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ALEX MAIERSPERGER: From the largest global governments and health insurers, to local hospitals and public health agencies. From Sweden to Singapore to South Dakota, SAS Health helps the world get to a healthier future faster with advanced analytics and leading artificial intelligence and machine learning platforms. I'm your host, Alex Maiersperger in season three of our podcast and video series.

We celebrate those changing health care and life sciences for the better. Today, we get to celebrate and welcome Dr. Robert Handfield, Bank of America University Distinguished Professor of Operations and Supply Chain Management, NC State, and director of The Supply Chain Resource Cooperative.

Welcome Dr. Handfield.

ROBERT HANDFIELD: It's a pleasure to be here today, Alex. Thank you.

ALEX MAIERSPERGER: With all the other demands on your time, thank you so much for spending some time with us today. Although, you may not have a lot going on. I mean, you could be pretty bored these days. It's been a couple of slow years in supply chain.

ROBERT HANDFIELD: Ha, ha, yes indeed. I was joking with someone the other day actually. I don't think I've had more media mentions in any other period in my life than I have in the last two years. I've been interviewed by the Wall Street Journal, Financial Times, NPR, Washington Post, and none of these periodicals took any notice of supply chains prior to that time.

ALEX MAIERSPERGER: Right, so well-deserved time in the spotlight. And we'll get some predictions from later about when you can rest. Though we'll talk health care specific in the initial part of this conversation. I was at a large health care system back, probably, seven or eight years ago. And at that time, we had a debate about buying a large warehouse and stockpiling the goods that we didn't need then, but we may need in the future.

And I think we ended up not doing it. So we lost that side of the debate because at that time the just-in-time delivery was working so well. Is there a big pendulum swing coming? Are we rethinking just-in-time delivery now?

ROBERT HANDFIELD: Well I think we're rethinking the overall health care supply chain in our National health care system right now because of COVID. And just to give you a little bit of background, Alex, I wrote a story-- a report for IBM actually in 2010 about the H1N1 pandemic. And at that time, it was called Planning for the Inevitable.

And it wrote about the fact that we did need to have better national stockpiles. And we needed to have better alignment, better agility and better training for these pandemics, which could very likely happen again. Sadly, no one read that report.

I think I still have copies of my office covered in dust. But certainly, I think one of the things that happened then during the pandemic-- and I had an opportunity to really see and have a firsthand experience of what was happening. In February of 2020, a colleague of mine asked me to join the Joint Acquisition Task Force, which was tasked with actually finding PPE and health care supplies for the country.

And as part of that, I had interviews with the FDA, with the national stockpile, with FEMA, with the Department of Homeland Security. And it became very clear during that time period that this country was completely unprepared for the pandemic. That almost all of the supplies that we required to deal with it-- including ventilators-- were sourced in Asia. And Asia, China and in Asia, of course, shut down during the pandemic and halted all their exports to the US.

And so we were really stuck. And as you pointed out, we were largely dependent on a global supply chain, yet we had just-in-time inventory system. Now just-in-time, I think, gets a bad rap. I've studied just in time for years. I've studied it in the automotive sector, with Honda and Toyota.

And just-in-time means that you have local suppliers that are maybe a mile down the road that delivered to you on a daily-- or sometimes multiple times a day. And you're in direct communication with them. When you have suppliers that are located around the world, and you don't have enough inventory, that's not just in time. That's the opposite of just in time. And that was one of the biggest problems we had during that pandemic.

ALEX MAIERSPERGER: Interesting so it's just just-in-time if it works.

ROBERT HANDFIELD: Yeah.

ALEX MAIERSPERGER: If not, that's a good call out. And the answer may scare me a little bit, but we said we were unprepared or under-prepared at 2020. And so now we're just two years into the future. And so we think about health care specifically. We had-- like you said-- the masks and personal protective equipment and then it was vaccine ingredients, different pharmaceutical ingredients, cold freezer storage, all of that. Have we got that situation sorted out to where we feel like we're not under-prepared or unprepared anymore, like we've got some of the basics down, or is there still a scramble on some of those basics?

ROBERT HANDFIELD: Well I think we're OK right now actually. But what has happened is that health care providers have actually gone the opposite direction. Where now, they are leasing warehouses and stuffing six months of inventory in them. But they're actually not managing that inventory. They're not looking at expiration, they're not turning it. So it's likely going to expire, just like what happened with the national stockpile.

ALEX MAIERSPERGER: Interesting, this is the fear part of this. So maybe the pendulum can swing pretty drastically.

ROBERT HANDFIELD: Exactly, and one of the concerns I have is that we were short of masks, N95 masks during the pandemic. And most of those were produced in China. In fact, 3M, all of their masks were produced in China. And a number of US manufacturers sprung up to start producing masks, domestically here, in the US.

Well after the pandemic wore off, what happened-- many of them are now going bankrupt because their prices are higher than the Chinese, who have re-entered the market. And health care providers are going back to the Chinese for their masks. So we really-- I don't if we've really learned. We seem to be not really supporting a domestic health care supply chain industry.

ALEX MAIERSPERGER: You're going to have to have another article with an inevitable title to tell us what's coming next. And you talked about this, the national stockpile. And so there's obviously a lot of government involvement in supply chain now from the national task forces that we've seen sprung up, to the strategic national stockpile you mentioned.

There's a White House Council on economic advisors looking at supply chain now. Can you talk about what's working and what's not between government and private sector? Is there a better collaborative environment now, is it one versus the other? Can you walk us through some of that situation?

ROBERT HANDFIELD: Sure yeah, I can speak a little bit on that. So one of the outcomes after I worked on the acquisition task force was, I was asked to testify before a Congress committee, led by Senator Gary Peters and Senator Rob Portman of Ohio. And I was asked to speak on the number of shortages that were experienced, including a lot of the pharmaceutical shortages that occurred, especially for ICUs, propofol and some of those. A subsequent to my testimony, that bill actually passed the Senate and the bill stated that they wanted to begin reshoring and requiring domestic manufacturing of certain types of pharmaceuticals.

Now to my knowledge, that bill is in the house. I don't if it's passed yet. But I think there will be a requirement by the government, for domestic sourcing, especially of certain pharmaceuticals that are really critical to our health care system. I was also asked recently-- in February-- to join the White House council of economic advisors to help inform them on how I could improve, or what were my suggestions on improving the supply chain.

And unfortunately, the government-- there isn't really a lot that the government can do to improve the current situation. I think that some domestic sourcing could certainly be encouraged, but the question is, will the Medicare system be willing to cover that? There's also a lot of shortages right now with ports, with manufacturing in Shanghai.

And again, the government is getting-- a lot of the blame is getting pinned on the government. But I don't if the government can really do much about these things. They really are a natural evolution of what's happening.

ALEX MAIERSPERGER: That's great insight because I think sometimes-- and maybe it stems from just our human nature wanting to be in control. And so if things happen outside of our control, it's oh, the government is going to come in and save the day. But I think you've talked a lot about the private sector opportunity and how this is somewhat of a company by company basis. And so at least in the news, you hear a lot about Apple, largely, being able to deliver on iPhones and other products.

You hear about Tesla largely being able to deliver batteries and components at a scale that others couldn't. And maybe even now, can't. So there were clear winners, or those that manage supply chain a little bit better than others throughout the peaks of the pandemic. Is that also true on the life science side? You mentioned certain drugs. Are there clear winners right now? One company that's just able to deliver at scale while others can't, or is it just everyone and everyone's largely playing the same game?

ROBERT HANDFIELD: Well that's a great example and great analogy. And one of the reasons why Apple and Tesla came out OK was the semiconductor shortage. And Apple, of course, designed their own semiconductor, the M1 chip, which they then got Taiwan Semiconductor to produce for them at a scale. And likewise, Tesla had shortages of chips. They've redesigned their chips. They've also redesigned their battery to use less cobalt, which is another difficult material. So they've had to shift. They've had to make changes to their product design to be able to do that. I don't see any health care or life sciences companies that are really doing that well, yet.

I think that still has to be determined. I think there's a lot of changes in motion right now to be able to improve. I will note that there's been a couple of health care companies, health care providers

specifically-- Cleveland Clinic is one that comes to mind-- that has done some very interesting things using SAS technology around what I would call, predictive analytics and scenario development.

And I think that's a real opportunity, is to be able to use technologies to run those tabletop exercises, but doing it on an analytical basis to try to understand what could happen and how could we plan better and prepare for that.

ALEX MAIERSPERGER: Yeah, I think adding in the complexities of regulation and the life saving nature of the drug interventions, or of some of the care delivery side, it sounds like it's early days for the health care industry. It sounds like retail and consumer packaged goods and things you can pivot a little bit more and remove a component, or add a component. But health care, it's probably a little bit early days of being able to find new ways to deliver things.

ROBERT HANDFIELD: And I also think that, remember, many of these health care providers just came off of a massive surge because of the Omicron virus. So during the first part of this year, January, February, they were inundated. And we're just trying to keep their head above water during this time period. I think many of them are now starting to look and say, what do we need to do differently?

And one of the things they're doing is to understand, first of all, what supplies is it absolutely necessary that they have on hand? And what supplies are necessary under different kinds of situations or disruptions. If it's a pandemic, if it's a pharmaceutical shortage, if it's some other kind of disaster, a hurricane, what would we need to have, how would we need to be prepared? And one of the real shortfalls that we saw during COVID, which is still a big problem today is workforce.

There's a real shortage of nurses and technicians and so forth for some of these technologies. And that's something they're really struggling with right now.

ALEX MAIERSPERGER: Yeah, there's no shortage of challenges it sounds like. That's what I'm hearing is the challenges are abound. You talked about hurricanes and natural disasters. I think we obviously have disease and war and food shortages and everything else that can come with that.

And in addition to the retention of talent, you talked about that from an organizational aspect of just how difficult it is to manage your forecasting and ability to think through what's coming tomorrow. How about-- I saw something that you recently wrote-- it was solution to supply chain disruptions. I think it was a tweet that you put out.

So it was this, you have the solution to supply chain disruptions, and it was stop buying so much stuff. So you've talked about it from an organizational standpoint. How about from my end, as a consumer, is there one thing that I should stop buying right now, either from a parts and component standpoint, or is it just literally everything? Like on the macro level, we all need to-- is this why minimalism documentaries on Netflix are so popular right now?

ROBERT HANDFIELD: That may well be. What we were talking about in that article was a concept called market satiation. And the idea behind satiation is, why try to promote and sell a product when you don't have it in stock? And in many supply chains today, we're seeing just that. There are major shortages of everything from certain kinds of drinks, to certain kinds of produce, to certain other-- even appliances. I ordered an appliance a year ago, it still hasn't arrived yet, a new refrigerator.

So there's a lot of shortages. And they have my money, I don't have my refrigerator. So I'm not a happy customer right now. So maybe what we need to do, instead of just selling people and saying, well, just buy as much as you want. I was starting to promote the idea of well, maybe, you want to buy less.

And that goes-- it's completely antithetical to what most companies want to do. They want to sell more. They want to get more revenue. But maybe we need to be pricing differently. Maybe we need to be thinking about selling them different kinds of things or substitutes for instance, which is what Tesla and Apple are doing is creating this value analysis perspective. So it's an interesting take on the current problem.

And I think companies need to maybe rethink that value proposition for the customer is, do you really want to try to sell them something that they're not going to be able to have in their hands? And we live in an e-commerce, Amazon click, instantaneous gratification.

ALEX MAIERSPERGER: One click has definitely done us all in, I think.

ROBERT HANDFIELD: Yeah, and that's gone away, it's changed.

ALEX MAIERSPERGER: Well I am I'm personally rooting for your fridge to show up. I think you can forego a lot of things, but a year wait for the fridge is probably one of the tougher ones.

ROBERT HANFIELD: It's on the fritz, I hope it arrives soon.

ALEX MAIERSPERGER: Yeah, if it's a couch or something, you can sort of sit on the floor. You can deal with it in different ways, but I think a fridge is something we're crossing our fingers for you.

ROBERT HANDFIELD: Well the other thing that's interesting is people are returning back to bricks and mortar retail now too. People who are going to stores because they can see it, they can touch it, they can buy it right there. And so I think sometimes we buy things online, you get the old, oh, it's in stock out, it's on back order. And you don't know when it's going to arrive.

ALEX MAIERSPERGER: Interesting, that's a good take on the power of brick and mortar, and how we'll see some of that demand level set between online and in-person. That's a great, tangible thought that, if I can see it and it's physically there, I know I can get it. And maybe that's part of the value, maybe I'm willing to pay more for it because I can physically put it in my car and take it home.

You talked a little bit about the just-in-time and on shoring and the local nature of how we're trying to get to some aspects of supply chain. There are lots of headlines right now of globalization is over, and that individual countries are going to try to onshore more or most of their manufacturing and supply chain capabilities. That, in some effect, can be true. But in a large effect, that can't really be true, can it? We just rely so much on a global supply chain.

ROBERT HANDFIELD: No, you're absolutely right, Alex. And I saw a presentation recently by an executive who basically said the same thing. There are certain supply chains-- not every supply chain is the same. And not all of them are fungible and can be moved around the world.

And there are certain types of products that we have to continue to rely on China. We've outsourced so much to China. They're much more effective and efficient in certain categories of goods and services that we will continue to rely on them. But I think what we're seeing right now is what I would call near shoring, or in some cases, double shoring. I've heard that term as well, where we can say, let's also use a secondary supplier.

Let's develop another supplier that's maybe more local to where we are today that we can rely on so we don't have all of our eggs in one basket, in one global supplier overseas. And, at least for North America, one of the best locations for near shoring is Mexico. Well, Mexico is a truck drive away. They speak Spanish and English.

The workforce is excellent. And I've visited some of the automotive factories in Saltillo. And they're fantastic. They're highly efficient, great workforce. And by the way, their labor costs are now lower than the labor costs in China.

ALEX MAIERSPERGER: Interesting, I haven't heard that.

ROBERT HANDFIELD: Yeah, and when you add in the lower cost of transportation, a container cost now from China is more than \$8,000, from LA-- from Shanghai to LA. Then the savings are quite significant. And I think we have free trade with Mexico, we also have free trade with Canada. So I think we're going to start to see the movement towards what I'll call, a pan-North American supply chain.

The US has lots of capital, right? So if you have capital, labor, energy, that's a really good combination for an efficient, effective supply chain.

ALEX MAIERSPERGER: So the globalization discussion will be very dependent on unique organizational and unique country aspects. It sounds like it's not a one size fits all, either country or organization specific, there's going to be definitely varied flavors for different products and different sectors of the economy.

ROBERT HANDFIELD: Absolutely. And as a good example is, I spoke with an automotive manufacturer and they sourced brake pads from China. Well in China, there's three major manufacturers of brake pads that control 80% of the market. You're not going to suddenly start sourcing them from Mexico or somewhere else, unless you have an already very efficient supplier.

And there's also technology considerations and so forth. One of the things I'm hearing a lot about also is semiconductors, that we're going to build a domestic semiconductor industry. Semiconductors are very complex products to make. They take almost, it takes almost three years to build a facility. Taiwan has 50% of the world's semiconductors today.

And they have entire supply chains dedicated to them, and tens of thousands of suppliers. You can't just build a semiconductor industry overnight. You can't just do that.

ALEX MAIERSPERGER: Sounds like a lot can happen in those-- I think we know now that a lot can happen in those three years that you're setting up a facility in the whole world changes at the end of those three.

ROBERT HANDFIELD: And the other thing that's very interesting, I wrote a blog about this past week is, we're hearing a lot about green energy and about electric vehicles. Well, the supply chains for these green products consist of what I'll call, the green metals. And there was an excellent article in The Economist that did a forecast.

And guess where these green metals are mined from? The major countries are China, Chile, Congo, Indonesia, these are global countries that have the major deposits of lithium, nickel, aluminum, cobalt, et cetera. And that's where we're going to have to mine them. And so we're going to have to build these mines, which take 10 or 15 years to build, in many cases.

So we're still going to be very reliant on global sourcing, particularly, as we move to a more of an electric economy.

ALEX MAIERSPERGER: So it sounds like you have a long time still to go in the spotlight. I think, one of the questions around that is that now we have a little bit of the benefit of time of seeing just how much the world has changed from 2020 until now. We can see that a lot of the predictions were so bad in the beginning of the pandemic. And maybe it's negativity sells papers, or sells digital clicks. The first wave, I

remember reading that experts were saying, crowds will never come back, or flights, we're never going to fly anywhere again.

Travel will never come back to these certain levels. As far as we're all going to die, just a whole lot of doom and gloom, I think, in the initial phases. Now I'm seeing some of that negativity and some of that discussion around supply chain of, just-- it's only going to get worse and then there's sort of the dot, dot, dot, forever.

That's the ongoing headline and prevailing thought is just supply chain is going to be disrupted-- like you're saying for maybe the next 10 years, as it takes to build up supply chains in certain sectors of the economy and world that we're trying to get to. Is that true? Are we on this doom and gloom path, or are you going to be able to get to rest in 2024 or 2025?

ROBERT HANDFIELD: Well I think 2024 and 2025 is probably a good horizon for thinking about what some level of normality might come back. I think, certainly, 2022, 2023, we're going to continue to see major disruptions throughout that time period. And the problem is, today, is I think there's almost a pre-COVID and post-COVID period. It's forever changed things.

It's definitely going to be different. In our new book that I've written with Tom Linton that's coming out in June, it's called Flow-- How the Best Supply Chains Thrive. And we compare supply chains to the laws of physics. And we interviewed Dr. Adrian Bejan, from Duke. And he talks about this idea of the evolution of flow.

Eventually, things flow to their lowest total cost, to their lowest point. And I think what we're seeing today is simply an evolution of supply chains. We're evolving to supply chains, which are flowing towards more domestic sourcing, more local sourcing. We're evolving towards more automation. We're evolving more towards people working from home.

These are all changes that are-- I think will be permanent. That will likely forever change the way that we work. So it's a very interesting time to be working in supply chains. And I think we're going to continue to see that evolution of flow of supply chains, going forward.

ALEX MAIERSPERGER: So that-- the idea in concept of Flow, I'm no physicist, but the link between physics and flow and supply chain makes a lot of sense of just the natural-- I think we see that in a lot of areas of our lives, that natural ebb and flow of pricing and availability and things. It still doesn't help your fridge situation, in the short term, but the pace of supply chain disruption certainly-- at least the feeling-- feels like it has picked up. I think every day that we turn on the news, you have disease and war and possible recession and inflation fears and different material feels.

And you mentioned that new normal versus next normal. That smoothing thing that you predicted 2024 or 2025, people used to talk about 2021 as the roaring 20s. And so now we're talking about 2024 as the roaring 20s?

ROBERT HANDFIELD: That's my prediction right now. Obviously, I monitor a lot of the issues that are going on. And the problem we're seeing right now-- as you point out-- is our supply chains were always very fragile. And we got lucky for a long time. We didn't have any major disruptions. And then you had the Trump, China trade wars. You had COVID that hit.

You have a lot of the climate events, the big freeze in Texas, the hurricanes, the forest fires. All of these things are constantly disrupting supply chains. And today, right now, it's COVID zero in Shanghai, that's shutting down the electronics industry. So I predict in about three or four months, we're going to start to see shortages of even Apple phones because those are all built in China, in that region of China.

So we're going to see periodic disruptions continue for at least 2022 and again, part of 2023. And I think that organizations will have to learn how to become more agile. And we'll start coming up with interesting solutions through double sourcing, through redundancies, through near shoring. And we'll start to construct what I would call more resilient, adaptable, supply chains to what we're seeing today.

That resilient and adaptable are just great words for what's needed from a technology and leadership standpoint, in the future. There's a lot to be pessimistic about, certainly. There are no shortage of challenges. One thing we like to do is just hope for the future. What's one thing you're either celebrating right now or one thing that gives you a lot of hope and optimism for the future?

ROBERT HANDFIELD: Well, I think we're starting to see that people are really starting to have these discussions about preparation, about being more prepared. I think, in some respects, now people are also starting to see the value of relationships and supply chains. And you can't just worry about what's going on in some part of the world and remain distanced from it.

I think it's kind of brought us closer together as a global community. And to recognize that we're all in this together. We all need to be getting vaccines for everywhere in the world, or we'll have more variants. We all need to be thinking about how we work together to improve our ports, we improve the flow of materials. We all need to be worried about medical supplies and how we work together between different parties in the supply chain to share information.

So I think we're starting to see a lot more collaboration in supply chains. And that's something that I'm a big fan of. I've always been a big fan of that, over my 30 year career. But I think we're starting to see more of it. And that makes me feel pretty good.

ALEX MAIERSPERGER: That is exciting. I think there's a lot of opportunity. When we talked about globalization being over, just as a headline and how much change that could bring and, potentially, will bring to certain economies in certain countries. I love how you flipped that on its head a little bit to say, some of that change also brings us closer together and makes us realize that we're not-- even if you are on an island alone-- you're not on an island alone, per se.

We have to really rely on one thing that happens in one part of the world, certainly affects other parts of the world. And with travel and just the timing of things, it could be that same day now, which is wild to think about. I really appreciate your time. And I know there's a lot of demand on your time, sounds like you're in the spotlight now and going to be in the spotlight for the foreseeable future. And so we're really celebrating having you on here today and getting to know you and learn from. Thank you so much for your time, Rob.

ROBERT HANDFIELD: No it's really been a pleasure. And I really look forward to working more with SAS going forward. SAS is very close ties to NC State University. And so, as you know, Jim Goodnight was once a professor of statistics there. And I've got to add this, the building where we house our supply chain center, there's a little plaque there. It said, 2806 Hillsboro Street. And it says, SAS. It was the first SAS building. So you can claim to be working in the first SAS building ever.

ALEX MAIERSPERGER: There's a lot of red as we walk around SAS campus now today, too. So I think we'll remain close friends.

ROBERT HANDFIELD: Absolutely. Thank you so much for the time. I really enjoyed this, Alex.

ALEX MAIERSPERGER: I appreciate you. And, as a viewer, there's so much demand on your time.

Thank you so much for listening and participating. We can't wait to continue creating a healthier future with you. There are so many real challenges in the world, we hope that wherever you are, there are ways



to find and be the good around you. And we welcome you to the conversation at our email address, [TheHealthPostPodcast@SAS.com](mailto:TheHealthPostPodcast@SAS.com), and here in the comments on YouTube. Thank you.

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