how we use data in real time (to identify new trends and patterns; predict potential shipping delays; optimize manufacturing and logistics operations, etc.)

**The Internet of Things** – changing where data comes from (Internet-enabled retail shelves monitor and communicate inventory levels in real time; trucks integrate data about speed, road conditions to optimize routing, update customers and schedule preventative maintenance.)

**Three-dimensional (3D) Printing** – changing how we build (providing unlimited customization, resulting in major changes in where we source and produce, how we distribute and what we sell.)

**Autonomous Vehicles** – changing how we move (inbound and outbound shipments become less reliant on human interaction; more automated warehousing operations, drone-based delivery as a new standard for fast delivery.)

The key to success is considering customer needs by aligning appropriate technologies for each supply chain application and avoiding a one-size-fits-all approach.

At Clarkson, our supply chain management program incorporates the latest trends and technologies into the curriculum so we continue to develop professionals who are change-makers and cross-functional thinkers. Leaders who understand how each process works, who recognize the potential of disruptive technologies, and most importantly, who know how to integrate each function into the overall supply chain system for superior performance.

In this issue of *Linkages*, you can read about recent examples of our faculty’s transformative research, professional leadership and educational initiatives that have secured Clarkson’s spot as one of the Top-20 programs in the nation for 13 years; including research that is improving the efficiency of global humanitarian operations (p. 2), a new Corporate Partnership program that includes a unique case competition with Goodyear (p. 5), as well as achievements of our faculty and students.

We hope you enjoy this issue and welcome your feedback (mahmoodi@clarkson.edu).
In April, 2015, an earthquake hit Nepal killing 9,000, injuring 23,000 and leaving hundreds of thousands more without homes. Tsunamis triggered by a powerful undersea earthquake in the Indian Ocean in 2004 took out entire coastal communities. While in 2005, Hurricane Katrina devastated the Gulf Coast. Levee breaches left 80% of the city of New Orleans underwater.

After a cataclysmic disaster, the worldwide response — from governments to schoolchildren, from corporations to relief organizations — is a genuine desire to help.

But that can lead to serious logistical challenges despite the best altruistic intentions says Professor Santosh Mahapatra. “Enormous numbers of people and organizations from across the globe get involved. And all of these individuals and efforts must be managed effectively for relief operations to be successful. At the same time, the situation on the ground is often highly uncertain and that adds to the challenge.”

Unsolicited goods — from clothing to packaged food — typically come pouring into the affected region. But the clothing may be inappropriate for the culture or the climate. Millions of pounds of food arrive by air but ruined roads prevent trucks from transporting it to the disaster zone. Meanwhile, lack of sanitation, clean drinking water and housing provides a fertile bed for the growth and spread of disease.

“Every humanitarian crisis is a logistics nightmare,” says Prof. Mahapatra. “Every disaster brings a demand for materials and assistance, but each one has its own unique set of challenges so each solution is different.”

For Prof. Mahapatra, an operations and logistics expert, the humanitarian supply chain presents an exciting opportunity for research. “Organizational approaches to humanitarian operations have not been adequately studied. And it requires a very different application of the basic principles of supply chain management to balance costs with social responsibility.”

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— Prof. Santosh Mahapatra

A Case Study

Prof. Mahapatra has been working with a research team led by Prof. Maneesha Sudheer at Amrita University in Kochi, India, on the management of disaster relief operations. The researchers are developing a humanitarian supply chain model utilizing the experience of Mata Amritanandamayi Math (MAM), an international relief organization headquartered in India with some 40 centers around the world, including the U.S.

Since 2001, MAM has been providing relief, funds, supplies, medical personnel and other volunteers through all stages of a disaster cycle from immediate response and recovery to long-term reconstruction efforts. “Our interest is in looking at the operational elements that makes this organization so successful and how it can serve as a model for large scale-relief and reconstruction,” says Prof. Mahapatra.
As part of their investigation, the researchers considered the MAM’s responses to four major crises in India: an earthquake in Gujarat (2001); the Indian Ocean tsunami (2004); a flood in Bihar (2008); and a landslide in Uttarakhand (2013).

The Triple-A Supply Chain Framework
Recent research into commercial supply chains has deflated the long-held notion that speed and cost effectiveness are the twin pillars of success. For organizations to achieve their goals, they must build supply chains that are agile, adaptable and aligned.

Prof. Mahapatra and his fellow researchers applied the AAA framework to their research into MAM and humanitarian operations.

“Agility is understood as the ability to act and react quickly,” he says, “while adaptability is the ability to adjust to contextual dynamics, and alignment relates to an ability to make one’s own interests correspond to the varied, and at times conflicting, interests of different stakeholders.”

The characteristics of a region — the geography, the culture, the population size, communications channels and infrastructure — also affect humanitarian efforts, as does the type and scale of the event. The researchers considered these circumstances in each of the four Indian disasters; conducted multiple interviews with personnel involved in managing and conducting humanitarian operations; and collected information on response, recovery and rebuilding activities.

“What we found was that in each case and at each phase of the recovery, MAM was able to quickly develop and adapt successful responses,” says Prof. Mahapatra. “They accomplished this by working within the local culture and social structure and being respectful of institutions and political structures.”

“This is essential to creating successful outcomes,” he says. “You can’t get the materials and resources you need to build shelters, or distribute food without the support of local government officials.”

Because MAM is involved in year-round charitable work across the globe, they have connections, communications networks and decentralized operations already in place. And MAM teams also remain involved in long-term rebuilding efforts, such as providing earthquake-proof housing and educating the local community to build the necessary resilience to safeguard against future disasters.

“Many of the strategies and principles that we are learning from our work with MAM can readily be applied to other NGOs. By solving problems with humanitarian supply chains, our hands can carry out the wishes of our hearts.”
15 Years and Counting
Clarkson Hosts 15th Executive Seminar for Corporate Professionals

Last August, Clarkson’s Global Supply Chain Management (GSCM) program conducted its 15th annual Executive Seminar, delivering state-of-the-art education to corporate professionals.

“We are pleased that our executive seminar continues to attract working professionals from highly respected global corporations,” said Prof. Farzad Mahmoodi, Joel Goldschein ’57 Endowed Chair in Supply Chain Management and director of the program. “It’s a strong endorsement of the quality of our faculty and the relevance of our curriculum.”

The four-day, on-campus program attracted participants from 11 states and 15 companies — Toyota, Stanley Black & Decker, Xerox, Global Foundries, Lockheed Martin, Corning, Goodyear, Lutron Electronics, Raymond Corporation, Snap-on Tools, Car Freshner, Arrow Electronics, Graham Manufacturing, Protiviti and Tapecon Inc.

The seminar utilizes a highly interactive format that employs team and hands-on activities, including simulations and negotiations exercises. Participants also benefited from networking opportunities with industry professionals and Clarkson faculty.

Seminar topics included emerging trends and proven strategies in GSCM, measuring supply chain financial performance, inventory management and logistics strategies, global sourcing and supply chain integration, coping with supply chain disruptions, mitigating risk through contracting, negotiations in supply chain management, and disruptive technologies in the supply chain.

Corporate sponsors included Toyota, Raymond Corporation, Stanley Black & Decker and Xerox.
Goodyear’s Clarkson Challenge

A reliable supply chain has been a central component of Goodyear Tire & Rubber Company’s success as far back as its inception in 1898 when rubber and cotton had to be transported to its factory in Akron, Ohio. Today, with annual global sales of nearly $20 billion, the manufacturing giant relies on a complex supply chain that reaches around the world.

Last spring, a team of Goodyear managers created a unique case competition exclusively for Clarkson graduate and undergraduate business students to find solutions to actual supply chain challenges faced by the company.

Participating student teams were tasked with creating a low-cost procurement model for the company by streamlining operations and costs associated with transporting materials supplied by a Brazilian rubber company. The students submitted their findings and recommendations to the company. Finalists were invited to present their findings to Goodyear representatives who visited campus.

For Michael Maresca ’17, a member of the winning team in the undergraduate competition, the competition provided a valuable learning exercise. “It wasn't like traditional test questions with one right answer. There were a lot of options to choose from all along the way, and it took a lot of time and effort to identify the options that made the most sense and were efficient all along the supply chain.”

According to Goodyear Project leader Ray Robinson ’12 (MBA), the company’s partnership with Clarkson is part of its strategy to develop “top talent” for the organization.

“Clarkson students graduate with advanced skills,” he says. “They exceed our expectations and fit Goodyear’s corporate culture and core values.”

Goodyear and Clarkson will team up again with another competition in April of this year.

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Associate Professor Weiling Ke co-authored the article, “Influence of Power and Trust on the Intention to Adopt Electronic Supply Chain Management in China,” which was published in the International Journal of Production Research. Electronic supply chain management (eSCM) has become a popular Web-based seamless supply chain process. In this study, Prof. Ke and her coauthors examined the impact of three power sources — non-mediated, coercive-mediated and reward-mediated power — on the three dimensions of trust — competence, goodwill and contractual — and their influence, in turn, on a firm’s eSCM.

Professor Farzad Mahmoodi, Joel Goldschein ’57 Endowed Chair in Supply Chain Management was the recipient of the 2015 Clarkson University Student Association Outstanding Teaching Award. This award is granted to one faculty member at the university each year by selection of the senior class. He was also the recipient of the 2015 Professor of the Year— MBA Module, which is awarded to the best professor in the MBA program by selection of the MBA students.

An article written by Professor John Milne, the Neil ’64 and Karen Bonke Assistant Professor in Engineering Management and two co-authors was named the President’s Pick for June 2015 by INFORMS (the Institute of Operations Research and the Management Sciences) and was featured on the INFORMS Connect website. Published in Interfaces journal, “ASP, The Art and Science of Practice: How Analytics Practitioners Can Learn from Published Patents and Protect Their Work,” was co-written with University of Michigan Professor Brian Denton and Clarkson sophomore Troy White ’17, an engineering & management major.

Prof. Milne’s research has also been published recently in the International Journal of Production Economics; Computers & Operations Research; and the International Journal of Industrial Engineering: Theory, Applications and Practice.

A paper coauthored by Assistant Professor Amir Mousavian on reducing the risk of cyber-attacks in power grid networks was featured on the IEEE Xplore Innovation Spotlight, which reports on new research published in some of the world’s most highly cited journals.

The paper, “A Probabilistic Risk Mitigation Model for Cyber-Attacks to PMU Networks,” appeared in a recent issue of the IEEE.
Assistant Professor Zhaleh Semnani-Azad is the recipient of the Outstanding Reviewer Award of the 2015 Academy of Management, Organizational Behavior Division. A paper by Prof. Semnani-Azad, written with collaborators from Northwestern, Carnegie Mellon and Georgetown universities that examines strategies and outcomes of negotiators from North American, the Middle East and East Asia, has been accepted for publication by the Journal of Organizational Behavior.

Associate Professor Dennis Yu and Assistant Professor Cecilia Martinez are working with the Rural Healthcare Leadership Development program to improve the management, operations and delivery of medical care in St. Lawrence County, N.Y.

Prof. Yu was part of a leadership team working on capital budget process development and assets management at Canton-Potsdam Hospital (CPH). He is now working with a CPH team to incorporate data analytics into environmental sustainability and facility management decision making.

Prof. Martinez has provided training and coaching in Lean Six Sigma methods for healthcare organizations and local hospitals, including Canton-Potsdam Hospital and the Claxton-Hepburn Medical Center. As part of the project, Clarkson engineering and management students are helping to design and improve processes in an orthopedic clinic.

Inside the Classroom

Course: Advanced Topics in Supply Chain Management
Assistant Professor Chen Xiang

Do you think Amazon can really use drones to deliver goods?
What is The Internet of Things? Does it have implications for the future of supply chain management?

Prof. Xiang brings these emerging topics into the discussion from a supply chain perspective. Students are encouraged to explore questions like the ones above and post video responses online. In-person or online discussions are carried out in the form of “supply chain chats,” in which teams investigate, present and organize discussions. Other modules in the course include a large-scale supply chain simulation called LINKS, and lectures related to revenue management, supply chain coordination, supply chain risk/disruption management, and supply chain finance.
MBA Students Place Second in Case Competition

Clarkson MBA students finished second out of 13 teams in a supply chain management competition at the 2015 Association for Operations Management (APICS) Northeast District Conference held last spring in Albany, N.Y.

The case study competition, based on a real scenario Polaris Industries recently faced, challenged students to present a solution along with their reasoning and supporting data.

The teams’ solutions were then evaluated by a panel of supply chain professionals who awarded the Clarkson students second place for their presentation.

APICS is the leading professional organization for supply chain management.

“The competition provided a great opportunity for the students to apply material learned in their classes to fully develop a creative solution and support a strategic recommendation.”

— Prof. Farzad Mahmoodi

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