

A podcast by the Institute for Defense Analyses

Episode #14

Understanding Defense Supply Chain Risk



Guests: Julie C. Kelly and James S. Thomason Host: Rhett A. Moeller February 2024

> Product 3001364 Distribution Statement A. Approved for public release: distribution is unlimited.

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Understanding Critical Supply Chain Risk

IDA Ideas Host Rhett Moeller spoke to James S. Thomason and Julie C. Kelly, who discuss how they estimate the risks to critical supply chain. James and Julie co-lead the resilience and risk portfolio within the Strategy, Forces and Resources Division (SFRD) of the Systems and Analyses Center, an IDA-operated federally funded research and development center. They oversee projects that address risk and recommend mitigation options related to current and future supply chain challenges using a suite of IDAdeveloped models called Risk Assessment and Mitigation Framework for Strategic Materials (RAMF-SM). RAMF-SM has been used for years to assess potential shortages of critical materials in the National Defense Stockpile Program. However, DOD and other federal government sponsors of IDA research have recently become aware of how such risk assessments help them build effective plans for embedding resilience in supply chains and essential services to protect U.S. warfighting abilities in the event of hostilities.

[Begin transcript]

Rhett Moeller: Hello listeners. I'm Rhett Moeller and I'm the host of IDA Ideas, a podcast hosted by the Institute for Defense Analyses. You can find out more about us at www.ida.org. Welcome to another episode of IDA Ideas.

Today, we're going to talk about supply chain risk. It's fair to say that this is a topic that has had a fair level of awareness before the COVID pandemic. But since then, it seems really to have blossomed and highlighted a lot of concern. Supply is everywhere even in ways we don't usually think of it. Something that I'm sure will come up in the course of our conversation. With that, I'm very happy to introduce Julie Kelly and Jim Thomason who are both researchers from IDA's Strategy, Forces and Resources Division or SFRD. They both joined me in the studio, and I'm sure you'll find we'll benefit from their expertise through the course of this discussion. Julie and Jim, can you take a moment to introduce yourselves?

Julie Kelly: Hi. My name is Julie Kelly. I'm a Research Staff Member with IDA. I've been working at IDA for 25 years now in the area of risk and working for more than 10 years very closely with my colleague, Jim Thomason. We work together on the risk and resilience portfolio of work within our division. And my background is in public policy, political science and economics, with an undergraduate degree from the College of the Holy Cross and a master's degree from the University of Maryland School of Public Policy.

Rhett: Great, welcome Julie. Jim?

Jim Thomason: Morning Rhett, I'm Jim Thomason and I am a Research Staff Member and co-lead of the resilience and risk portfolio within SFRD. I've been at IDA coming up on 40 years now, and for that entire time, I have been working on issues of supply chain and supply chain risk. But in addition to that, just by way of background, my background is in international relations and political economy. I have degrees from Harvard and Northwestern.

Rhett: Great. Well, welcome Jim. We obviously have a lot of experience in the room here and let's get going. Supply chain and supply chain risk; this sounds like a very big topic. It's probably helpful if we start off by pulling back and looking at it more broadly. What are supply chains, what is supply chain risk and who is at risk?

Jim: Well, Rhett, I will take a crack at this to begin with and let me just say that supply chains frankly are all around us — ubiquitous — and some people say we're wrapped up in supply chains at every step. But in fact, it's half of the market, every market around the world is about delivering supplies and producing them. So, you might say that supply chains are an organized sequence of activities that providers use to both produce and deliver products of various kinds to the marketplace or to the demanders. And so, we focus on a lot of supply chains that have particular relevance for national security purposes. And we do a lot of work related to fundamental materials in the supply chains that the national security community in the United States relies upon. We do a lot of work having to do with identifying vulnerabilities in those supply chains. But let me back up and just say that supply chains are not only critical for the production and delivery of just about everything in the world, but they also are organized and frankly marvelous human creations — human ingenuity — and increasingly they will be helped by AI [artificial intelligence] as well. These supply chains are fundamental to producing national security goods, defense products. But there also are great examples of supply chains that are used every day by consumers of all kinds for medical products, for power, for food, for fuel. And they're not new. Supply chains were used to build the Great Pyramid at Giza, for example, and all sorts of amazing constructs over human history. The key point about supply chains is that they don't just appear out of nowhere. They have to be designed, they have to be built and maintained and nurtured and improved and protected. And it's the protection part that we are focused on most closely in our work for the Department of Defense and other departments as appropriate, like the Department of Homeland Security, for example. Those kinds of vulnerabilities that need to be guarded against can be accidental; they can be deliberate. So accidental, either disasters at a production facility with very limited backup plans in place or accidental in the sense of natural disasters like extreme weather, or they can be deliberate in the sense of the risks that could be associated with heavy reliance upon an adversary or potential adversary for some of the key ingredients in key weapon systems, for example, for the Department of Defense. So, these are the kinds of things that we focus on in our work in the portfolio that Julie and I lead.

Rhett: Great. You mentioned adversaries, Jim, what kinds of adversaries are we talking about here?

Jim: Adversaries include, for example, the People's Republic of China. They have over the last several decades become a very, very major supplier, not only of a variety of consumer products, but also of materials that are extremely important. And if they dominate the market in the production or the refining of those kinds of materials or parts up the value chain that draw heavily on those kinds of materials, that's a potential risk from the standpoint of where would parts and the key ingredients for weapon systems come from in the context of a conflict with an adversary such as China. They're not the only one, there are other potential suppliers that [the United States is] heavily reliant upon largely as a function of the trend toward globalization over the last few decades, where prime producers have been guided by the motive of trying to find low-cost solutions to their production problems. And so, while there are considerable benefits to globalization for U.S. consumers, for example, there are risks associated with relying too heavily on the kinds of materials or components, end items in some cases, that a potential adversary like the People's Republic of China represents today and is likely to represent increasingly in the future.

Rhett: Thank you, Jim. Julie, how has supply chain management changed over the last few years? Obviously, we've seen a lot of major upheavals. Can you talk about how that might have played into some of the things that we're seeing?

Julie: Sure, I'd be happy to, Rhett. And I think you touched on it early on when you introduced the podcast when you mentioned the pandemic. Prior to the pandemic, a lot of focus was on just-in-time inventories, lowest costs, products and inputs, etc. And there really wasn't much attention or investment given to the thought of disruption, backup plans, kind of preemptive planning in the case of the unexpected. That has really changed since the pandemic among commercial companies and within our federal government sponsors here at IDA. Some of the things that the department is now focused on really revolve around modernizing our approach to supply chain resilience. They want to ensure that we can deliver capabilities to the war fighter and respond to a dynamic threat landscape. And much of the assessment work that we do at IDA helps the department as they work to achieve this goal.

Let me mention, Rhett, some examples of the types of risks we're talking about. These include dependence on China for the production, refining and separation of critical materials. Jim alluded to this, but there's also reliance on more processed or finished goods, including semiconductors where we're heavily reliant on Taiwan for those. And all of these sorts of products, whether we're talking very upstream at the strategic and critical material level or the semiconductor level, these are really ubiquitous in both our defense weapon systems and in our commercial products. And you may remember during the pandemic,

there was an issue with automobiles and the ability to produce new cars because of the backlog on semiconductor demand across a number of different industries.

So, those are the types of risks that we're talking about when we discuss supply chains. And our work at IDA has been on trying to help the department minimize the effects of any disruption on their supply chains and looking at a number of potential mitigation options that may be available, and those include things like buying additional inventories, diversifying your supplier base and qualifying new suppliers, reducing dependence on unsafe suppliers — so, we talked about potential adversaries, China and Russia, looking to boost the supplier base both domestically and with our allies across the globe — introducing substitution where that's possible and expanding capacity where we have constrained nodes and competing demands for items at the input level or the finished product level. And these are all steps that we work with our sponsors to encourage consideration of so that they can be prepared in the event of disruptions.

Rhett: Now, Julie in your response, you mentioned strategic and critical materials. Can you describe a little bit more what you mean by that?

Julie: Yes, by strategic and critical materials — these are key inputs that are used in products for both DOD and civilian applications in their most upstream form. So, these are things that would appear on the periodic table like antimony, cobalt, dysprosium, etc.

Rhett: So, as you were speaking, Julie, one of the things that came to mind is I hear often, recently it seems like, about shortening supply chains, is that a factor here? And what's the end result?

Julie: Absolutely, Rhett. There's been a lot of activity recently within the U.S. government to invest in domestic capabilities to allow additional processing and input production, especially in the area of strategic and critical materials. For example, the department has an effort underway now — the Department of Defense has an effort underway now that they call their mine-to-magnet program, which is the mining of rare earth materials all the way through the processing of a finished rare earth permanent magnet, which are the most powerful magnets that exist today. Right now, we cannot fully produce those magnets domestically. But the department is making investments to position the U.S. to be able to have those capabilities domestically in the future.

Jim: Rhett, I'd like to add to what Julie has already said and point out that another major initiative has been in the form of the so-called CHIPS Act [Creating Helpful Incentives to Produce Semi-Conductors (CHIPS) for America Fund], which includes a large domestic investment on the order of \$60 billion to help U.S. producers like Intel, IBM and others, including Korean firm Samsung, to develop facilities in the United States.

Rhett: Well, obviously, what we've talked about so far represents a lot of possible problems. There's lots of consequences. When these things work, when they don't work,

seems like there are many factors involved. I know Jim, you mentioned several, including government, business, weather, logistics, technology, there's a whole panoply of things that can affect the supply chains. Given this, are there any key tradeoffs that need to be considered, frameworks that are useful when you're thinking about a problem this complicated, Julie?

Julie: Rhett, absolutely. Some of the key tradeoffs that need to be considered are cost versus resiliency, sole source versus a broad and diverse supplier base, both geographically and in terms of the number of vendors that we're talking about, reliance on a network of low-cost suppliers versus a network of safe suppliers — and those could be defined by various criteria — and to address these tradeoffs, that's part of what we do with our sponsors. These are challenging questions, but key to all of it is understanding your supply chain, who the players are, what the global landscape looks like.

For example, IBM uses the metaphor of a control tower when thinking about supply chains. A control tower allows you to see how the supply chain is working, what areas are malfunctioning or in critical mode, and allows you to think about how you might address those issues. The better you understand your supply chain, the better you can understand risk, and the more prepared you are to mitigate risk and ensure that your supply chain is resilient and agile.

Jim: That's great, Julie. And let me just say that in order to help our sponsors with mitigation recommendations and assessments of the extent of the problem, we have developed a framework that we call the Risk Assessment and Mitigation Framework for Strategic Materials. It's a suite of models that allows the government to bring in the best available objective information about demand and safe supply, make policy judgments about what's safe enough to rely upon in the context of a usually classified national security emergency scenario. We've developed this particular framework — RAMF-SM is the acronym we go by for this framework — in order to provide the Department of Defense with a rigorous transparent means of estimating what would be short in the way of key strategic and critical materials in the context of a hypothetical classified national security emergency.

We have developed this framework and continue to develop this framework that now the Department of Defense relies upon it for its official estimates to the Congress of what ought to be in the so-called National Defense Stockpile. And we cover on the order of 150 to 200 different strategic and critical materials in the assessment process that happens every two years, and we're very excited about its potential, not only for further application in the strategic and critical material area, but also with respect to other key parts, components, for specific essential national defense or essential civilian kinds of systems. When I say enforcement and communication equipment and facilities that need to be maintained in the context of a national security emergency. RAMF-SM addresses all of those kinds of things

in a very rigorous and explicit way. So, we're excited about its potential to be used more broadly by the government in other areas. And IDA can take a lot of credit for this contribution to national security.

Rhett: Sounds like impressive work. Julie, here at IDA, we can't always speak in specifics, especially in a public podcast, about things that you're doing for our government sponsors. But as much as you're able, can you share a little bit about the kinds of questions you're tackling for them?

Julie: Certainly, we support our sponsors by addressing risk and recommending mitigation options related to current and future supply chain challenges. Recent assessments have focused on real-world challenges such as the COVID pandemic and the conflict in the Ukraine and the effect on supply chains. But in addition, Rhett, we look at future challenges and we work with our sponsors to plan ahead for potential conflict that may occur in the future to build plans that will allow the U.S. to be resilient, not only in [U.S.] warfighting capabilities but in the provision of essential services such as the essential civilian services that Jim mentioned earlier, running hospitals, providing electricity, ensuring clean water, etc., during the event of a conflict.

Rhett: That makes sense.

Jim: I would add a couple of things. We are also in the business of helping sponsors identify potential allies or friendly countries that it would be worthwhile for them to figure out better, more coherent ways to cooperate in the context of a national security emergency. That's one additional area. And we are very excited about the potential for applying that beyond strategic and critical materials. Another is when we think about risk, a lot of what we do is trying to develop measures that will give a coherent and rigorous assessment of, for example, if you are in the situation you are in now in the context of a national emergency, what couldn't you produce on a timely basis that would be essential as defined by the Department of Defense, as defined by the Department of Homeland Security? What couldn't you produce? And then what would be the value added of one or another mitigation measure at a given level of investment (dollar investment), and also taking time into account, how long would it take to implement that? So, these are areas that we are very much involved in helping sponsors think through, make policy decisions and investment decisions about.

Rhett: Great. It sounds like important answers to pressing questions and that's wonderful to know that you're working like that. Well, we've talked about quite a few things in our time together. Obviously, this is not a small topic. There's a lot to it in terms of both what supply chains are and the risks involved. But in spite of the challenges that you've brought up, I wouldn't want to leave us feeling like there's no hope. Are there any areas where you think things are moving in the right direction? What areas are ripe for improvement or where some extra attention might help change things for the better?

Julie: Things are trending in the right direction. Not to say that improvement isn't needed and would not be welcomed. Improvement is important. Continuous improvement is really critical, but where things are trending in the right direction, the recognition by the Department of Defense and other federal agencies that risk and resiliency is of critical importance. In fact, it's been identified by the Department of Defense as a strategic imperative; that is a major shift in the U.S. government's thinking and a very positive trend. The U.S. government has also made significant investments in domestic supply chains. And we've talked about those investments like the CHIPS Act, like the mine-to-magnet program. And the other important trend is the availability of data that comes to us as an FFRDC [federally funded research and development center], both highly proprietary company-held data as well as classified data and the best available government data that has been flowing to IDA to inform these analyses. And that is critically important. Although there are still challenges on the data horizon — and I think Jim may want to speak to those in a little more detail — but there are a number of very positive trends and the investments of the U.S. government in these areas, both at the national level and within IDA and the type of projects that we're being asked to support, show a major change in our country's understanding of risk and resilience and the ability to be prepared for disruptions in the future.

Rhett: Yeah. And just before I hand it off to Jim, I just wanted to clarify that when you say FFRDC, you're referring to federally funded research and development centers like IDA [manages], where we receive government funds to do the work that we do.

Julie: Absolutely. The advantage of IDA as [the administrator of] an FFRDC is the objective nature of the analysis that we do. And those are really critical for the government and allow us to receive the type of data that I mentioned earlier, including company proprietary data.

Rhett: Absolutely. Jim?

Jim: Supply chains are an organized way of both producing and delivering key items to the market or to demanders. And I haven't mentioned that there are both great legal supply chains and there are great, unfortunately, illegal supply chains like the drug supply chains that are such a scourge in America today. More work needs to be done to identify how to cut off those illegal supply chains. But more fundamentally for our work [there] has been good news of the Department of Defense taking more seriously the idea that getting a soup-to-nuts, if you will, or a material-to-end-item view, a lá the control tower concept that IBM has been implementing, is a really important thing — taking it more seriously. And that has led both the DEPSECDEF [Deputy Secretary of Defense] and the Congress to press for more visibility for key supply chains in this emerging strategic competition context.

Julie and I wrote a paper a couple of years ago, a War on the Rocks article in which we called for greater visibility. The reason it's so important is that in the context of an

emergency, if you can't get either key parts or materials to produce those parts, you can't replenish low stocks of key items like munitions, like other important consumables. Greater visibility is really important. And the only way that's going to happen is if the Department of Defense and the other key organizations in the federal government insist on it, insist on getting that information from the prime contractors who oversee the supply chains for many of these items. And the only way that's [going to] happen is if the department is willing to pay those contractors to gather and assemble and then verify that information. The question then is where are vulnerabilities and what do you do about it? That's a really important next step. And the next step then is to work with the sponsors to figure out what ought to be done in the way of potential backup plans and transition away from current, by virtue of globalization, excessive dependence on unsafe suppliers for critical supply chains.

Rhett: Well, Jim, Julie, thank you very much for your time. You've raised some interesting things to think about, discussed some of the challenges that we face, talked about the work you've done over the last 40 years or so to try and make things better in terms of supply chain, and the risks involved with maintaining those. It's a timely topic and we really appreciate you providing us with the framework to understand both the importance and the challenges of the topic. So, thank you. It's been most illuminating.

Julie: Thank you, Rhett. It's been a pleasure speaking with you.

Jim: Absolutely, Rhett, thanks a lot.

Rhett: As always, if you want more information on IDA and its ongoing work, please do check us out at ida.org. We also have a presence on [X, formerly] Twitter at IDA_org and we have a channel on YouTube. IDA Ideas is hosted by the Institute for Defense Analyses, a nonprofit organization based in the Washington, D.C., area. Once more, you can find out more about us and the work we do at ida.org. Thanks for tuning in, and we hope you'll join us again next time as we discuss another big idea here at IDA ideas.

Show Notes

Learn more about the topics discussed in this episode via the links below.

Kelly, Julie C., and James S. Thomason, The Risk Assessment and Mitigation Framework for Strategic Materials (RAMF-SM), IDA Document D-33112, May 2022, https://www.ida.org/-/media/feature/publications/t/th/the-risk-assessment-and-mitigation-framework-for-strategic-materials-ramfsm/d-33112.ashx.

Schwartz, Eleanor L., and James S. Thomason, The RAMF-SM Stockpile Sizing Module: Updated Documentation and User's Guide, IDA Paper P-22696, April 2022, https://www.ida.org/-/media/feature/publications/t/th/the-ramf-sm-stockpile-sizing-module/p-22696.ashx.

Schwartz, Eleanor L., James S. Thomason, and Julie C. Kelly, Formal Processes for Mitigating Risks of Strategic Materials Shortfalls, March 2023, IDA Document NS D-

33375, March 2023, https://www.ida.org/-/media/feature/publications/f/fo/formal-processes-for-mitigating-risks-of-strategic-materials-shortfalls/d-33375.ashx.

Schwartz, Eleanor L., The RAMF-SM Material Demand Computation Program: Documentation and User's Guide, IDA Paper P-22689, March 2022, https://www.ida.org/-/media/feature/publications/t/th/the-ramfsm-material-demand-computation-program-documentation-and-users-guide/p-22689.ashx.

Thomason, James S., Julie C. Kelly, Nicholas S. J. Karvonides, and Daniel K. Rosenfield, RAMF-SM Assesses Risk to Rare Earth Magnet Supply Chain, IDA Document NS D-10860, August 2021, https://www.ida.org/-/media/feature/publications/r/ra/ramf-sm-assesses-risk-to-rare-earth-magnet-supply-chain/d-10860.ashx.

Thomason, James S., Justin M. Lloyd, Wallice Y. Ao, Amrit K. Romana, and Eleanor L. Schwartz, Forecast Uncertainty in Critical Material Stockpile Needs, IDA Document NS D-9027, April 2018, https://www.ida.org/-/media/feature/publications/f/fo/forecast-uncertainty-in-critical-material-stockpile-needs/d-9027.ashx.

Thomason, James S., Nicholas S. J. Korvonides, and Julie C. Kelly, Assessing Strategic and Critical Materials National Security Risks, IDA Document NS D-10899, August 2022, https://www.ida.org/-/media/feature/publications/a/as/assessing-strategic-and-critical-materials-national-security-risks/d-10899.ashx.