

ILLUminate Blog Transcript: Zach Zacharia on Supply Chains during COVID-19

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- ROB GERTH: 00:00 Welcome. I'm Rob Gerth, director of marketing and communications for Lehigh University's College of Business. Today is April 27th, 2020, and we're talking with Zach Zacharia about how supply chains are affected by pandemics. Dr. Zacharia is an associate professor of supply chain management and director of the Center for Supply Chain Research at Lehigh University where he teaches graduate and undergraduate courses in supply chain and operations management and logistics and transportation. Welcome, Zach.
- ZACH ZACHARIA: 00:30 Thanks very much, Rob, for inviting me to this podcast. I really appreciate it.
- GERTH: 00:34 And the first question I have is my son's question, and he wants to know if there's going to be a bacon shortage in the coming weeks.
- ZACHARIA: 00:39 Let's talk about how the food supply chain actually works. And let me first be clear that the US food supply chain is a well-designed, well-managed supply chain where we know what the demand is going to be, and we create a supply chain that's focused on efficiency. However, the last week or so, there has been another Tyson plant that has shut down. And right now, the last plant that shut down serves more than 5% of the food, meat packing plants in the US. So there is a chance. There is a risk that there could be a shortage in bacon in the next few weeks.
- GERTH: 01:23 And I guess meat in general, right?
- ZACHARIA: 01:25 Absolutely. Absolutely. Definitely.
- GERTH: 01:29 And my wife's question has to come ahead-- because I always talk to my family before I do these things. My wife's question is about toilet paper. Why is there a lack of toilet paper? Is that a supply chain problem?
- ZACHARIA: 01:41 Well, I think it's actually related to two things. One is that, first of all, it's a hoarding problem. You get people panicking and going and buying product, in this case toilet paper. And when the demand spikes, you're going to run out of availability. That's always there. One of the things that we need to consider when we take a look at the toilet paper supply chain is really that the companies that make toilet paper serve two large customers. One set of customers are the industrial customers, and the other set is the consumer set of customers. In the consumer market, they are pretty well-aware of the kind of things they need to make, and it's different than what the industrial market is. And that's about a 50/50 split. So when you have a lack of toilet paper, you've got demand that is unpredictable. And toilet paper by itself - let's be clear - it's very bulky. It takes up a lot of space. That's a low-margin item. So if you're a grocery store, you're not going to store a lot of extra toilet paper because demand is relatively constant. Actually this brings this basic idea that in supply chain we try and focus on reducing inventory to be efficient. But there is a thing called the bullwhip effect.
- ZACHARIA: 03:04 So bullwhip effect by definition is the increasing variability of demand as one moves away from the point of change, as one moves upstream. So let's say you've got a consumer, and the consumer increases their demand by 10%. The retailer seeing that increase in demand is going to order an additional 10%. And the wholesaler who they

order from seeing that increase in demand will order an additional 10%, then the manufacturer. And eventually, this goes to raw material supplier. So this demand which started off as a 10% increase could potentially become 40%, and that's a huge difference in demand. So what is key about the bullwhip effect is that this effect has been seen to happen whenever there is distorted information, when there's order batching, there's overreactions, or when there's hoarding. And so the bullwhip effect really happens when people don't share information. So when you look at this example of toilet paper, the question is that could we have predicted that kind of demand? Could we have understood and been prepared for it? Well, you couldn't have because people were hoarding, and people were overreacting to that perceived lack. And it takes a while for a supply chain to be flexible, to change because to add flexibility, it's going to add cost. So the question then is that-- when are you going to have enough toilet paper in every grocery store? Well, when the supply chain has retooled to produce more toilet paper for the consumer market.

ZACHARIA: 04:51

And by the way, this goes also in the food supply chain. Remember, Americans are used to eating about 50% outside the house, be it restaurants, be it school lunches, cafeterias. And when you've taken the demand out of that area, it takes a while for the supply chain to retool because obviously what you are going to sell to a restaurant is different than what you're going to sell to an average consumer in terms of packaging, in terms of the marketing that goes with it. So I think any of these kinds of issues that relate to supply chain-- really has to go to this idea that you design a supply chain to be efficient, to keep it low-cost, and therefore when you make a change, it's going to add a lot of additional cost in the system. And a grocery store doesn't make much money on toilet paper. It's a low-margin item, and it's a big, bulky item. So you're not going to keep a lot of it. You'd much rather have more pasta or bread that people are going to buy and have a little bit more margin and take a lot less space.

GERTH: 05:58

Now, I kind of jumped in the middle of the whole conversation. So let me give you a chance to do a basic definition of what a supply chain is because supply chain-- they're kind of using it on the news as this one thing, "The supply chain is broken." But it's not really a one thing. There are many, many, many supply chains. Is that right?

ZACHARIA: 06:16

Absolutely. So a supply chain by definition, you're simply looking at a group of companies that work together to serve a particular consumer. For example, if you want to look at this idea of the toilet paper supply chain. You've got Georgia-Pacific that is actually processing pulp from another company that actually will cut down the trees. They actually make paper. Well, they take that paper, and then they give it to-- they ship truckloads of that paper to give it to somebody who takes that paper and processes it into a smaller roll that actually fits the toilet paper. And you could potentially go to a distributor, a wholesaler and then finally goes to a retail store. So a supply chain by itself is a group of companies that have one product all the way through. But it's a bit of misnomer because most retailers will have multiple supply chains for even toilet paper. They might not just get-- it could be Kimberly-Clark or Procter & Gamble. I mean, there's a number of different companies that could serve with that particular product, and each one of them has its own supply chain.

GERTH: 07:25

I've heard you say you can't build 99% of a car as far as talking about supply chains.

ZACHARIA: 07:32

Well, the reason I say that is that-- this the idea that sometimes you have a single part. If you are missing the cable that connects the brake pedal to the brake pads, you're not going to sell the car. It doesn't matter that you've got everything else built. Without that one part, you can't finish the car. The only reason I sort of brought that up was the idea that, in some cases, it's some very small, minor part from a supplier that could be on the other side of the globe because you found that that is the best either quality and best cost combination to get out there. You still can't sell the car until you get that part. So I was using that as an example to say that you can't finish something till you've got all the parts manufactured assembled even if it's a tiny 1% or %0.01 of a car.

GERTH: 08:29

And so obviously pandemic disrupts supply chains. What are some other things, until we were suddenly inundated with supply chain news, that we didn't really think about that are disrupting the supply chain?

ZACHARIA: 08:46

Well, there's a lot of different things that could potentially disrupt the supply chain, but the top seven sort of supply chain disruptions that as a supply chain professional you're going to actually plan for-- the top seven in the last 10 years, in order of priority, the most disruptive is something related to unplanned information technology or telecommunication problems. That is the number one reason you could have a disruption, that information didn't get across. Second is adverse weather. For example, it could be just as simple as a storm to something as severe as a hurricane. But weather issues can affect the delivery of the product to its final destination. There's something wrong with the transportation network that's bringing the product; for example, a port strike or actual problems in the infrastructure and getting that product through. If the third party, the 3PL as you were, the company that actually transports the product has a problem. If you don't have the right kind of people available to be able to work in your supply chain, that's number five. Number six is a cyber-attack or data breach. That's a sixth kind of disruption. The seventh one is new laws or regulations. For example, tariffs that came across affected the supply chain. So those are the top seven supply chain disruptions in the last 10 years.

GERTH: 10:17

So do companies plan for this? Do they have algorithms like, "Oh, wow, if there's a hurricane, here's what we're going-- in Louisiana, here's what we're going to do"? Or are they just playing it by ear [laughter]. I guess where I'm going-- I want you to answer that question, but where I'm going is, how come everyone's caught so flat-footed on this pandemic because it's something we did know about? We could see it coming from the other side of the world.

ZACHARIA: 10:43

One of the things that we do in supply chain that's important is to be able to manage even when there is a disruption. And I want to distinguish from those disruptions that we could plan for versus unplanned events. So things that we can plan for are those seven supply chain disruptions, things like adverse weather. We know when a hurricane is coming, and we can actually plan what to do when there is a hurricane. However, there are some kinds of disruptions that are so unique that we actually call them black swan events. And by that I mean is something that is unpredictable and has a potentially severe consequences for the supply chain. And here is the point. You don't plan for black swan events. You basically react. So I want to distinguish between disruptions you can plan for and that you could build redundancies in-- you could say that, "Hey, if the hurricane comes in from this side, I know the first things people need, first responders, they need water." That's something that is really, really

critical. So you can get bottles of water available. You can get flashlights. You can actually plan for these kinds of things, and your supply chain can survive in these kinds of situations. However, black swan events are things you can't plan for because that's the whole point. It is something completely unpredictable. And what you really need to do in that case is just simply react and be capable, be flexible in your supply chain.

ZACHARIA: 12:12

So let me give you some examples of black swan events just to sort of tie this in. An example of a black swan event is the 9/11 terrorist attack. Could not have planned for it, and when that black swan event happened, worldwide demand decreased substantially. Another example that was a black swan event was the SARS epidemic 2002, 2003. Here is what's interesting. That particular event happened, and it was somewhat contained in China. And what did it do? It affected the supply of products. The financial recession, the Great Recession 2008, that's an example of where demand got constricted. Again, something you couldn't have predicted. It's a black swan event. 2011, the earthquake and tsunami in Japan. That's kind of interesting because there was a lot of suppliers in both the automotive supply chain and the IT supply chain that were affected when those manufacturing centers went down. And paradoxically, a lot of companies took their manufacturing from Japan and moved it into China to be prepared in case there is another issue over there. But now, I want to compare that to COVID-19. COVID-19 not only affected the supply when it was affecting places in China and Japan, it also affected demand. And that's what makes COVID-19 particularly impactful because it affected both the supply of product, and it affected the demand of product, and it has had a huge worldwide effect.

GERTH: 13:58

And is there somebody at these companies that is planning for these things? Are they running scenarios? Like I said, do they have algorithms where they're trying to guess what is going to be the next thing? And the rest of that question is, are we going to--? They talk about this pandemic reoccurring, whether it's in the winter or the fall or even sometime in the future. Will we be ready for it when it happens?

ZACHARIA: 14:26

So to answer your first question about are there people working on these kind of scenarios, absolutely. The better supply chains are those companies that have taken the time to do what is called sort of war gaming or getting into some sort of a simulation where you say, "What if?" And in every supply chain, you need to be able to handle discrepancies, handle changes, things that aren't planned. And if you can do that, then you're prepared for that change. The best supply chains are those that respond to change adequately. If you're focused just on efficiency and lowest cost, you can get a very efficient supply chain, but then you can get totally blindsided if something happens that you aren't expecting. That's that toilet paper example. You could have a very low-cost supply chain assuming that there's really going to be no change in demand. All of a sudden, change happens, and you could end up with no product.

GERTH: 15:29

And just to put it in perspective, you just did the list of SARS and recession and tsunami as black swan events. Where does COVID-19 fit in as far as the level of disruption? Is that the biggest one ever to date, or?

ZACHARIA: 15:44

Absolutely. It is clearly the largest single supply chain disruption that's out there. We're seeing worldwide huge drop in demand and in production. And by far there is no doubt this is, I'm sure - we're also looking at the economic indicators - is going to

have huge impact on US GDP and world GDP because it's simultaneously affecting not just the demand but the ability of people to purchase.

GERTH: 16:19

So tell me how has COVID-19 specifically impacted business worldwide?

ZACHARIA: 16:26

COVID-19 is kind of unique out of the black swan events we talked about before in that it impacts both supply and demand. So sources of supply worldwide, whether you're in China, whether you're in Italy, whether in Europe, the US, you're not able to manufacture product. So that has completely reduced the availability of product. Second is it's also reduced demand. So China, which was a major production source-- and to be clear, during the original SARS virus in 2003, China made about 4% of world GDP. But now in 2019, the latest time we had dated, it made up 19.7% of world GDP. 20%, that's a huge impact. So when you constrain the production in China, then you're not able to produce for the world. The other thing that people forget is that China is also a large consumer market. It actually consumes demand. It takes product away from the US. We're not able to sell to them. So when it's a production source and a consumer market, you've got a constraint on both sides.

ZACHARIA: 17:36

The other part of that is that if employees are unable to work and manufacture products, they're not getting wages to buy more product. And you've got to-- take a look at the US situation. Consumer spending comprises 70% of the US GDP. So if the consumer is now staying at home and not spending, not buying stuff, then the US GDP really falters. The flip side or another very important ancillary component of that is that 70% of the US GDP is services. And services are unique in compared to production or product manufacturing in that for services to actually get actualized, you need to have the involvement of a customer. So you can't provide haircuts without the customer actually being there. You can't provide food in a restaurant without the customer. You can't have a plane flying without the passenger. So when you have services, you need people's direct involvement. And so that is a double whammy that COVID-19 is affecting the supply side and the demand side. And we in the US feel it even more because so much of our GDP is based on consumer spending and on services.

GERTH: 18:55

And do you have any examples of companies that have been handling this disruption in any of these supply chains?

ZACHARIA: 19:01

There are a number of companies that actually have been doing well in this situation. First example, I'm sure, is Amazon. What did they do? Amazon put it out that they're not going to be able to give two-day delivery for all their products because they're going to prioritize certain things over others. And you know what? Most consumers are okay with that because they could see there's value in doing this. So Amazon has done well. I've talked to someone who is an executive at Walmart. Walmart is hiring more people because there has been an increase in demand. They're also managing their supply chains. So companies who have a good understanding of their supply chain are doing well in this situation. And let me define what I mean by that. Most companies know who their customer is and know who their suppliers are. But it takes a more sophisticated company to know who their supplier's supplier and their customer's customer. To me, once you go beyond the immediate level of your own firm and your own supplier and your own customer, then you're starting to talk supply chain because now you're looking at the choices you make and the impact it might have on your customer's customer's customer possibly.

- GERTH: 20:19 And I guess there's some cost that's somebody is figuring out, the cost of keeping customers.
- ZACHARIA: 20:24 Absolutely. In fact, there's this idea that sometimes we actually say that-- some customers cost you too much; it's not worth [laughter] [needing?] them. And we actually have this idea of firing the customers. And invariably sometimes it's the large customers-- because they're so large, they expect all sorts of concessions that by the time you actually look at the cost of servicing that customer, you could see that you're losing money. And so companies all the time make that decision about is this particular customer worth keeping because it could be that they might ask for so many special services; you might decide it's not worth keeping them.
- GERTH: 21:09 And are there companies that do go the opposite side of that? It's they're like, "Forget the marginal customers, let's stick with our best customers and service them"?
- ZACHARIA: 21:19 Yes. Companies have to make that decision. Again, another company told me a week ago, and this particular company works in medical devices. When they started seeing COVID-19 happening, they started limiting the sale of their products to hospitals because they knew these were existing hospitals. And when they immediately ramped up 100, 200 percent, they felt that they were possibly overbuying and - remember that bullwhip effect? - hoarding product. So they limited even their best customers. They limited how much product could actually go to them. And this company is still capable of meeting demand because they managed that early-on panic buying. They kept things in line, and they're servicing all their customers.
- GERTH: 22:07 And the supermarkets would adjust on that with toilet paper [laughter]?
- ZACHARIA: 22:12 Absolutely. And I'm sure, Rob, you've gone to a grocery store recently. I mean, I went to one yesterday, and on it, there is a clear sign that said what the limit was, how many gallons of milk you could buy because they want to make sure it's available for everybody. So yes. You're absolutely right. If you limit it and you get people to make decisions based on the limited amount, then you can actually manage the supply chain.
- GERTH: 22:36 So speaking of managing now, so right now companies all across the world are having meetings, Zoom meetings no doubt, that are like, "Okay. What do we do when this happens again?" So what kind of strategies are companies coming up with do you think from your experience? What are those conversations like?
- ZACHARIA: 22:57 So again, I had a great board meeting with the companies who are in my center for supply chain at Lehigh. And they talked about some of the things that they're trying to do different. Number one, they're actually trying to figure out or get visibility into the supply chain. They are talking not to just their immediate suppliers. They're talking to their supplier's supplier to ask them, "Are you guys going to be able to handle this? How was your financial situation? Will you be able to make product for us? Can you ride out the storm?" Because one of the key things that supply chain management really relies on is good information sharing. So the number one thing that we sort of have talked about in supply chain is get an idea of what we call end-to-end visibility. That means you might have to got into one, two, three, or four tiers away from your own company - by tier I mean a supplier's supplier and so on - to really understand and make sure they're viable because there's no point in sourcing some part that you get from your supplier and then they get from their supplier-- to where somebody

three, four tiers away is now out of business and can't provide the product, your entire supply chain could fail. So good companies are talking and sharing information. And I'm also telling their suppliers that if you can't get access to credit, can't get access to capital, we will help you because we know that we need you to be viable so that we can continue to make our product. So companies are looking in getting into understanding who their suppliers are.

ZACHARIA: 24:41

The other thing that companies are starting to do, and I think this is really important, is information sharing and transparency, transparency for managers to employees. You've got to let the employees know what are the steps you are taking to protect them. Another person on my board talked about the fact that they have reconfigured their actual workspace so that they can maintain close to that six-foot distance on the workers. Another company said that we make sure that there is no overlap of employees when there is a shift change. Now, this would be unheard of three weeks ago. But they didn't want all the people coming in at the same time and leaving at the same time. They actually put a [staggerer?] so that you don't have everybody crowding through the front door and the back door and that kind of stuff. So companies are making changes to sort of handle what the changes have been going on because of the COVID-19 pandemic.

GERTH: 25:43

And how long do you think it will take to get-- every supply chain I'm sure is different, but how long do you think it will take generally to fix the supply chains? And is there like this catch 22 where you had a factory in China where they had to stop manufacturing things, and now you're going to start manufacturing things? But all of a sudden, people have enough of it. By the time it all catches up, people have enough things, so now you have a surplus. What's the science involved in that to get things restarted?

ZACHARIA: 26:15

Well, that again could be that example of that bullwhip effect, right, where all of a sudden, you have increasing demand. And then everyone gets a surplus, and you get decreasing demand. And the way to counteract that is by sharing information. You tell them what the demand actually is. But you're actually right, Rob, that there is going to be some inertia in the system. You can't start these things in full speed. Even though the manufacturing plants have started in China, the steamship lines that actually send the container ships that can get that product, they've taken out significant number of their sailings. They've just idled those ships because you don't have enough demand. So it's going to take a while for those companies to start putting those ships out to pick up those containers. So there is going to be some inertia in this whole process, and the problem is there's going to be a little bit of overshooting. Do you prepare for customers to come back into your store? And if those consumers don't come back, what do you do? Let's take the oil as an example. I'm sure, Rob, you saw that the futures market in oil was for a brief day there trading negative implying that if you drive to a gas station, they're going to pay you money to take that [laughter].

GERTH: 27:35

Right. Right.

ZACHARIA: 27:36

Yeah. To fill up your gas. But look what's happening is that that's what's called a batch production. So if you are pumping oil out of the ground that makes sense as long there is demand at a gas station to draw that gasoline out. But as a manufacturing-- the oil producer, when they're refining that product, they need to store that somewhere. In fact, the price of very large crude carrier - these are those massive oil

tankers, the largest ships on the planet - the lease rates have gone up by almost 200% because companies are now saying, "I can at least use it to store oil and wait for the price to come down, and then I'll drive those ships back." So getting back to this idea, there is going to be inertia. It's going to take a while for it to go through. You might overshoot. You might overproduce. And then you might-- and again have some stock-outs because you have too much demand. But this is where a good collaborative supply chain can sort of manage that process.

GERTH: 28:46

And give me your best prediction. Let's say nothing else bad happens in the next two years - I'll give it two years - on this level of promise as COVID-19. How much time will it take to get back to what people think of as normal, people in the United States anyway think of as normal?

ZACHARIA: 29:06

Yeah. Excellent question, Rob. The basic thing is that-- I think businesses suffer the most when there is uncertainty. If you tell me that there is this kind of, let's say, demand fluctuating, demand variability-- if we can't, we have to be six feet apart. We can manage under all of those conditions. It's when you don't know what is going to be or should we invest in additional items that is going to cost us money, but that way that's the only way we could serve the public. If you know that forever we're going to be six feet apart, then you can change the configuration in your restaurant. It's because you don't know that you don't know when you're going to actually switch. So you gave me that two-year challenge. I am confident that we will be well-capable of coming back to a new normal. I'm not saying we're going to come back to the exact same normal, but I want to give you the example of 9/11. Look what happened with airport security. And I don't know if you're old enough, Rob, but--

GERTH: 30:13

Thank you [laughter]. But yes. I remember [laughter].

ZACHARIA: 30:17

Where we could actually go on with a bottle of water. We didn't have to take our computer out of our bag. We didn't have to take our shoes and belts off. We got used to that. And you know what? Passenger travel increased to a much, much larger level than it ever was in 2001. So my short answer to this is, of course, we're going to come back because we're going to figure out how to handle this. And the quicker we get into-- obviously, the big issue right now is vaccination. It's testing, contact tracing. These are all issues associated with the science of the pandemic. But once you start getting those things into place, we can manage the supply chain. We have a lot of very, very smart people who are focused on how to become efficient again given these conditions.

GERTH: 31:09

And then is there any chance that companies, international companies that are based in the United States will bring their manufacturing back to the US just to shorten their supply chain?

ZACHARIA: 31:19

I think that this particular experience has shown that there is value in handling what we could call extremely volatile demand, get that served by perhaps by a manufacturing side much, much closer to the US or in the US itself. But we're not necessarily going to move 100% the manufacturing that was done outside the country. And this is where that 80/20 rule sort of comes in. 80% of the time you are willing to wait for the product to take 21 days to go on a boat, to go through-- from Shanghai all the way to Los Angeles. But 20% of the demand, you might fly in because you want to get it here in 11 hours instead of waiting for the 21 days. In the same sense, the very regular stable kind of demand you could source internationally. But

the highly volatile, the kind of demand that you can't necessarily predict for, you're probably going to source within the country so that you can handle that kind of quick either increase or decrease in demand.

GERTH: 32:28

And from your experience, will companies-- either whether it's big packing companies or manufacturers of paper products or anybody else like that, will they learn from this? Or is there somewhere built into their DNA to be sort of short-sighted and only thinking of the immediate results on their stock? Or will they be able to take the long-term? Because some of this is an investment. You have to make an investment to keep up with some of this and an investment that you don't necessarily see return on unless it's one of these black swan events.

ZACHARIA: 33:03

So there's two ways to answer that. I mean, all companies are motivated by the bottom line and the need to satisfy their shareholders. So if there is a way that shows the companies stay profitable by creating redundancies, they're going to do that. If it only looks that-- it's only possible to survive because you're the lowest cost and because that's what your customers are going to purchase, then you're going to do that as well. So it's this idea. I mean, a few years ago, people thought that organic would never work because consumers would never pay the extra premium but now-- and this took a number of years. Finally, you can see the consumers are willing to pay more for organic product. And I don't want to get into whether it's any better or worse, and that's a whole different decision, but companies are motivated by the need to show a return on their investments.

ZACHARIA: 34:06

And so if you have companies that go bankrupt because they didn't have redundancies, redundant supply chains, manufacturing closer over here, then that will be a lesson. But no one - and let's be clear here - no one is going to have an extra whole warehouse full of toilet paper for everybody to buy one-year supply of toilet paper. You can't design for that. What you can design for is somewhat of a change, of a surge. But eventually, we're going to go back to that 50/50 percent split where 50% goes to industrial customers, and 50% goes to consumer customers. And you might make the process of switching from one kind of customer to another faster, but you've got to be able to serve both markets because your industrial customer is not going to pay a premium. And so at the end of the day, you have to look at the bottom line.

GERTH: 35:08

So what I'm hearing is slowly-- once things get back to normal, I'm going to slowly stock up on toilet paper in my basement somewhere [laughter].

ZACHARIA: 35:19

I don't know. The focus on toilet paper, I mean, it just--

GERTH: 35:25

I'm sorry [laughter].

ZACHARIA: 35:28

But would you though [laughter]? Let me ask you this. Actually this is a great supply chain question. You run your own house, your own inventory system. And let's say you have only a limited amount of space. Now, I'm not saying that you-- let's actually make an apartment dweller. So now, you don't have a basement to store a year supply of toilet paper. Would you go and buy a year supply and then go put it into a storage bin that you're going to pay extra money over because you don't ever, ever, ever want to be out of toilet paper?

GERTH: 36:01

So you're saying I'm like a mini-Walmart [laughter].

ZACHARIA: 36:04

Absolutely. You're managing your own inventory.

GERTH: 36:07

No. I wouldn't do that. Of course, that would be way too expensive for what it'd be worth. See, but I'm willing to take the risk, I guess, of not running out of toilet paper in that situation. Yeah.

ZACHARIA: 36:17

Absolutely. And see, managing inventory in a grocery store, managing inventory in your house, it's all about inventory. Now, some people do have a year supply of beans, for example, or canned goods and those kinds of things because they always believe that that could be an issue. And some other people do not. You can't say one is any better than the other. But if the economic conditions change where you can't get access to food, and then you have someone that-- got a year's worth of whatever, then they might have made the right choice. But the long-term answer is that supply chains are efficient when they manage cost, and there is no logical reason having a year supply of something assuming that demand and variability is somewhat constant. We can always handle a 10% up or down. And in fact, that's what good supply chains can actually do. We can handle that kind of change in demand. No one goes for that once in a-- 100-year flood. You can't design and build for that because if you do, then 99 years you've got extra what you have to pay for.

GERTH: 37:29

It's a perfect place to end it, Zach. Thanks so much.

ZACHARIA: 37:32

Thank you, Rob. I really appreciate this.

GERTH: 37:34

Thank you to my guest, Zach Zacharia. As director of the Center for Supply Chain Research at Lehigh, he and the faculty and students at Lehigh Business are generating new ideas for education and future knowledge in the field of supply chain management. This podcast is brought to you by ilUminate, the Lehigh Business blog. To hear more podcasts featuring Lehigh Business thought leaders, please visit us at business.lehigh.edu/news. If you want to find Zach's Center for Supply Chain Research at Lehigh, you can just search that, and you'll find it. Don't forget to follow us on Twitter at Lehigh Business. Thanks for listening, everybody.