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MANUFACTURING: A TOOL TO RECAPTURE AMERICA'S INNOVATION EDGE:

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P R O C E E D I N G S

MS. LOWREY: All right. So we'll go ahead and get started. I'm Annie Lowrey and I'm on the Economic Policy Reporting Team at the *New York Times*, and here are our panelists. Greg Tassey is a senior economist at the National Institute of Standard and Technology in the Commerce Department. And Rob Atkinson is the president of the Information Technology and Innovation Foundation. And then Mark Muro is a senior fellow at Brookings and policy director of the Metropolitan Policy Program.

So to start off with, I'm going to start my clock here and each of them is going to talk for about five minutes, and then we'll get into our panel discussion. So do you want to start off, Greg?

MR. TASSEY: Sure. Delighted to be here. As of 4:00 yesterday afternoon, I did not know I was going to be on this panel, but nevertheless, I'm losing my voice. I want to make a general statement about where our manufacturing policy fits into the broader economic growth paradigm, because I think this is a huge problem for this area of policy.

The U.S. has a tradition of hands off the marketplace, so that leads to many problems in defining and implementing appropriate roles for the government. And you cannot pick up a newspaper today or turn on the TV without hearing a discussion about monetary policy, should there be a QE3, how is Operation Twist working; on the fiscal side, what about the large deficits, are they working, do we need to have even larger deficits, as Paul Krugman opines in his op-eds for the *New York Times?* And I think this is causing us a problem and it certainly is showing up in the economic statistics, namely the weak recovery, if you can even call it that.

MAPO Stabilization Policies, monetary and fiscal, are designed to control the fluctuations in the business cycle about a long-term growth track. They say nothing and do nothing, or very little, about the slope of that growth track, in other words, the annual rate of growth.

That comes from long-term investment in a set of structural assets, many of which have been discussed here in the previous two panels: skilled labor force; technology through investment and R&D; capital formation; not only traditional infrastructure, but a newly evolving technical infrastructure that

my agency, NIST, is intimately involved in. Without these investments, the growth track slope will be lower, and, in fact, the fluctuations become more pronounced, because when they're applied, for example, you run into inflation much more quickly than you do if you have an economic system in which productivity is growing. So manufacturing clearly is the centerpiece to driving long-term productivity growth, which should be the central element of an industrial growth policy.

Now, that leads us, of course, to manufacturing, which traditionally has been a major element of the U.S. economy and all industrialized nations. Now, you know that its share of GDP has shrunk over the past several decades and that's led some, including a lot of my economist colleagues, to kind of dismiss the issue of saving manufacturing. Their argument is that if relative prices say that manufacturing should all be done offshore, the way, for example, Apple Computer basically produces its electronic products, then so be it. That's how global economic efficiency is achieved.

Unfortunately, economic life today is not that simple. Manufacturing increasingly employs high skilled and high paid people. So since the ultimate objective of growth policy is to increase real per capita GDP, if you have an industry where the potential at least is to produce high paying, stable employment, then you shouldn't ignore it.

But there's another less obvious reason for the importance of a domestic manufacturing sector. In the earlier panel, this idea of supply chain and the importance of coordination up and down the supply chain was mentioned. And I've studied this at some length and written about it because supply chains today are incredibly immigrated. The complexity of modern technology, I can't think of anything more complex than a manufacturing system as we now envision it in the future. Smart manufacturing, adaptive manufacturing, these are concepts that will only be delivered through complex systems of hardware and software, produced by a whole host of industries that have to be integrated, all the interfaces between these components have to work.

This is a huge, complex growth problem that's not going to be handled totally by the private sector. So what you see around the world is, there's $1.4 trillion in R&D being spent currently in the world, and that's a big number by itself. But when you think about it, every dollar of R&D stimulates multiple dollars of capital formation. In turn, that stimulates multiple dollars of investment and marketing assets and supporting infrastructure. So the leverage on economic growth is substantial.

Unfortunately, our manufacturing sector has the same R&D intensity as it did back in the 1980s. So even though we've had all these shuffles and we've reorganized our supply chains, although reorganization unfortunately is meant a lot of hollowing out, which leads gaps, and hence this synergy problem that I was alluding to.

So we have a job to do there in terms of increasing the amount of R&D. But there are two other issues here in terms of sort of an overall growth model. The second one is the composition, which Phil eluded to this morning, and it's not just which technologies you invest in, but it's also the phases of the R&D cycle where government has a legitimate role. You know, most of my economist colleagues look at technology as a white box, so they don't see any role for government at all beyond science.

NIH and other government agencies are sort of implementers of this black box model. NIH funds billions of dollars of science, they stand out of the way, and then they expect industry, venture capital, small startup firms to come in, develop the new drugs. And the productivity of this model has been extremely low, and it's generally recognized as such, but they don't seem to have much of a clue as to what to do about it.

So you have to discard this black box model and understand that you don't just go from science to innovation, you have to have technology platforms, and that's where we're beginning to go in manufacturing.

NIST is now involved as the central point for coordinating research portfolios across government that will provide, in cooperation with industry and universities, these new platforms. And this model is not unique to the United States; in fact, to some degree we're playing catch up.

MS. LOWREY: I'm going to stop you there. Rob, if you have -- okay, Mark, five minutes.

MR. MURO: And Dr. Atkinson passed some of his time.

MS. LOWREY: And we'll come back.

MR. MURO: But I'll be passing back. It's great to be here. I want to focus on another misperception or misdirection. You know, Greg has talked about the effective focus perhaps on the gyrations of macro economics; I'm going to focus on the notion that what manufacturing is has been misunderstood, as well.

I mean, manufacturing is innovation, you know. We set up this dichotomy and wonder if manufacturing is the root to get our mojo back in innovation. It is the prime site of innovation already.

So, I think that, you know, we've celebrated innovation properly, but we've done it in a way that has narrowed and simplified and disembodied and really turned into magic the kind of details of innovation. Innovation process has been isolated, it's come to seem like something much more akin to invention, meaning the sudden development of novel, new products, and it's often been reduced to unfair pouring, as Greg says, R&D spending into university laps. So we have a narrow account of innovation.

And as for the world of manufacturing, it's essentially been demoted and has not really been part of the discussion broadly. Dirty and noisy, where innovation was silent, you know, clean and spontaneous and exciting, that has left manufacturing as sort of fungible, a kind of work a day activity oriented towards commodity, mass production, it's been an after thought at best. So, you know, the reality here is, we're realizing the conventional view of innovation has been simplistic and misleading, and that has led to problems for how we understand manufacturing.

The two can't be separated. Manufacturing is, as I was suggesting, the principal site of commercial manufacturing in the system, in the U.S. system. Seventy percent of all company performed domestic R&D takes place in manufacturing companies, even though they generate only about 11 percent of GDP, so a major presence.

Half to two-thirds of engineers and scientists in this country are actually employed by a manufacturing or production concern. Twenty-two percent of all manufacturers produced a new product or service between '06 and '08, only 8 percent of nonmanufacturing. So in a very real sense, you know, production is where U.S. innovation takes place.

Now, not all that is equally innovative, computers and electronic products, or aerospace or highly innovative -- well, food and tobacco production clearly aren't, but the point is the same. You know, importance of U.S. manufacturing are growing off constant streams of incremental and practical -- process innovations that drive productivity. That is a fundamental driver of U.S. innovation in general.

And, you know, we can't separate -- this is not simply a matter of the direct manufacturing sector, it happens to the health services in this country: R&D, design, finance, marketing, consulting, you know, maintenance, all kinds of analytic functions are themselves tied up in, you know, major feedback

loops around that originate with production.

So, you know, this is all bound together, we can't separate these things. So to suggest that manufacturing -- I mean, manufacturing most clearly is a root towards increased innovation in this country because it is where that occurs mostly.

Now, this just offers us I think a few hints about how to get the mojo back. One is not rocket science. If manufacturing is where innovation occurs, then that would seem to counsel trying to retain some of our manufacturing, but not all of it is of the same importance as we've been hearing during the day. You know, IT, computers, electronics, aerospace, chemicals in some areas, medical devices, energy equipment, these are the places to look. So these are the industries that likely matter most to regaining competitiveness.

And then there's one more point that I think Greg is beginning to point to. More and more of the best analysts are showing that the optimal dynamics of innovative production suggests we should work harder to foster the co-location, the linkage of production and R&D. You know, people, Rob here, Greg, Danny Breznitz, (inaudible), Erica Fuchs at Carnegie Mellon are all now showing that high levels of innovation seen in strong manufacturing networks frequently depend on these synergies between production processes and design processes.

That argues that, you know, that those have suggested a prosperous economy can be had without production are, you know, looking in the wrong direction. We're realizing the proximity and interconnection of research design and production, if not in the same building, in the same, we would contend, metropolitan industry cluster is an important determinant of which industrial groups are going to lead the next technology cycles. You know, think about these feedback loops, information spillovers, and casual cuts of copy in a place like Silicon Valley that flow around this mix of R&D entrepreneurship and manufacturing places, like Silicon Valley, are a great model of this.

This synergy suggests that, you know, the way to recapture our edge is to foster the strength of these regional production clusters where the interconnections and feedback live between production and more classical R&D occur. So again, I would say that something would have to happen region by region, by metro area, industry cluster by industry cluster, and, you know, very supportive of NIST's decentralized network of innovation manufacturing institutions is a way to get at this, but that's

maybe another discussion. I'm going to give the rest of my time to Dr. Atkinson.

MS. LOWREY: Okay.

MR. ATKINSON: Well, great, thank you. It's a pleasure to be here. I agree with everything Mark and Greg said, but I want to -- we want a disagreement, though, don't we? I didn't agree with anything you said, ridiculous nonsense. But let me actually add another wrinkle to this, I guess.

So let me throw out two numbers to you, and, to me, they're completely related, but no one seems to think they are. One is 0 percent and the other is -33 percent. The first number is the number of -- the percentage change in employment in the last decade. Zero percent change in employment, it never happened before in U.S. history. And the second number is the percentage loss of U.S. manufacturing jobs, -33 percent, a loss that was greater than in the peak to trough of the U.S. Great Depression in the '30s.

So we lost more of our manufacturing jobs in a decade than any country in world history and in our own history, and yet virtually no one makes the connection between the first number and the second number. So when you're losing 60,000 factories being closed in 10 years, you're losing 18 to 20 factories a day being closed. That is, in sort of Federal Reserve parlance, that is a stiff headwind.

So, yeah, you can grow some other jobs some other places, but that is a leaning against the wind. So that is why it was so hard for the U.S. economy to gain traction. That's why it's so hard for the U.S. economy to gain traction today.

Just the loss of manufacturing in this down cycle, the Great Recession, was the biggest loss in any business down cycle we've ever had. The manufacturing loss this last time was the biggest it's ever been, and that's all in a report. There's some on the table out there we recently published called "Worse Than the Great Depression."

So why is that kind of not an obvious thing? I think it's not an obvious thing because the people who run economic policy in this country are either, as Keynes said, they're influenced by long dead economists -- in this case, unfortunately, they're still alive -- and it's still alive economists who are essentially called neoclassical economists. And there's a sort of fundamental core belief of neoclassical economists which is every sector is exactly the same. We saw that with Christina Romer's op-ed, I don't know, five months ago, where basically she said barber shops, manufacturers, what's the difference?

Now, when I was head of the Rhode Island Economic Policy Council and worked with John White and his father back in the '90s, I can tell you, the governor did not have a policy towards barber shops. We didn't have a barber shop policy, not because we didn't think barber shops were nice people or barbers, they didn't provide a valuable service, it was really simple: if a barber shop went out of business, another one would take its place, because people would get haircuts.

Now, the problem with neoclassical economists is they don't want to make that distinction between traded sectors and non-traded sectors, and that really is the fundamental reason why manufacturing is important: it is a traded sector. It is the largest traded sector of the U.S. economy. Some services are traded, and we run a tiny, little surplus in services. But really for the next foreseeable 10 to 20 years, at minimum, there is no way for us to run a trade surplus or a balance of trade without a healthy, robust manufacturing sector.

So if I had one wish, anybody -- you all have seen *Men in Black* and Will Smith, when they go around and they get some alien thing, they have this neurolizer. This is a neurolizer. I would like to hold up a neurolizer to all the neoclassical economists and then erase from their brain this notion that they have that says -- and you think I'm making this stuff up, but I'm really not -- this notion that they have that the trade deficit, which is, by the way, the U.S. has run the largest trade deficit in world history in the last decade, the trade deficit has nothing to do with anything other than our savings rate.

So think about that for a minute. If you really -- by the way, I'm not making this stuff up. Most economists in Washington, this is a core belief. And if you're in the room or you're looking -- they think I'm like totally nonsensical, I clearly don't understand economics because I'm rebutting this core fundamental pillar of belief.

All right. So if you believe this pillar of belief, then you should then agree with this following statement: Let's double the corporate tax rate to 70 percent and we will have no effect on the trade deficit. Let's have really, really bad managers running U.S. firms and drive them all into the ground, like we had with GM, and there will be no effect on the trade deficit.

Let's have EPA promulgate regulations for one part per trillion for every emittent they can think of and make U.S. manufacturers comply with it and spend hundreds of billions of dollars and there will be no effect on the trade deficit because the trade deficit has nothing to do with these things about

productivity or cost by producers. It only has to do with this magic formula about the savings rate.

Lastly, we could then, if you really believe that, we could say, well, why do we even bother having NIST, why have MEP, why have the President's National Network of Manufacturing? None of those can do anything because they all basically are running up against this formula, this iron law that says the manufacturer and the trade deficits only are related to serving savings deficit.

So at any rate, I'll just close by saying, to me, that's sort of -- you know, I'm happy to sort of explain mathematically why that is wrong, that it basically is -- the simple answer is it's reverse causation. Yeah, the savings rate is equal to the trade deficit, but they think the savings rate causes the trade deficit rather than the other way around.

The basic bottom line is we need a healthy manufacturing sector because we simply cannot run a vibrant U.S. economy unless we have a healthy traded sector. If you don't have a healthy traded sector, you're leaning into this very, very stiff headwind, and I think the last 10 years in particular have shown that the results of that are essentially economic malaise. I'll stop there.

MS. LOWREY: Well, that sounds great. So I think that the other big, wonderful, complicated discussion about manufacturing's role in the economy and in the recovery and in economic growth, we're here to talk about innovation and manufacturing, and that's grounded by the fact that the Obama Administration has made a calculated bet. If you ask the members of the NEC, they will say that one of the reasons that they want to support manufacturing and have tried in a number of bills and with some small policies, is that they believe that part of the reason that manufacturing firms are different and that they've developed this industrial policy is that you need manufacturing in order to innovate.

They kind of agree with Mark's argument that if you have people making stuff here, that will actually make the economy more innovative. And so they've tried very hard to, you know, create incentive for manufacturers to keep jobs in America, and part of that has been a jobs policy, but also part of it has been a broader economic policy.

But economists disagree about this. And there's definitely some evidence, but some of it also seems to have to do with, you know, whether the spillovers are due to kind of how close people are together versus whether they're actually making things.

So I guess that that's the first question that I'd like to ask the panel is, do we need to

keep the manufacturing actual production jobs here in order to innovate or to help, you know, increase innovation? So Mark, I think, would agree with it.

MR. MURO: Well, the answer is absolutely yes. Studies have shown, and my conversations with high-tech companies certainly confirms it, that R&D and the actual production have to be co-located, especially in the early part of a technology's life cycle.

No complex technology when it's first commercialized has lost attributes at optimal levels. There's usually not an optimal production process. One is kluged together from existing production techniques. As the market grows and the centers increase to investment optimal process technology, if you don't have the interactions back and forth between the product development people and the process people, you lose a lot of synergy, and hence, advantage.

And if you look at the evolution of aging economies, first they were offshore destinations for the actual production. They had to have some R&D capability to do that, and then they, to their credit, they expanded that R&D infrastructure to the point where now they're experts in innovation in the product and the process levels.

You can go all the way back to the Japanese experience in the 1980s, where they focused on process development, but then they realized around 1990, they had to become innovators, as well, from the long-term growth point of view. So the sort of general model is out there, but it's not well understood, as I think all of us have indicated, and it needs to become more of a core management strategy.

SPEAKER: Yeah, I mean, I just completely agree with that. I mean, if you look at -- I was talking recently with some folks from ITRI, which is essentially the big sort of NIST for Taiwan I guess, but with a broader mandate and a lot more money, and one of the -- they were talking about how did Taiwan really become the leader in memory chips. And the answer was really interesting, is they actually went around back in the '70s and they looked around to see if they could buy some technology. And they bought some technology from this little company in the U.S. called RCA, who thought, oh, yeah, we can license this stuff to the Taiwanese because this is making stuff and we're the innovators.

Well, now they're the innovators and the world leaders with two major companies in Taiwan, world leaders in this, and RCA, I guess maybe they're still in business. I mean, who's ever heard

of RCA? And the point was that there was this mythology that you could innovate here and lead production because they're just doing the low end.

And I think Clay Christensen's work has shown us pretty well from Harvard, they start with the low end and they work their way up, they work their way up, they work their way up, and they keep, you know, sort of taking parts of the production, and at first you don't notice it because it's the low end and the commodity stuff with it has, you know, low margins, it's like, oh, that's the low margin stuff, but they're working their way higher up and higher margin, and eventually they get the whole thing. And that's really, to me, emblematic of not just a few companies like RCA, but of the country as a whole. And that's our real risk, I think, is we have this view that innovation is science, and in a lot of ways we are very good at science-based innovation, perhaps the best country in the world, but what we're really not very good at anymore is -- that's engineering innovation.

You compare that to Germany, for example. Germany is just maybe, you know, maybe the world-class engineering innovation country, and it's not an accident. It's not because Germans are born engineers. It's because they work on it.

They have these Fraunhofer institutes, they've got great engineering programs and universities, they've got great engineering technician programs, apprenticeship programs. There's an engineering culture in Germany, and that's really what I think we've got to restore here in the U.S. We can't go down this path of saying, well, we do science and they do engineering. Engineering and science have to come back together, and we're not going to be able to be good at science anymore unless we're good at engineering.

MS. LOWREY: But it seems like the experience -- and just to make the argument in the other direction, you know, the United States has remained massively innovative despite the fact that all of these jobs have been offshored, right. And so maybe looking at the next 20 years, there's an argument that that won't be true. But I guess the question, and kind of a question that's been touched on in a lot of panels is, which jobs do we want here and which jobs do we want to bring back if we can, or at least like, you know, keep here and keep co-located, since obviously I don't think anybody would argue that it would be good for the United States to be making widgets and bolts, and, you know, the really, really low-end labor. So I guess that's the kind of question is, what do you want to keep here and how?

MR. MURO: Well, and I think, you know, I mean, I think the answer is, to some extent, implied by all of this. It is those engineering-intensive, you know, R&D-intensive segments, but with the fear that if you aren't engaged on the production for those, you'll lose those, too. So I think that's the logic. A question is to whether jobs are the only metric, you know. And I think some of the factors that favor U.S. manufacturing include the disappearance of actual jobs from shop floors that are in some ways going to help level the playing field and will bring manufacturing jobs -- well, manufacturing back here, but maybe not so many jobs, because these are going to be extremely, heavily automated, extremely efficient and productive operations. I would still say whether or not they have large numbers of jobs, we need them because of the whole rest of the ecosystem, including on the services side that they drive. But, you know, so I think that's a riddle for us, and I think over-focus on jobs as the only metric here will lead to disappointment.

MS. LOWREY: Do you agree?

MR. TASSEY: Absolutely. In fact, another example of how as a society we still don't understand the modern technology-based road is when this talk of automation and improving the productivity of manufacturing comes up, there's pushback by people saying, well, you know, productivity reduces the labor content and, therefore, is going to cost jobs, which the exact opposite is the case, and this has been documented by a number of economic studies. If you're more productive, you gain market share, and, therefore, your volume expands and so you're going to employ more people, and those people are going to be higher paid and their jobs are going to be more stable. So, you know, we have to really get the basics in place of what is the growth model before we can start worrying about what the specific policy should be.

MS. LOWREY: Although, I mean, it seems like the policy questions are important now, right, because, you know, there's a lot of concern about jobs, and there's a lot of policies that are being created and fomented now to keep these jobs here, right. And I do think that the conversation in Washington is essentially framed in terms of jobs, right.

There's been tremendous hurt in manufacturing communities as these jobs have left, and, you know, cities like Detroit have essentially been hollowed out. And a lot of the argument is about like bringing those jobs back or at least, you know, on-shoring or re-shoring are keeping people here. I

agree that a lot of the conversation gets this kind of like lump of labor policy that, you know, if these companies become too efficient, then there'll be no jobs for anybody, which has not, you know, been proven true by history.

But I do think it is a policy question, you know, since it's -- so what kind of policies do you think -- you know, you said that the policies (inaudible), but what may need to change here?

MR. ATKINSON: Okay. Well, first of all, labor does not obviously exist in isolation, it has to be combined with technology, capital formation is important. The previous panels talked about small firms and the issues they face. And I've been at a number of conferences where I've talked to small startup firms, professors included, who have taken a risk, as well as time, to get involved in those. And they're okay at the R&D stage, they develop a product, and all of a sudden they realize they haven't either the capital or the expertise to produce it. So what is the infrastructure? In Germany, you get help, here you really don't.

MR. MURO: Let me go back to your original statement because I think it's not quite accurate, which is, well, we still lead on innovation, but we don't on manufacturing. I don't think we lead on innovation anymore. If you look at the metrics, we're actually falling behind relatively rapidly on things like venture capital funding, new business start-ups, corporate R&D, patenting, scholarly articles, on pretty much every measure, high-tech trade deficit. So we feel like we're leading in innovation because we all use Facebook and Twitter, and, yeah, those are cool things, I love Facebook and Twitter.

And to be fair, the one area we really do still lead on, and that's sort of Internet software kind of stuff, we do lead in that, and that's kind of everybody -- that's their daily experience. But how many of you recently bought an industrial laser for your home? Anybody? Well, we don't lead on industrial lasers anymore. So there are a lot of things we don't lead on anymore.

So what we need to do about it, I think, what we've talked about is what we call the four Ts: tax, trade, talent, and technology. We have the highest statutory tax rate in the world. We have among the highest -- one recent MBR study of 20 major countries; we have the highest effective tax for manufacturers. We have a report coming out in a couple of weeks on the R&D credit now reusing the most recent data. We're now 27th in R&D tax credit generosity in the world. To get to the most generous R&D tax credit, we would have to increase our credit, triple it.

So we've got to have a better tax code, we've got to lower the rate, we've got to increase incentives, we've got to do a lot more on technology. Look at a program like the MEP, NIST Manufacturing Extension Partnership. It's a wonderful program dramatically under funded. Germans invest 20 times more than we do in that kind of program, the Canadians 10 times more, and the Japanese 40 times more. We need an NNMI. The President has proposed, and the Germans have Fraunhofer, Taiwan has ITRI, a lot of countries have things like that. We need a real apprenticeship and skill standards program for manufacturers. And the last thing we've got to do is we've got to really aggressively fight foreign trade mercantilism.

I mean, we can't win this battle when we have countries like China forcing U.S. companies to move production and technology there to get market access, manipulating standards, manipulating their currency, doing all sorts of onerous things, and now the Brazilians are following them, and the Indians are following them. So I don't think it's a mystery as to -- we don't have to get down and, you know, and pick, you know, John, this is your company, we're picking your company, that's the one, you know. It's like we don't have to do that. That's not a manufacturing policy, but we do need to get the big parts right.

MR. ATKINSON: So trade is the last T, right, so I'm going to add an R for everything has to be focused through a regional lens. That's a way to get the co-location of activities, the synergies and feedback loops that Greg is talking about. So it's four Ts plus an R, and I would say it's, you know, things -- it's a mix of hard centers of regional dynamism, so hubs and institutes are an important model that the Germans and others have.

You know, you need a focal point to force that kind of collaborative activity between business and academia and labs and so on. And then we've advocated the use of competitive cluster grants, you know, that are simply to, you know, to match and turbo charge regional industry cluster efforts to try to put this stuff together, connect these, you know, really with often very diverse industry clusters with all kinds of actors that, you know, are hard to organize, and yet can't -- that will have the best knowledge of what is needed to connect the collaborations needed in a place.

So I think that's -- when we get to policy, we are often aspatial about it and don't understand that we don't have a single economy, we don't have a single manufacturing economy. We

have the Rhode Island manufacturing emphasis; we have the Denver, Colorado, focus in aerospace, you know; and we have other ones around the country. So we have to have that specificity in some way to get at that self-organized activity in these regions.

MS. LOWREY: All right. And in some ways it's interesting because that might be somewhat easier. I think a lot of what Rob was talking about is it is policy that needs to happen at the federal level and can be very difficult. It's, you know, kind of hard to think about a huge sort of tax reform pass thing and a huge amount of investment in science necessarily passing. But regions competing for businesses to locate there, I mean, that's already happening, right.

MR. MURO: Well, there's a great history of that. I mean, there's a great tradition of southern industrial policy in which conservative southern states are the most aggressive about assembling industry and helping to resolve these corrective action problems and supply chains and so on.

But I was going to say, I think this is -- the regional piece is not a nice-to-have piece of it, it is a highly functional, politically viable way to get at these issues, and a little less obtrusive way than sometimes federal policy tends to be.

MR. ATKINSON: Let me just sort of clarify and, Mark, you will I think agree that besides you and Metro, I'm probably the second most strong advocate for regions in Washington.

MR. MURO: Yes, you absolutely are.

MR. ATKINSON: I have my bona fides here. I don't think it's an either/or, and I know you're not saying that. As much as regions are doing good stuff, and as I said, I worked for a governor, you know, they don't have, you know, they can eliminate their taxes, their tax rates are pretty low, you know, 5, 6 percent compared to 35 percent, so they don't have a lot of headroom there.

You know, they have big budget problems. They can't invest as much as -- so to get the scale we need, we've got to have a federal role, and clearly that role has got to be in partnership, it's got to see regions as a key enabler. But I think there's a real misleading view in Washington that, well, we'll just leave it to the regions and we don't have to do the heavy lifting in Washington, and that's just not going to get us anywhere near as far as we have to go.

MR. MURO: Well, we're lacking that basic national platform for regional activity, right?

MS. LOWREY: So I think we'll take some questions from the audience. The gentleman over here on the side.

MR. MALLOY: I'm Pat Malloy. I'm a former assistant secretary of trade at the Commerce Department, and I'm a trade lawyer. I salute Rob Atkinson because I think he's hit the nail on the head. Here's the way I see it, and then if I could ask you guys to comment. We have these huge trade deficits because we're outsourcing more and more of our production and then importing things that we used to make, and when you're not making things, your ability to innovate is lost. Willy Shih up at Harvard Business School has pointed this out in that brilliant article in *Harvard Business Review*. And then when you can't innovate, then you're losing your ability to be next in the big things in manufacturing.

So as I think about these things, I look back at Kennedy saying we've got to get to the moon by the end of the decade. Nobody knew how to get to the moon, but we set a goal and energized the whole society.

If we set a national goal to balance our trade by the end of this decade, and then got serious about what policies we would have to put in place, would that be a way to energize us to stop this hemorrhaging of jobs and manufacturing that's going on in this country and begin to put policies in place that could reverse these trends that are killing the economy, killing the future for our young people in this country?

MR. MURO: Yes.

MR. MALLOY: Thank you.

MR. MURO: I mean, I would say the President boldly articulated doubling of export goals. You know, we may or may not make it, but I think it has done a huge amount to draw more attention.

MR. MALLOY: (inaudible) increasing exports, so the hole just gets deeper.

MR. ATKINSON: Yeah, I agree with Pat. I think the export goal is a nice one, but, you know, it's sort of a half of a loaf. You've got to really bite the bullet and say, no, it's really about balancing our trade. The one thing we forget about that, and again, you know, classical economists ignore this, but this is as much of a debt on our future generation as the national debt. In fact, it's even more, because national debt is sort of within the country, you know, I'm loaning the government money or whatever.

So my son, or my daughter, at some point in their lifetime, they're going to have to be consuming five percent less than they're producing for a long time, because that's essentially what we all have been doing. We've essentially -- we have a new book coming out in September called *Innovation to Economics: The Race for Global Advantage.* And I calculated this: the average American is essentially getting a Jeep Grand Cherokee every four years for free because we're not paying for it.

So if you add up the trade deficit, all the money that -- things we're buying, we're not giving anything back, we're not giving the Chinese things, they just have these little pieces of paper with presidents on them and we can't do anything with those, they're worthless, unless you trade them in for something of value. I mean, the thing itself is worthless. It's basically a -- it's an exchange mechanism for other value. They're not trading it in for value because we're not buying anything from them; we're not buying very much for this. That's the amount every four years we're getting for free. And I love my Jeep Cherokee. Whatever, I don't have one, but I have a Honda, so I probably got it for free.

My point is we need to bite the bullet and say at some point we've got to least balance the trade deficit, otherwise we're going to be passing this big debt onto our children, even bigger.

MS. LOWREY: Okay. Up in the front here.

MS. WORTH: I'm Mitzy Worth with the Naval Postgraduate School. Rob, I love what you're doing. I come at this from a broader spectrum, which I think one of the dilemmas we have is that we don't teach in our schools complexity and systems, and we basically train people, and it gets worse when you get into graduate school. You become narrower and narrower on a smaller piece of information, and until you start understanding the interdependencies of all of these components and how they affect the consequences of what we're living with, I mean, I think we're failing on that, because we are -- and I would argue that our three-month metric of having to produce a result is driving that, and until we can understand the complexity of the world that we live in, we're going to continue to go on this way. We look for the simple, short-term answers.

MS. LOWREY: Well, I think, you know, it seems like there's been a lot of efforts to try and get people to go into stem fields and to go into engineering fields as you guys have described. So do you identify any other problems in the graduate education system, ways that we could sort of use the educational system to help foster -- both to get more of the graduates that we need and to help foster

innovation more generally?

MS. WORTH: I wasn't clear. Starting in kindergarten you have to start talking about (inaudible).

MS. LOWREY: Yeah. All the way down (inaudible).

MR. ATKINSON: Well, one quick thing we could do is, we could do, again -- I hate to keep bringing up the Germans, but we could do what they do, and a lot of other countries, which is restructure our engineering graduate programs to really be much more interlinked with industry and with industry co-ops and other things like that. We don't want to do that as much anymore.

Engineering has become a science and not a problem solving discipline. They have science, and we need to reorient engineering and education around practical problem solving and integrating it with industry and we don't do that.

MS. LOWREY: On the median right there. Thank you.

MR. CHATTERJEE: My name is Samar Chatterjee from SAFE Foundation. I'm curious, the heading of this session is "Manufacturing to Recapture America's Innovation Edge." Do you want to really recapture the innovation edge that's been lost, or the manufacturing, or you want to have a lesser trade deficit? Because the others I -- the gentleman who pointed out the Chinese hold a piece of paper with a lot of money written on it, they're going to make use of it to make sure that their innovation edge keeps increasing.

So other competitors are not going to let you just recapture all the innovation edge or whichever. So what is the ultimate objective? Because if free trade means let the chips fall where they may, that's not what we're talking about; is that right?

MR. TASSEY: Well, trade policy is not something that I really want to discuss at any length here. But let me put it this way, if you removed all these barriers that we know exist in global trade today, and actually there's been several recent articles talking about how they're getting worse due to the global recession so it's even more of a problem, you still have to be competitive in what you make and sell. So whether it's a manufactured product or a service, you have to be able to do it better than your competitors. So the whole question is: what is the growth model that gets you to that end point? The trade deficit, which we've had a manufacturing for 35 years, actually going on 37, I think 1975 is the last

time we had a trade surplus in manufacturing, so a deficit is a dollar-for-dollar reduction in GDP, so that's a dollar-for-dollar reduction in income, okay.

So the bottom line is, you have to find a way to be competitive, and the trade deficit is an indicator of your competitiveness, even making adjustments for restraints on trade, which are clearly issues.

But what bothers me is when a discussion gets too strongly on blaming the Chinese or somebody else, we're losing sight of what will we do if we solve all these trade restriction problems, and that's what we're discussing here more than anything else today is what's the right growth model.

And so we've talked about many elements of it, but one of the main problems, by the way, is inside the federal government, there is not an innovation policy infrastructure. When I was a graduate student at GW back in the '70s, there was more institutionalized innovation policy capability in the federal government than there is today, and on the congressional side, as well. When OTA got shut down, and we had a couple small programs on the federal government side when I was a grad student, they were shut down, and then we had the technology administration which was shut down, so there are some signs we're beginning to rekindle some momentum towards reestablishing a policy infrastructure.

When you think about all the issues we have discussed here today, how complex they are, how are we going to make intelligent decisions if we do all policy on an ad hoc basis, which, frankly, is the way we do it? So we've got to change that first and foremost.

MS. LOWREY: Over on the side here.

MS. EDMONDS: Good morning. First I want to thank the panelists for your very insightful comments. I have a question going back to Greg's initial opening remarks and the belief that, you know, science leads to innovation, and, you know, not supporting the actual maturation of these technologies.

So first I should introduce myself. I'm Corina Edmonds. I'm the tech transfer coordinator for the Department of Energy. In the last two years I spent trying to reduce barriers and trying to derisk these technologies to go from the lab to the marketplace. And I've seen that in the best situations where you have a proof of concept model in the lab, you know, even those cases, it takes a long time and a lot of funds to move those.

And I struggle because, you know, you just talked about innovation policy, which we don't currently have, and it's a struggle because a lot of folks believe, you know, I -- there's people that actually think that once you have a plan, it's done, the commercial sector should be picking it up, and so how do we address that? I'm interested to know what NIST is planning to do to enable more maturation, derisking of these early stage technologies that we spend all these funds to develop, yet will sit on a shelf because we can't get it to a point where we can attract private equity.

MR. TASSEY: That's a great question, though I may weasel on this a little bit. And my boss over here, he manages the tech transfer programs in this, so he's the authority on this. But I will point out that NIST produces a lot of public good technology. After all, we're a government institution, so that's not readily patentable. It's technical infrastructure, I call them infratechnologies, many of which become the basis for standards. Without these standards, the high tech sector is bottoms up.

The semiconductor industry has well over 1,000 standards. You take those away and they don't function. So there's this element of government role in producing intellectual capital technology, which is not patented, but obviously the spinoffs from that work that is patented, and then we have the issues you have identified of what are the best mechanisms for getting that technology into the hands of the private sector. We addressed this at universities back in 1980 with passage of the Bayh-Dole Act; we tried to improve the flow of intellectual capital into the private sector through that law. There have been a number of acts since then, but this is -- it's definitely a complicated issue which needs attention. And this administration is certainly giving a lot of attention to that.

MS. LOWREY: In the middle here.

MS. CLINE: Hi, Andrea Cline, development consultant. I'd like to ask about the R&D credit. Do you see two different standards, particularly one focused to small, medium capital firms with a greater credit so that they can have a greater impact in the market versus multinational companies?

And secondly, with regard to the competitive cluster grants, what are the conversations that are happening with foundations, NGO networks to go into let's say a three- to five-year program that will allow that, let's say that entrepreneur to work with that municipality or regional government entity and agency to bring forth production and having that regional localized effect, but also being able to break into the global market?

MR. ATKINSON: So on the R&D credit, a lot of countries have a more generous credit for SMEs than for larger corporations. We generally don't. And I just recently wrote a blog called "In Praise of Big Business" just to irk people. And my argument essentially was that we should be size agnostic, and I think we should be. I don't think we should have a better credit for small companies. What we really do have a problem on, this is a bill that Senator Chris Coons has just introduced that actually -- it actually was part of the start of America 2.0 Act which is a bipartisan act with Senators Rubio, Warner, Moran, and Coons, but it's a refundable credit out of the payroll tax for smaller -- for new companies essentially, companies that don't have any profits.

You can carry forward the credit for a number of years. Eventually you might have some problems, but it doesn't really work for startup companies. So this provision that Senator Coons has put in, which we support, is a good idea because it gives companies the ability to actually get a refundability part of the credit early on in their life cycle.

MR. MURO: I think you raise a good issue. In terms of stimulating these regional initiatives, you want to make sure that they're not being, you know, so short term that there's no impact, but you also don't want some ongoing sustained, you know, steady flow of government support for them. So I think some of -- there are a number of competitive offerings for, you know, two, three, four year sort of start up with heavily matched funding for, you know, various projects and that's a way to get that kind of on-ramp, but then, you know, uptake is expected in the region. But you're absolutely right that, you know, a one-year, you know, grant victory can be almost disruptive. What you really want to do is the stimulating regional activity to solve these problems as best you can in addition to as we're seeing a national problem.

MR. TASSEY: One issue associated with the credit that's not discussed enough is the structure. We're the first country to implement an R&D tax incentive back in 1981. It's been temporary since, which shows how little we understand it and have confidence in it. But structure is also important. And the credit as it originally was structured was incremental based -- in other words, they had a formula which determines based on the amount of increase in your R&D base calculation that determines what is eligible for the credit.

The structural problems of that, and then Congress recognized it, at least to an extent in

2007, they introduced an alternative simplified credit it's called, which has some improvement, but it's still a partially incremental credit. Most countries in the world have gone to a flat credit, which I believe is the right way to go.

It's simpler to administer and then recognize it as all dollars of R&D are risky and have some degree of market failure associated with it.

MS. LOWREY: I think we have time for one more question, in the middle.

MR. HARRISON: Glenn Harrison, CRS. When you're talking about innovation and preserving innovation here in the United States, and you look at some of the economic and regional clusters that have formed abroad that essentially aggregate a lot of production in one place, Shinjin, for instance, in China, or other places, as well, in fact, there are numerous locations where this happens, how do you go about, you know, pulling that back, you know, where a lot of the -- I think Annie mentioned screws and why do we need to make bolts and things like that. And, you know, I guess my question is, if all of these other countries are taking grounds up, you know, startup approaches to it, and we've lost that, you know, is there any way of recovering it and would it even be feasible to try? And especially when, you know, you look at Taiwan and chips and whatnot, do chips really matter? You know, is it the old potato chip versus computer chip thing?

MR. TASSEY: Well, that's an excellent question. And I think as Americans, we have to realize that we count for less than 5 percent of the world's population, so 95 percent of the world's consumers are outside our country and, therefore, that's where the growth is going to be in the future.

We will never, because of the size factor, be dominant in all technologies again. Nanotechnology is a great example of that. There are multiple countries who are putting substantial R&D resources and are achieving advances in nanotechnology. We are a player, but we will be one of a number of players, and that's a shift from the post World War II phenomenon in which the U.S. dominated every technology. In fact, we were the source of every technology. Those days are over. So we have to pick and choose basically.

My view is we focus on supply chains rather than individual industrials because of the synergies that we've discussed. But beyond that, it's choosing those supply chains and then providing world class infrastructure to support them.

MS. LOWREY: Okay. Well, I'd like to thank our panelists and the audience for listening. Thank you.

MR. WEST: Thank you, Annie, and our panelists for sharing your thoughts. We have a buffet lunch out in the hallway, so please help yourself.

And again, I want to thank John Hazen White, Jr., for the leadership that he has demonstrated, and we will be continuing our work in this area. Thank you very much. (Applause)

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