



Technology Policy Institute

Academic Keynote Address, Aspen Forum 2022

Speaker:

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Moderator:

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Event page: https://www.youtube.com/watch?v=gWXS_63P0RY

Scott Wallsten:

Now to start the substance of the day for questions, we use a platform called Slido. Can, you know, can we put that slide back up there that has the information?

Scott Wallsten:

The slide for Slido, anybody? There you go. And so to use it you go to one of those, one of those two websites, it'll ultimately take you to the same place on your phone or your computer type in your question. They get moderated to make sure nobody's asking anything too offensive. And then they go up on, on the screen and also every you'll see everybody's questions you can ask 'em anonymously or put your name there. It's very rare for a question to get moderated out. I think one of the only times that happened was when Nathaniel moderated out a question I asked <laugh>, but he was probably right to do that. And this works if you're here or virtually, so everybody can ask questions that way, ask them as, as the talk or the panel's going.

Scott Wallsten:

And, you know, we'll get to, to the questions towards, towards the end. Also a quick reminder, if you're watching virtually that you have different link for each session, and I'll remind you between the sessions to, to switch now to start our actual conference. So we are truly honored today to have MIT professor Fiona Murray kick off the day. She's going to present a new hypothesis on how great power competition is affecting startups and entrepreneurship in ways that are not yet well understood, but can have significant economic impacts. Very few people are as well placed as she is to credibly develop this kind of argument. So I suspect we'll be hearing a lot about it in the future. Professor Murray is Associate Dean of innovation and inclusion at the MIT school of management and the William Porter professor of entrepreneurship. She's the co-director of MIT's innovation initiative and faculty director of the MIT Legatum Center for entrepreneurship and development.

Scott Wallsten:

She's an associate of the National Bureau of Economic Research. She serves on the British prime ministers council on science and technology, and was awarded a CBE commander of the British empire for her service to innovation and entrepreneurship in the UK. She's a member of the ministry, defense innovation advisory panel and the European innovation council joint expert group. She's an international policy expert on the transformation of investments and science technology into deep tech startup ventures that solves significant global challenges and create national advantage from defense and security to health, food, and water security. She also works with large public and private sector organizations to effectively drive their strategic goals by linking to external innovation ecosystems, especially university startups and risk capital. I could use all her time just talking about her. But instead I will turn it over to her and we'll listen. We're very glad to have you with us today.

Fiona Murray:

Thank you, Scott. I really appreciate it. Whoever's in charge of the slides. Will you do me one favor and take down my photograph? <Laugh> I find that deeply disturbing. So <laugh> the other request I have is whether anybody has a watch for a clock anywhere I can see, because as any of you in the room who are academics, and I know there are a few of you in this room, you know, that once you wind us up, we could go on *ad nauseam*. And so I'm actually just gonna put my, my watch here. All right. So look, thank you very much for the opportunity to present here at the Aspen Tech Policy Institute and Scott, I just

want to thank you in particular for your very kind invitation. You were extremely patient as we trying to organize my schedule. As some of that brief bit of my bio probably reveals.

Fiona Murray:

I spend a lot of my time traveling from Boston Eastwood to London to do a lot of policy and organizational work. And so trying to work out how to get in a plane and go west in almost the number of hours that I could get to London, but in the wrong direction, turned out to be quite complicated. And so having arrived here, I'm incredibly glad that I've had this opportunity to meet a number of familiar faces and old friends. And also just to meet some new people. I will just say that the world I sort of inhabit intellectually and as a scholar has often been at the intersection of issues around law and institutions, but a lot of the work I do, I think we could argue we would call innovation policy or science and technology policy. And interestingly for me, that's the policy apparatus that we use to sort of think about shaping the rate and direction of scientific and technological change.

Fiona Murray:

And yet on the other hand, technology policy, as I understand it right, is very much regulating and understanding the policies for the technologies that we have and the intersection between those two things and those two communities is often much thinner, I think, than perhaps we would wish it to be. And I remember that recently in a meeting at MIT where we have a technology and public policy program where I had an argument with John Deutch--never a good idea--about whether or not we should include issues of R and D policy and innovation policy in the curriculum. And he explained to me that that was utterly irrelevant. And so I said fine, but why don't you just send your students over to my class occasionally. And we can see whether we can kind of cross those boundaries. But today what I want to talk about is really work that actually sort of is a merger of your night between two aspects of my life.

Fiona Murray:

So I spend a lot of my time in the UK working on science and technology policy issues for the prime minister, through the prime minister's council for science and technology, I will say it's the prime minister, regardless of who he or she might be. So it's a surprisingly, apolitical organization in some ways, and it doesn't change when the prime minister changes. So I've been doing that for about 10 years, which has been extremely interesting. The other part of my work has very significantly focused on innovation in defense and security. So I work with large organizations in that world and the two worlds. So that sort of world of policy and defense and security very rarely intersects with my MIT day job, which is really to support those individuals, trying to take their ideas out of the lab and into startup ventures, but in recent years, my sense, and my perspective is that these two worlds are actually converging in really, I think, important and interesting ways.

Fiona Murray:

And so my thesis today is really that we are seeing a confluence that two distinct worlds are basically colliding the first world then is the world of governments, whether it be the UK, the U.S., Israel, Singapore, many of the European countries who see science and technology as essential elements to national competitiveness, and increasingly see that national competitiveness as a grounded, also in issues of national security. And so the sort of confluence of science, technology, security and competitiveness, I think is a new framing and a new role for science and technology. And so this is very much seen as science and technology as the opportunity to exercise power and to exercise advantage.

And in thinking about that, that puts us squarely in the realm of not just technologies that we might think about as classic for defense or security, but rather a broader set of strategic technologies around things like quantum space, AI, the usual sorts of critical tech shopping list, if you want.

Fiona Murray:

The second thing that's been going on in the world at the same time is that startups increasingly are key to the ways in which these types of technologies, these very deep tech, as people might describe it get out of the lab and out into our economy. It used to be the case that very large traction of new and novel ideas ended up in the hands of large corporations. They were licensed very directly. The talented individuals and young people from our various universities would go into these big technology organizations. I would say there's increasingly some of the same list of technologies, whether it's in quantum or fusion in space, satellites, telecommunications are basically forming new ventures. And so it's precisely the confluence of these deep tech ventures with the science and technology ambitions. That is, I think, a confluence that is going to be more of a collision than anything else.

Fiona Murray:

And the reason I think it's gonna be a collision is that traditionally these deep tech companies and ventures are very, very capital intensive. They need a wide range of skills of test beds, of infrastructure, of supply chains, and their ambitions tend to be global and the way in which they access their resources has a very global orientation. And so what we're seeing are these essential deep tech ventures with global frameworks, if you'd like for their growth converging and colliding with national science, science, and technology interests. And I would argue that this is I think, a new transition. We might have seen that in the past, in very narrow areas, such as nuclear or directed energy weapons or frankly encryption. But those tended to be in the hands of a very small number of individuals who were often in national labs, inside government agencies or in large corporations with whom we had very particular and well-structured relationships.

Fiona Murray:

And just to give you an anecdote about why I think this is really happening today. A few months ago, it was probably still snowing. So maybe more than a few months ago we had a visit to Boston, to the Boston consulate, to the Boston area of the DG, the director general for technology from MI6. So that individual is the one that you would see in the movies called Q and it turns out Q is a real person and Q is sufficiently allowed to introduce herself first female Q excellent in a meeting and the meetings that she wanted to have were with the deep tech startups in the Boston community. And the question that she asked one after another of these was fairly pointed, how do you protect yourself from hostile state actors? I'm not sure anyone of these startups had ever actually been asked that question.

Fiona Murray:

They certainly never met Q before, or at least not knowingly. And I don't, I don't think frankly, that they have the sort of intellectual apparatus to think about what this means, really what that question's all about and where in the range of what they're doing organizationally, does this question really bite, but equally the world of startup ventures and particularly these very sophisticated, deep tech ventures is an entirely new world for many of the people making policy and trying to think about protecting their science and technology advantage, whether that's in the UK or the U.S. And you'll see, I mean, I'm, I work quite a lot with the U.S. government, but much more with the UK government. And so my, I will go backwards and forward between U.S. and UK examples, but I see a tremendous amount similarity. And

so that very question and the moment of that individual being in that room with the CEO of this company, I think is a sort of a visible representation of the collision that I see.

Fiona Murray:

And so the confluence of startup ventures with international and global ambitions with the geopolitical ambitions and complexities of individual nations, I think is quite new. And so it's not really been, as Scott said, deeply examined. And yet I think it has the potential to shift the nature of startup venture building the way in which you know, venture founders and venture funders are basically gonna operate. And I think perhaps more importantly, frankly it requires a change in the way government agencies understand and engage with the venture community as they build their ventures. And I think this is especially important as we move into a time of recession and a little bit more of an economic sort of bite because I think the vast flows of capital that we might have expected coming into some of these companies domestically I think is somewhat threatened.

Fiona Murray:

And so I think this is particularly important. And so from a government point of view, the policies and practices that I think we need to shape this confluence are going to need to be quite sophisticated and subtle. And yet at the moment, the machinery that we have is fragmented incredibly bureaucratic, and very difficult for startup ventures to navigate. So even if they are with the best will in the world, willing to entertain and understand the national imperative, their ability to do so is extraordinarily limited because that apparatus is just clunky I suppose, to use a not very technical term. So let me just start quickly by outlining some of what I see as the essential changes in the government's perspective on S and T. So I think if we wind the clock back to the sort of two thousands and the beginning of the century policy attention, especially in the U.S, I think was focused on building the economy, thinking about 2008 economic crisis; science and technology not necessarily seen as essential to this effort.

Fiona Murray:

So although we have Vannevar Bush, if we go way back to, to 1945, I think it would be fair to say that in the two thousands, the data on R and D and government spending was basically flatlined and science, although was seen as essential to national security; national labs were the nexus of that activity. Large corporations were often important of primes to solve some of these problems the real world at scale. But beyond that, I think the U.S. basically saw science and technology in its most global sense as essential to economic growth and a very small handful of technologies were seen as being strategic. And I think it was only really if you, if you go back to 2015 and Xian paying announces his 2025 Made in China and listed his core list of interesting technologies, which some people, I think read as a shopping list in specific areas that went well beyond defense and security, that there was a sort of wake up call, I think, in the U.S. context.

Fiona Murray:

And so in a growing urgency around S and T, which I think we now see as being reset at the heart of U.S. competitiveness, you see threads of that, obviously in the CHIPS act with, I respect to semiconductors, but I think more centrally in the at least sometimes referred to as the Endless Frontier act, which refers back to Vannevar Bush's essay in 1945, passed in the house, which quote, aims to make bold investments in research development, to manufacturing a critical technology to preserve America's global leadership. And in the Senate, we get U.S. innovation and competition act, which focuses on strategically important technology with a much greater emphasis on manufacturing and supply chains.

And Schumer notes that this is to address dangerous weak spots in America's economic and national security that threaten our global technology leadership. And so I think this is a reframing that again, puts science and technology in its broadest context at the core of national competitiveness, great power competition, frankly, and national security.

Fiona Murray:

And so what this does is I think puts into place a set of wider strategic critical technologies. And the U.S. is not alone in doing this right, and in framing, great power competition in terms of technology and science, or frankly thinking about science and technology is an incredibly important form of national advantage. Obviously countries like Israel and Switzerland and Singapore—the country I was thinking of—this is not new. So Israel government's chief science advisor, now the innovation agency has always emphasized expertise in strategic areas that include most obviously national security, especially cyber. But if you look carefully at their science and technology portfolio, you'll also find water security. Israel is actually the leading country in desalination technology and increasingly food security. They are one of the leading countries in alternative proteins work that actually comes out of all their deep work and stem cells.

Fiona Murray:

So you can see the threads of a really core focus and while certainly not, I think in many terms of great power, the UK has also framed its strategic ambitions around science and technology. Interestingly, in a document called the Integrated Review which is an integrated review of security, defense development and foreign policy. And so this is a document that thinks about and puts science and technology at the heart of those activities and notes that advantage and influence is gonna be attained through expertise in key areas of science. And the prime minister in his forward--so this is the Boris Johnson document--talks about keeping the UK's place at the leading edge of science and technology being essential to prosperity and securing our status as science superpower is going to be incredibly powerful, important, not just to prosperity, but also to security. And so you link these two things together, I think in an important way.

Fiona Murray:

So while less sharply argued, you would see the same if you went into the European union and some of the work around the European innovation council and even multinational bodies like NATO, beginning to think and have conversations in the same way. And I would say that this change in perspective from simply supporting science and technology startup ventures in a general way to having a much more strategic focus is probably most usefully characterized actually in the case of Arm. So many of you might be familiar with Arm in the newspaper in the last however many months because of the failed merger within Nvidia. The company was actually founded in Cambridge in the UK in 1990. It's originally stood for acorn risk machine. Acorn was the failing computer company. It changed its name when it finally launched and went public to advance risk machine.

Fiona Murray:

And it actually grew from the ashes of acorn and actually investment from Apple and BLSI who put together 3 million at the time to design new processes. So the company now has CPU designs and almost all smart phones and has competition from Qualcomm and video and others, but it's incredibly widespread technology. So the company grew in the 1990s in a classic startup sort of way, incredibly global opening--offices in Silicon valley and Tokyo going on to open offices in Beijing and all over the

world company listed in the UK was secondary listed in the U.S. and after its listing, it made acquisitions in the UK, Texas and Norway, France, Belgium headquarters remained in Cambridge until at some point the leadership team actually moved to Silicon valley. In 2016 after rather lackluster evaluations, which are quite common for tech companies in the UK.

Fiona Murray:

The company was acquired by the SoftBank group. So Japan-based fund, and then later by their vision fund, which has extensive funding, the whole variety of sovereign wealth funds including all over the Middle East. And at the time when its so-called national champion industry was acquired in this way, UK prime minister, Teresa May said, this is a sign of confidence in the post Brexit UK and noted the deal as evidence of the UK playing on a global technology stage. And we fast forward to the potential acquisition by Nvidia in 2020, there was a very different reaction. And so the UK's reaction, so the U.S.' reaction I think was perhaps as we would expect, right? It's about competition. And so there was a whole series of competitiveness investigations as we would expect. And so that would be for the us, the classic framework. For the UK arguments of what you might think of as sort of techno nationalism and the role of science and technology in national security, the advantage were raised and the UK was concerned about loss of jobs.

Fiona Murray:

That's not unusual, a loss of a national champion, albeit one that had actually been in the hands of a completely different international set of investors, concerns about national security, but really which play into a wider sense because there's not a specific national security concern that you could really deeply point to. And one commentator talked about the U.S. weaponizing tech dominance. And so all of a sudden you have this between allies, you have this sort of conversation; the deal stalls, and as many of you know, the company is likely now to be listed on the NASDAQ. Also much gnashing of teeth from the Brits because it's not being listed on the London stock exchange. And so what we see then is the threads of national competition around science and technology, not only between adversaries, but also among allies, which suggests I think that we do not yet have a framework for understanding this.

Fiona Murray:

And so what happens is that this comes at a time when, as I've said, an increasing amount of science and technology is actually being commercialized through venture founders and venture funders, and not going into the hands of large organizations who have much better established relationships with the government and frameworks for thinking about national boundaries. If you really wind the clock back 1998 to Akamai founded actually as an MIT business plan competition around the idea of content delivery networks being mathematically optimized, rather than share these insights with the large corporation, Professor Layton, who was a mathematics professor, his student, Danny Lewin, and a management student founded the company. So there, we had complex technology, a lot of intellectual property and assets in the hands of a startup. And although at the time that was quite unusual today, we see 60% of our university intellectual property license to startup ventures.

Fiona Murray:

And that is a complete reverse from 20 years ago when it would've been about 30% and the rest large are going to large corporations. 20% of our undergrads join startup ventures when they finish. So they take their deep technical skills. And although they prefer going to the big tech companies over banking, they are much, much more interested in going. So we see the global flows and the flows of highly skilled

technical talent. But nonetheless, I think traditionally venture investing and venture funds have basically focused on things in which have low capital requirements. And so as a result with the exception of biotech, deep tech until recently was sort of languishing in the lab still, but is only in recent years that these science and technology based solutions for major problems have promoted new flows of capital. But again, this capital is global in nature. And if you look at where the funding is coming from for these kinds of companies, you'll see it coming certainly from the U.S., but also from significant numbers of individual high net worth individuals globally, from sovereign wealth funds, whether that be Norway, right?

Fiona Murray:

Whether it's Tamasek, Mubadala, and multinational corporations. So if you actually sort of double clicked on the capital stack of any one of these deep tech startups, you would find a massively global financial flows. You would also find incredibly global talent. So if you think about the two startup companies that were incredibly powerful in the pandemic Moderna and BioNTech obviously partnered with Pfizer, then journey both started in academic labs, founded on the idea of these RNA vaccines, but funding was global. And in fact, in both cases, it was actually immigrants to their respective countries who are the leaders and founders of these companies. More generally, if you look for example, at the capital stack in the UK of any one of these deep tech companies, by the time you get to very large rounds, more than 70 or 80% of the capital is international and deep tech limited partners, and many of the venture funds come from Europe, the Middle East, et cetera.

Fiona Murray:

And so we have, again, this global sense of these rising deep tech startups. I think coming at a time when we really are thinking about sort of the national. And so to drive home the point in many areas of strategic advantage we absolutely are seeing this globalization and a company like Commonwealth fusion systems, which some of you may be aware of. It's a fusion energy startup company spun out of MIT has subs has raised probably well, they've raised about \$1.9 billion to do their first sandbox test. We've talked about sandboxes ever dinner last night. This is the mother of all sandboxes--to test out the high temperature, super conducting magnetic tape that they need. And to think about whether the tokamak is stable. If you look at its global footprint, the company is firmly based in Cambridge, Massachusetts, but it has funding from six or seven different nations.

Fiona Murray:

It has a global supply chain. It has a supply chain for certain kinds of tape and other materials that typically would run through Russia and other countries that we find in supply chains, more troubling. It certainly has a global potential footprint in the way in which it rolls out its technologies. And so I think with that example in mind, we see, I think a convergence in extra becoming and a national government or national governments plural set on building S and T advantage as a nation colliding with these startup ventures, who basically think about themselves as global in their aspirations. And so having just sort of set out that convergence and I hope convinced you that these two worlds are about to, or are colliding. Think it's really important to think about to what extent and how frankly governments might think about shaping the behaviors and the opportunity set of these companies, and really thinking about this powerfully important balance between providing the resources so these companies can grow and flourish while also thinking about the nature of national interests.

Fiona Murray:

And so this is not a new balancing act, but I think it is a balancing act with a different partner on the other side of the table and a venture community and venture builders who are not necessarily framed and steeped in the language of national interest, national advantage, great power competition. Having spent a lot of time this year, working with some of these companies for most of them, these are new constructs, they're extremely clever individuals, so this is not hard, but it is a new framework for them to think about. And so I just wanted to reflect for a moment on some of the sort of apparatus that I think exists or doesn't for dealing with some of these challenges and the way I think it might be useful to do that is to think about some of the resources that these companies, as they grow, have to gather to them, you know, into their entity.

Fiona Murray:

And I think we should think about at least four, that are essential. One is human talent. A second is obviously funding. A third is infrastructure for testing for demonstration, for scale. And I would include supply chains as an essential part of that infrastructure. And the fourth is demand. So customers who actually going to buy something. Those who teach entrepreneurship sometimes talk about whether the dog eats the dog food. So the question is who is gonna eat the dog food who provides these sorts of who are the customers for these things? And in each instance, deep tech ventures have specialized often extensive and complex needs that often require a kind of a global search because any given country may not have all those assets. And yet how they think about doing this in a more constrained context, I think is important. So let me just touch on briefly on human talent.

Fiona Murray:

So clearly there are mechanisms to think about who is and is not involved in any one of these projects. When projects are classified, we obviously have mechanisms and places to deal with those things. When they are unclassified, we assume that the people involved are individuals who are here either because they are nationals or because they've come here through visa processes that we somehow think are acceptable. To just put a finer point on this, this is somewhere where we have to think about a global pool of talent, the recent activate program that works in some of the national labs to support startups in a variety of very technical areas found that in the most recent round, over 50% of their applicants were not U.S. nationals. And so having them sit within the national labs, turned out to be much, much more difficult and their program was much less effective and they had hoped because they were surprised by that percentage.

Fiona Murray:

And I think all of us in academia see the continued power of the attraction in the uU.S.of global talent. And so I think the question we have to ask is what's at stake. Should we be concerned about foreign our nationals in our startups? I mean, I think the logic suggests that these individuals doing common complex work have access to knowledge that lies well beyond the boundaries of patents or trade secrets. And yet we worry about this as much in a national context. We think about, you know, Uber and Waymo the theft of trade secrets happens regardless. And so I think our instruments are currently blunt. And I frankly think that at the moment, our need to attract global talent to any one of our countries and our nations probably outweighs the concerns around loss of advantage from single individuals, particularly in the startup context, I'm a bit less sanguine about funding.

Fiona Murray:

And so if you think about deep tech ventures, the path to market often requires billions of dollars because they're doing something literally hard, deep. So there's deep risk, deep pockets are required, right? And the technology is extremely complex. And so the question becomes, where do we find that capital and how do we ensure that that capital is appropriate given our national interests? The U.S. obviously can use CFIUS as a process to examine capital sources. And I think more generally in terms of the norms of behavior, sophisticated investors, and now pay much more attention to the provenance of the capital that they bring in through their limited partners. And yet there is no simple way to ask the question, is this limited partner acceptable or not? There's no one to actually ask in particular. And frankly, the list of who's acceptable also changes over time.

Fiona Murray:

As we've seen very recently after the Russian invasion of Ukraine, a whole series of limited partners were no longer acceptable and venture firms who had them in their midst had to rethink about what to do. The U.S. has tried a number of things to deal with this, including a trusted capital program that was so administratively arduous that basically no venture capitalists would sign up. It required too much information that they weren't willing to share. The UK has a new National Security Investment act. That's trying to serve as a mechanism of influence, but a group of individuals serving that who really don't have the kind of financial expertise that we might need. Should we be worried? I think the question is what's at stake. I think the, the problem that we need to deal with is the fact that particularly at a time of recession and sort of emerging, I, I think capital limitations, we need to think about whether these companies who can very easily go out and raise all the capital that they need in China and Saudi elsewhere.

Fiona Murray:

How do we think about maintaining their national presence or potentially how do we think about maintaining their presence across a group of allies? There are obviously, you know, many examples I could share with you of companies who've not been able to do that effectively. But I do think that there are opportunities. We heard yesterday about the new public wireless supply chain innovation fund. That's a, we need a better shorthand for that. I <laugh>, I wrote it down so I can remember all the words in that NATO is thinking about, has a new multinational innovation fund. You know, the narrowest U.S. example is IN-Q-Tel, but has a very different sort of purpose. The UK's NSSIF is able to make strategic investments if they have a national security relevance. And they would frame that not just as national security as a customer, but rather economic security in sovereignty.

Fiona Murray:

So I think there's much to be done. And again, the mechanisms through CFIUS are not easily used by either the venture capital industry or the companies themselves. And the last bit I want to focus on is really infrastructure and supply chains. So when these ventures grow, they need to test. Testing of a piece of software is very different than testing of large pieces of hardware. A new green way of producing steel requires you to build an enormous facility to test a kind of 30% scale. As I've mentioned, nuclear fusion, you need to test your magnet. The only place to do that turned out to be in Switzerland. You want to build a 50% scale plant. You need to test out some of these elements. And I think the question the U.S. has to ask and many other countries is, do we have the test beds?

Fiona Murray:

We often have the testing facilities, but are they accessible to startups? How do we think about, again, the ways in which we make it possible to keep our companies where we want them to be. For a company like Commonwealth fusion, the UK oddly has much easier regulations around nuclear fusion than the U.S. for the U.S. The nuclear in fusion is problematic from a regulatory point of view. And so you see companies being quite sophisticated in some of their forum shopping around regulation and testing. And so thinking about how we deal with that, I think is extremely important, recognizing that there may be, again, a multilateral approach. NATO is doing some interesting work in this regard, and likewise, the European innovation council, thinking about a pan Europe set of access to such things. I think supply chains are a place again where startups really don't have the sophistication that we perhaps need them to have in particular things like critical materials, requiring much more sophisticated interactions.

Fiona Murray:

I think the DOE's critical materials Institute a really important step, but how we think about some of these very specialized inputs think is essential. And lastly customers. So I built my company. I've got domestic capital. I've been able to crowd in capital from allies. I have the right talent, I've tested, but who do I sell to? If I'm doing something with governments, is my national government, the right partner for me, do they step up? And can we get through the difficult procurement? If I become global and I serve global customers, how do I deal with it? And as a startup company, I will tell you that there's a very difficult and challenging process. That's a mechanism of framework that's really difficult for some of these companies to use. And for example, there's a considerable tension in the satellite and space venture community, I think around the inclusion of satellites and some of the regulated items and, you know, boundaries, including with Britain and Canada, even SpaceX is frustrated.

Fiona Murray:

And so as we think about that, how we think about how, again, we use that mechanism. And so just to really conclude; you know, if a government's bent on building science and technology advantage, and thinking about that as a source of power in their countries, working with these deep tech ventures who have global aspirations and frankly need to tap into global assets, there is I think a confluence and frankly, a collision not a collision I think as sort of a moment in time. It's rather a sort of a messy, bureaucratic interface, but I think we need to really think about how we reconfigure. There's work to be done with the startup ventures, having them appreciate, I think some of the issues, particularly the issues of hostile state actors as my UK colleague said. But also understanding some of the spirit in which this is being thought about.

Fiona Murray:

And I would argue that while it's easy for the U.S. to sort of think about this potentially in a pure U.S. context, there is probably some advantage to be had in thinking about this with respect to a broader pool of talent, of capital, of testing of customers across different groups of allies. I would say that right, cuz the UK is probably much more interested in the U.S. than the other way around. It's like a sort of uneven dating activity going on <laugh> but I think that things like orcas and other kinds of arrangements, just remind us that there are opportunities for some types of coalitions and alliances that I think in this particular context are likely to be quite powerful. And so I think the question that we have to ask ourselves is how we create policy and practice that supports this sort of convergence nationally among allies whilst also balancing protection with sort of promotion and thinking about the complex goals of national security, economic prosperity, and geopolitical positioning. So with that, thank you very much.