

Research threads: Professor David Pyke and Alastair Bor T'00

Alastair Bor T'00 recently sat down with David Pyke, Professor of Operations Management, to discuss his research on Supply Chain Coordination.

TP: What initially led to your interest in supply chain coordination?

DP: I used to play the “Beer Game” with my students well before it became a big hit. Today everybody plays it in the core curriculum of both business and engineering. When I first started to play it at Tuck about 12 years ago, we used to play the game for a class period and then do a debrief to talk about the systems dynamics of the game. The fundamental problem was how to smooth out the “bullwhip effect.” The bullwhip effect is the term given to the oscillation of the order pattern faced by a firm in a supply chain and to the amplification of that order pattern as one moves up the chain. In other words, firms at the top of a supply chain face much higher variance of orders than firms facing retail demand.

TP: What kinds of solutions were you thinking of at the time?

DP: One of the answers was to increase information flow up and down the chain. At the time there was no Internet to speak of but there was electronic data interchange [EDI] which was a very big deal. Everyone was talking and writing about it. EDI increased the speed and accuracy of orders, for example, by eliminating typos from one person to another and by providing instantaneous order transmittal. I was reading about EDI and felt that it was well suited to solving one of the root causes of the bullwhip effect, namely the lack of visibility up and down the supply chain. EDI could give the visibility you needed.

TP: How did you think EDI could help to smooth out the bullwhip effect?

DP: I started doing research with Professors Steve Powell and Karla Bourland. We asked ourselves if we could somehow model the bullwhip effect to understand what was going on. We grappled with questions about what information might need to be transmitted. How might inventory or production policies change if visibility increased in this way? If this would be implemented by a supplier, how would a supplier use the information to change inventory-ordering policies? How much money could be saved if we coordinated this way?

TP: What did you learn from this research?

DP: We learned that the factory saves all the money and that the retailer gets significantly better service. The retailer does save some money in the form of reduced inventory, but not as much as the manufacturer. In fact, when considering all the costs of such a system, the retailer’s costs in some cases actually went up slightly. The real gains to the retailer were in the service levels, which could increase significantly. In fact the slight increase in costs to the retailer were immaterial when you considered the increased service levels. The factory could easily cover the slightly higher costs to the retailer with the significant savings that it could attain.

TP: Was there suddenly a big rush to implement EDI?

DP: At the time EDI was still quite expensive and hard to implement. The basic communications and IT infrastructures needed to implement such a system were not yet fully in place.

TP: So to whom did you target your findings?

DP: Our hope in writing the article was that academics and practitioners would recognize that this technology could be used for more than just fast and accurate mail. Over and over again we saw that it was a nice way to increase visibility up and down the supply chain. They could fundamentally change the way they handled their inventory and production processes. While the research started in 1990, it was published much later. By the time it was out everybody was thinking about the Internet doing this kind of thing. Supply Chain was not even in the original title and we changed it to Timely Demand since it was no longer dependent on the specific technology of EDI. It could be done over the phone or over the Internet.

TP: Have you furthered the research?

DP: We had plans to go on but because there was such a long lag between the original research and when it finally got published, we began to conduct research in other areas. However, I am now working on something closely related which I will describe in a minute. One interesting outcome, however is this: the results of the beer game can be a bit misleading because some of the bullwhip problems are related to irrational behavior of the players. For example, most players forget that they have already placed an order when determining what their next order should be. A rational decision-maker would not make that mistake unless their supplier failed to deliver. On the other hand, ordering in "full truck load" shipments is rational behavior that can create significant spikes and valleys in demand. Many people are modeling this type of situation.

TP: So others have expanded upon your work?

DP: People are trying to understand the money that can be saved from Vendor Managed Inventory (VMI). In VMI, there is but one decision-maker. But what happens if we have independent decision-makers that do not want to give up their decision rights? Can we structure incentives to replicate the solution that would be generated by one decision-maker? Can we set up a system in which the Nash equilibrium solution is the same one that would be arrived at by a single optimizing decision-maker? In some cases, the structures that need to be put in place are theoretically correct, but bizarre to implement. An example would be a structure where a vendor pays a customer if the vendor stocks out. Such solutions are only interesting from an academic point of view.

TP: What other events have led to an increased interest in this subject?

DP: This stream of research resulted from four separate events. First, our original paper poked at the idea a bit. Second, the growth of the Internet and the supply chain initiatives that have sprung from it have increased the general awareness of these issues. Third, the widespread use and understanding of the beer game has increased the understanding of the bullwhip phenomenon. Finally, a paper written by Stanford Professors Lee and Whang has really pushed the thinking on this matter. They are the ones who began to understand the rational reasons for the bullwhip effect. These four events have led to an entire stream of research on how to integrate and smooth out the supply chain.

TP: What is the focus of your research today?

DP: With the e-commerce boom and the complete restructuring of the supply chain in some industries, I've decided to write an article about e-furniture and e-fulfillment. There is a complex logistics problem in trying to figure out how to restructure the channel. The ordering of furniture over the Internet has some cost advantages in order processing that are potentially outweighed by delivery issues. Two models seem to be emerging in this area. One is the www.homepoint.com model that is a cooperative of several organizations on the supply chain from the factory to the house. The other is one such as www.ethanallen.com in which one organization controls the entire chain.

TP: Thanks for taking the time to tell us about your research.

DP: Your welcome.