College of Business
LEHIGH UNIVERSITY

ilLUminate Blog Transcript: Jennifer Ryan on Studying Supply Chain Management Under Uncertainty

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ANNOUNCER: 00:04	This podcast is brought to you by ilLUminate, the Lehigh Business blog. To learn more, please visit us at business.lehigh.edu/news.
STEPHANIE VETO: 00:15	Welcome to ilLUminate, the podcast for Lehigh University's College of Business. I'm your host, Stephanie Veto. Today is August 29, 2025, and we're talking with Dr. Jennifer Ryan about her research in supply chain management under uncertainty and interdisciplinary teachings in engineering and business. Dr. Ryan is the new Frank L. Magee professor and department chair for the decision and technology analytics department in the College of Business. Before joining Lehigh, she served as the inaugural department chair for supply chain management and analytics in the College of Business at the University of Nebraska-Lincoln. Jennifer, welcome to the show.
JENNIFER RYAN: 00:56	Thank you, Stephanie.
VETO: 00:57	Also, welcome to Lehigh and happy beginning of the semester. How did the first week go?
RYAN: 01:03	Oh, it's been busy. It's been actually a little crazy. So much goes on at the start of the semester. And then being new, there's so much to learn. But it's exciting. I'm very happy to be here.
VETO: 01:16	This is my favorite time of year because there's so much energy and excitement. And the first years are ready to start their new chapters. The weather's like just beautiful. It's the best for me. I don't know.
RYAN: 01:27	Yeah, I know. The fall is beautiful. And the start of the semester, everybody has energy.
VETO: 01:34	Not like the start of the spring semester where it's cold and miserable.
RYAN: 01:39	That's right.
VETO: 01:40	I want to talk a little about your interdisciplinary teaching. You teach engineering and business. How did you end up combining these two professions?
RYAN: 01:50	Yeah, that's a good question. So I mean, I've always had sort of an interdisciplinary focus. When I was in college, I studied mathematics and the social sciences. So combining math with social sciences to understand why our systems work the way they work. And then when I went to graduate school, I studied industrial engineering and management science. And so again, from its title, it's just inherently interdisciplinary, right? It combines management, but it also looks at engineering. I got into it in graduate school studying supply chain management, and supply chain management is one of these really interesting fields that is-- just by definition, it's interdisciplinary, right?
RYAN: 02:29	So we've all seen in the past five years that supply chains are so important to business, right, to getting the products or the services where they need to be, to satisfying us as consumers, what we need, so important, so important to the world economy, right? So obviously, supply chain is tightly connected with business, but it's also connected to engineering because supply chains are big, complicated systems

that need to be managed. And that requires technical expertise. It requires lots of data analysis and quantitative methods that we learn in engineering. And so it really is a field that-- unlike some others, it really is interdisciplinary by nature.

RYAN: 03:10 And so that led me to really a career where I've been lucky to be able to teach in both engineering and business. It's given me some flexibility in my career and where I go. And I think also just it makes me a better teacher because I'm able to see issues from multiple perspectives, which is you have students coming from all different kinds of perspectives as well. So that's helpful.

VETO: 03:32 I think you said it at the beginning of that. And I also read somewhere where you said it's about applying math to study real-world problems, practical problems, and often in a business context. And I feel like that really tied what you do together for me. This is a weird question, but does your analytical profession sort of leak into your personal life with problem solving?

RYAN: 03:56 Yeah, no, it really does. So I like to have step-by-step process for everything that I do. And yeah, to be honest, it can drive my kids nuts because they're not like that. But yes, it does. I mean, it affects how you think about things. It affects how you solve problems. We all have problems in our daily lives. Sometimes they're very simple problems. Sometimes they're big, complicated problems, but we all have to solve problems all the time.

VETO: 04:22 I love that. And I ask because I'm the emotional thinker in the family, so I'm like, "It has to feel right. We have to feel like we want to do this." So it's very different. I try to take an objective, analytical approach, but it doesn't always work. So--

RYAN: 04:37 Well, both approaches are useful, right?

VETO: 04:40 Yes, it's a good balance. This semester, you're teaching Analytical Approaches to Supply Chain Management. What are some things your students have to look forward to in your course?

RYAN: 04:50 Yeah. So I'm excited about this. This is a course that's just really well suited to my interests and to my expertise. And so the course is really about applying analytics, so data analysis and quantitative tools, to make supply chain decisions. And I think it's a great fit also for Lehigh students. I think they're just such strong students, right, that they won't be afraid of this kind of content. Sometimes this analytical stuff, it scares people, but I don't think that's the case for Lehigh students. And so because the topic of the course really focuses on using analytical methods to solve supply chain problems, we're going to do a lot of hands-on kind of work.

RYAN: 05:26 We're going to do a lot of activities, a lot of case studies in class where the students will-- they'll work together in teams or pairs to solve a real-world problem. They'll be given some data, maybe a spreadsheet, they'll go through some analysis, they'll come up with some recommendations or some solutions and really try to understand how they would go about solving one of these problems. And what I really want to emphasize in the course is that there's no one right solution to a problem, that there can be lots of different solutions. And we'll spend a lot of time talking about, what if? What if this changes? How would your solution change? What are the trade-offs involved in making this decision?

RYAN: 06:04 And we'll also, I think, which is really important, spend a lot of time thinking about how are we going to communicate our solution to our boss or to our manager, right? And so I'm going to always be encouraging them to come up with some kind of visual way to represent their solution, whether it's a graph or a picture, to help with the storytelling aspect of, this is the problem we face, then this is what we're recommending as a solution. And this is what it means for you practically.

VETO: 06:32 I absolutely love that. And throwing in that communication aspect to it is such a real-world thing that you see in any professional environment, those communication barriers or how to actually articulate something to someone. I love that.

RYAN: 06:50 Yeah. And we hear that from employers all the time, that we really-- our students have these great skills, but they need to be able to sell what they're doing, right? They need to convince their manager that they've come up with a good answer.

VETO: 07:04 Your research interests are in supply chain management under uncertainty. So obviously that goes with your course. Can you talk a little bit more about that? Because it just seems like such a big, broad, open topic and very specific at the same time.

RYAN: 07:21 Right. No, you're absolutely right on both aspects. So supply chain management is really fundamentally about trying to make supply match demand, right? And so the challenge we face in supply chains is that both supply and demand tend to be unpredictable, right? We can think we know what our available product will be, but we could be wrong, right? We might think we know what consumers are going to want to buy, but we could be wrong. And so on the supply side of the supply chain, we've heard in recent years a lot about disruptions to supply. So things like earthquakes or hurricanes that might cause a manufacturing plant to shut down.

RYAN: 08:01 Or there was the Panama Canal, which was having problems because of a drought. We've had the wars going on in the Middle East and in Ukraine that have disrupted supply of all kinds of things. And so we've had these big disruptions to supply. But companies also face on a daily basis lots of smaller disruptions to supply, right? A machine might fail, or a worker might just not show up, right? Or your supplier might not make that shipment. And so companies on a daily basis have to deal with all kinds of uncertainty.

RYAN: 08:35 And they need to be able to design their supply chains to be resilient and robust and to cope with that kind of uncertainty. And then on the demand side, we've got consumers. People like you and I, we're fickle, right? We change what we want. One day we want to buy blue and the next day we want to buy red, right? And so companies can do a really good job of predicting what we want, but they can only look so far into the future, right? And so there's inherently going to be a lot of uncertainty on the demand side as well. So again, it's really important to companies to build these adaptable and agile, flexible supply chains so that they can pivot when consumers pivot. And so what I do basically is trying to come up with ways to help companies address all of those issues.

VETO: 09:25 And one of your current research projects is about the impact of nonprofit group purchasing organizations on the reliability of drug supply. I almost got through it perfectly.

RYAN: 09:39 Right.

VETO: 09:40 First, can you describe what a group purchasing organization or GPO is?

RYAN: 09:45 Yeah. So a GPO, a group purchasing organization, is an intermediary or a middleman who plays a role in between suppliers. So in this case, it's manufacturers who make medical supplies, including pharmaceuticals or drugs, but also other things like bed linen for hospitals, for example, right? So you have these suppliers on one side that make all kinds of medical supplies. And then the other side, you have customers. And the customers in this case would be hospitals or more likely these days, a system of hospitals, a group of hospitals. And the hospitals, they need all of these supplies to operate and to take care of their patients.

RYAN: 10:23 So the group purchasing organization is in the middle, and the hospital systems are members of this group purchasing organization. And what the group purchasing organization does is it aggregates, it combines the volume, the purchasing volume of these different members that they have and uses that and says, "Look, I have to buy this huge volume," and gets the suppliers to give them a lower price. So they use the power of having a huge volume that they're trying to purchase to negotiate with the suppliers, these manufacturers, to get the manufacturers to reduce their price, which is beneficial for their members, the hospital system. So the hospital systems like it because they can go to the group purchasing organization.

RYAN: 11:08 They can get all of the stuff they need, right? These group purchasing organizations will provide lots and lots and lots of different types of products. So the hospitals can get everything in one place or lots of stuff in one place, but they also can get it for a pretty low price because the group purchasing organizations are doing this hard negotiation, pushing down the price that the suppliers are charging. So they're a middleman, right? They're an intermediary in the supply chain between manufacturers and hospitals.

VETO: 11:37 How is a nonprofit GPO different?

RYAN: 11:40 Yeah. So that's a good question. So traditional GPOs are profit maximizers, right? They're seeking to earn as much money as they can, right? They're businesses, and businesses often have the objective of maximizing profit or maximizing shareholder value if they're a public company. And so they make decisions based on that, based on dollars and cents, right? But a nonprofit GPO is different because profit is not their primary objective. So they do care about profit. If they want to continue to operate and not go out of business, they need to earn some profit. If they want to expand their organization, if they want to have more impact, they have to make some money to do that, right?

RYAN: 12:23 So they do care about profit, but their mission is really different. Their mission is going to have some objective that is not profit-related. And so with the particular example that we look at, it's an organization that was formed actually from a group of hospitals or hospital systems. And they have a specific stated mission of trying to reduce the shortages of drugs that have been occurring, to try to ensure more accessible and affordable supply, more reliable supply of pharmaceutical products, and particularly related to some of the drugs that have been really prone to shortage. And these are generic drugs that have gone off patent. So they have a very specific

goal that is not profit-related. So money matters to them, but it's really not their number one priority.

VETO: 13:14 Can you talk about how they're doing that with the pharmaceutical companies? How are they ensuring it, in a way, or trying to ensure it?

RYAN: 13:23 So they have sort of what I would call a multi-pronged approach that they're trying to take to eliminate drug shortages or reduce drug shortages. And so one thing they're trying to do is to bring new manufacturers into production for these drugs that have been having shortages. And so what we've seen in the healthcare industry is a lot of consolidation in manufacturing of pharmaceuticals. So in some of these drugs, the manufacturers don't make a lot of money. So it's hard for them to stay in business. So they go out of business, they stop production.

RYAN: 13:54 And so what the nonprofit is trying to do is bring some of these back into business because having more sources makes you more reliable. Another thing they try to do is change the contracts that are being offered to the suppliers. So a traditional GPO that's worried about dollars and cents, when they negotiate contracts, what they're known to do is say, "Look, I'm going to give you a contract," to the supplier or the manufacturer. "I will purchase a certain amount from you over the next three years," let's say. "But if somebody else comes along and offers me a lower price, then I get to renege. I get to cancel that contract."

RYAN: 14:34 So there's really no guarantee for the manufacturers that this GPO is going to keep buying, right? And so not only is the price really low because of the strong negotiating power of the GPO, but there's really no commitment over the long term. So that causes problems. The manufacturers don't really have an incentive to invest any money in improving their processes, having better quality production, having more reliable production. They just don't have the incentive to do that. So what this nonprofit said is, "We're going to give you a real commitment. We're not going to renege on you. We're not going to push your price super low, number one. And number two, if we say we're going to buy a certain amount over the next year or two years or three years, that's what we're going to buy." And so that change to the contract structure gives more of an incentive, makes it easier for these manufacturers to say, "Okay, then it's worthwhile for me to go ahead and invest in improving my manufacturing."

RYAN: 15:33 And then the third thing that the nonprofit is doing is they're actually building their own plants. They're building their own manufacturing facilities here in the US because a lot of pharmaceutical manufacturing has been outsourced outside the US to places where they don't have the same degree of safety standards or quality standards that we might have. And so having it domestic, so close by, improves reliability, but also having those higher quality expectations can also improve reliability of supply. So they're trying to take this multi-pronged approach to addressing some of the reasons why drug shortages occur.

VETO: 16:11 What have you uncovered? What's the impact been so far with these nonprofit intermediaries?

RYAN: 16:18 Yeah. So that's a really good question. And so this company has been around, that we've been studying, for seven or eight years, but they're still pretty new.

Pharmaceutical manufacturing, it's hard to set up and get going. So it's hard to say for sure what their impact is. So the data is not there yet. But what we do in the research is we try to build economic models that will help us predict or anticipate, what do we think their impact will be? Or are there certain conditions under which we think they'll be more successful versus less successful? What we find is that it really does depend.

RYAN: 16:51 In general, if you have one of these nonprofits, the member organizations or the hospitals that work directly with the nonprofit, they're very likely to see a benefit just because of all of the things that I just talked about that this nonprofit is doing. So that's a good thing. The members will generally see a benefit. But not every hospital system currently is a member of this nonprofit, right? Sometimes they're still working with traditional GPOs and not the nonprofit. And that's fine. But those hospital systems won't necessarily see a benefit depending on things like the reimbursement rate, meaning how much are insurance companies paying hospitals for these pharmaceuticals, right?

RYAN: 17:34 Things like the reimbursement rate are going to affect whether more broadly the nonprofit improves drug reliability, broader than just its members. And so if the reimbursement rate, for example, is too low, then what happens is when the nonprofit comes into the market, it creates extra competition. And then the GPO is forced to focus even more on reducing price, which can hurt reliability. So I think the research is interesting because it demonstrates that the economics of supply chains are really complicated. And our intuition just doesn't work. In many cases, you really have to get into the details because there's lots of things going on that you have to get to really understand to make predictions about what will happen.

VETO: 18:18 How does game theory play into this?

RYAN: 18:21 Oh, so that's a good question. We rely a lot on game theory for this analysis. So game theory is a tool from economics that's used to understand how individuals or organizations, companies, react to incentives or how they react to each other. If I make a decision, how are you going to react to that decision, right? And so that's what supply chains are, right? Supply chains are a bunch of independent companies that are interacting with each other. For this particular project, right, you've got the hospitals, you've got the GPO, you've got the manufacturers. They're all making independent decisions but reacting to each other.

RYAN: 18:58 So I mentioned that one of the things that the nonprofit is doing is changing the type of contracts that they're offering to the suppliers, to the manufacturers. And so we use game theory to study, under different contract designs, how are the suppliers going to react? What will their decisions be related to investments in quality, investments in improvements to manufacturing processes? How do those things depend on the nature of the contract, the price, the quantity commitment, whether it's long-term or short-term, whether the GPO might renege on them, all of these things? So it's all about really studying incentives and how incentives affect the behavior of firms and individuals, which is game theory.

VETO: 19:45 When I first read game theory when I was researching you, of course, I had to Google search it. And it's incredible what it's used for throughout everything, industry, military. I'm going to start using it with my kids.

RYAN: 20:01 No, that's right. And then I think you probably already do use it with your kids, right? "How do I approach this with them? If I put it this way, they might react well. If I put it a different way, they might react poorly." So most parents actually are pretty skilled, I think, with game theory.

VETO: 20:18 I have a tween, and that is a constant.

RYAN: 20:22 Yes. I gotcha.

VETO: 20:24 I want to talk briefly about another topic that you're researching. And while it's completely different, I love that when we first talked, you said that it demonstrates the diversity of problems that arise in supply chain management. So this is another great example of it. This research is about dynamic resource sharing in private 5G networks with slicing. Please discuss.

RYAN: 20:48 Yeah. So no, I'm glad we're talking about this as well because I think it really gets at the more engineering side of what I do, right? So the first project was more on the business economic side. This is definitely much more of an engineering one, but still supply chain. And so we study companies that are implementing what are known as private 5G networks. So we all know 5G, right? 5G is what powers our phone, right? And so when we use our phone and we're out and about, not on our home Wi-Fi, for example, we're connecting to a 5G network through our cellular provider. And that's a public network or a commercial network.

RYAN: 21:25 Many companies don't want to use those public networks. They prefer to have a private network. So they will set up their own private 5G network so that they don't have to connect to any of the main providers that are out there, the public providers. And they prefer this for a number of reasons. One, in certain locations, it can provide better connectivity. Imagine if you're working in a mine, right? You might not get cell service, right? Or if you're on an oil rig out in the middle of the ocean, right? But sometimes also in manufacturing environments, there can just be interference from the buildings or from the equipment that's there.

RYAN: 22:04 And so having your own private network can help eliminate or reduce some of this interference. The other reason companies like these private networks is for security reasons. They can keep their data to themselves, right? They don't have to worry as much about other people potentially accessing, hacking into their systems. It's just a little bit more secure for them. So there's these private networks that companies have started setting up over the past five years, and they have a lot of benefits, but they're also costly and difficult to set up, right? You have a manufacturing facility. This is a big investment for you to set up one of these.

RYAN: 22:41 So when we talk about dynamic resource sharing, what we're really looking at is, how can companies better manage the resources that are required to operate one of these networks? And so the resources are computational resources like computer processors, storage that's associated with computer networks, but also things like the bandwidth or the spectrum that they have to use to get the connectivity. So we come up with policies to help companies better manage their resources so that they can operate one of these networks much more efficiently. And so the word dynamic is in the title of the paper because the use of these networks is dynamic, right? Companies

don't do exactly the same thing all the time. It changes over time. So how you manage your resources has to change over time as well.

VETO: 23:33 Have you found that companies doing this, in the end, it's more economical for them? Or is it just because they need access and also there's the safety for data?

RYAN: 23:46 Yeah, I mean, I think it's really the access and the security of the data that's driving them to do this. It's just so expensive. And they are looking for ways to actually earn some revenue off of one of these networks. So they're looking at things like, "If I build one of these networks and suddenly I have all these computational resources, if I'm not using them on a given day, can I lease them out?" Just as people can go to Amazon Web Services and get computational access to processors, these companies are saying, "Hey, could I do that as well and earn some money from this?" Now, that's all very, very new, and they're not really doing it yet, but they're trying to. They're trying to think about ways they can generate revenue off of the investment that they made into one of these networks.

VETO: 24:31 Is there anything else that you're looking into and working on right now?

RYAN: 24:35 Oh, I mean, I have a few other things. I mean, I think one other project I would just mention that I think is really important is looking at remanufactured products. So again, thinking about cell phones, a lot of people will recycle or sell back their phones. And so we're looking at the decisions that companies make about how to refurbish those phones, whether they're going to refurbish, how to refurbish them. And companies get to decide, "Am I going to refurbish it a lot so it's like new or just a little bit so it's more usable?" And so those are really complicated kinds of questions. And there's a lot of interesting research related to that.

VETO: 25:16 Well, Jennifer, thank you so much for being on the show. And again, welcome to Lehigh.

RYAN: 25:21 Thank you, Stephanie. I really enjoyed our conversation.

VETO: 25:24 That was Dr. Jennifer Ryan speaking with us about her latest research projects in her fall course Analytical Approaches to Supply Chain Management. This podcast was brought to you by ilLUminate, the Lehigh Business blog. To hear more podcasts featuring Lehigh Business thought leaders or to follow us on social media, please visit business.lehigh.edu/news. This is Stephanie Veto, host of the ilLUminate podcast. Thank you for listening.