THE BROOKINGS INSTITUTION

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INNOVATING AMERICAN MANUFACTURING:

NEW POLICIES FOR A STRONGER ECONOMIC FUTURE

THE JOHN WHITE, JR. FORUM ON PUBLIC POLICY

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PARTICIPANTS:

ADVANCED MANUFACTURING'S EFFECT ON AMERICAN INDUSTRY:

Moderator:

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Vice President and Director, Governance Studies
The Brookings Institution

Panelists:

TONY MADDALUNA
Executive Vice President, Pfizer Inc.
President, Pfizer Global Supply

ERIC ROEGNER
Chief Operating Officer, Alcoa Investment
Castings, Forgings and Extrusions
President, Alcoa Defense

IS MANUFACTURING THE KEY TO RECAPTURING AMERICA'S EDGE?:

Moderator:

JIM TANKERSLEY
Economic Policy Correspondent
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Panelists:

MARC LEVINSON
Manager, Transportation and Industry Analysis
Congressional Research Science

ASHA BALAKRISHNAN
Research Staff Member
Science and Technology Policy Institute

WORKPLACE EDUCATION AND THE MANUFACTURING SECTOR:

Moderator:

SOPHIE QUINTON
Staff Reporter
National Journal

Panelists:

THE HONORABLE DAVID CICILLINE (D-RI)
U.S. House of Representatives

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Taco, Inc.

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P R O C E E D I N G S

MR. WEST: Good morning. I'm Darrell West, vice president of governance studies at the Brookings Institution, and I'd like to welcome you to our second annual John White forum on manufacturing. And this forum was launched last year with the generous support of John White, who is the president and CEO of Taco, Incorporated, and this is a heating, pump and ventilation company in Rhode Island. Our goal is to use this event to raise awareness about manufacturing and to work towards improving the climate for manufacturing. John, his wife, Liz, and sons John and Ben are here with us in the front row, so please join me in expressing our appreciation to them.

(Applause)

MR. WEST: And for those of you who are on Twitter, we have set up a Twitter hashtag -- that will be #bimfg, bimfg. So any of you who would like to pose comments or questions during the course of today's events, you're welcome to do that. We will follow that and sometimes we're able to incorporate questions into our audience Q&A.

Manufacturing is one of our economy's most fundamental drivers. It is playing a major role in our current economic revival. We have seen how the adoption of advanced manufacturing techniques have improved worker productivity and how that has helped us grow our

economy. Today, we are hosting a half day conference on the exciting new innovations taking place in American manufacturing. We're going to describe some of the new developments that are transforming the sector.

Manufacturing is no longer your grandfather's factory. It's not that dusty old production line that many of you might have seen on TV and in movies. It is a modern place that requires skilled workers and new styles of operation. So, this morning, we're going to take a look at ways to promote a stronger economic future. We're going to start with a look at the people who are in the trenches; the people who are actually doing the innovating, and we'll talk about some of the new things that they're doing. And then later, we will look at the policies, practices and workplace education needed to prepare us for the 21st century economy.

So for our opening session, we have two very distinguished speakers. Eric Roegner leads the investment castings, forgings, extrusions, oil and gas and defense businesses for Alcoa. That sounds like five different jobs there to me, but (Laughter) there probably are days where it seems that way to you, too.

MR. ROEGNER: You've got it. You've got it.

MR. WEST: He has served in various executive roles since joining Alcoa in 2006. Before Alcoa, Eric was a partner with McKinsey and Company. He sits on the finance committee of the board of

governors of the aerospace industry's association and the finance committee of the board of directors of the Ohio Manufacturers Association.

To my immediate right is Tony Maddaluna. He's executive vice president at Pfizer and president of the Pfizer Global Supply. Under Tony's leadership, Pfizer has focused on plant network strategy, ways to improve the agility of the operations, ways to improve business practices, redesign and technology innovation in general. His career with Pfizer spans more than 35 years. He joined the company in 1975 in Saint Louis.

MR. MADDALUNA: I was only ten at the time.

(Laughter)

MR. WEST: And he has served in a variety of management positions since then. He represented Pfizer on the National Association of Manufacturers, and beginning in 2013, will be a member of the NAM Executive Committee. So I'm going to start with Eric. This year, Alcoa is celebrating its 125th anniversary; so clearly, your company knows something about staying relevant and keeping up with change.

So, can you speak to how Alcoa keeps innovating its processes and its products? And specifically, what the concept of advanced manufacturing means at Alcoa?

MR. ROEGNER: Very good. Well, first off, Darrell, thank you very much for extending the invitation to us both to be here, and to the

Brookings Institute and to our sponsors. We really do appreciate the opportunity to do that.

You know, this year, celebrating our 125th anniversary, the exact same thing that caused Alcoa to be born is what's kept us alive and vibrant to this day, and that is, a ruthless focus on process and product innovation. It was 125 years ago that Charles Martin Hall created a new process, the electrolytic reduction process, that turned aluminum from being a precious metal into really, a globally available material that could be used for a wide variety of different products.

That commitment to process innovation that then can create a new product is really what's carried Alcoa through all the different phases, through the 20th century and into the 21st century. It has an interesting little factoid. Aluminum is one of these odd materials, in that if you look around you, there are so many things that are made out of aluminum. Very few of them were actually originally designed in aluminum. Aluminum is almost by definition, a substitution material from the very original pots and pans and cables into packaging, into aerospace applications.

Now, if you hold up your iPhone, your iPad, you're going to see aluminum casing. Just about everywhere you go, you start to see that the ability to take a material, in those examples, aluminum, but we're going

to talk about others -- if you bring innovation to bear and you can solve problems that your customers either have or may not even know that they have yet, and you can bring that into the marketplace, it's that differentiation which is going to allow you to succeed. We call it advancing each generation of the different products and markets that we're in.

Now, there's a specific issue about manufacturing and advanced manufacturing. The way that you stay relevant as a globally competitive company is to stay globally competitive, which means you're either cheaper than other people or you can do things that other people and other companies can't do, and that means significant investment in improving your process technology or your product technology. And when we think advanced manufacturing, where we deploy our resources in R&D in particular is figuring out how we can move those positions.

I'll give you just two examples now. I'm sure we're going to talk about more later. On the process side, I mean, we have over 61,000 folks all around the world ranging from very commodity like businesses and refining and smelting through incredibly differentiated businesses thought make the fasteners for aircraft or the blades and veins for jet engines.

On the process side of the industry, the smelting of aluminum, something that's been around for 125 years, we are bringing state of the

art information technology; we have a thing called the Star Probe system, where on our pot lines, and you can picture these massive facilities that we have all around the world, we can collect huge amounts of data from every one of our production cells on all the process variables. We can monitor them real time across the entire facility to be optimizing and tweaking as we go, but then, we can bring advanced information technology tools to study those statistical data on a massive scale across multiple variables to look for opportunities to find linkages.

If a temperature here for a period of time mixed with a particular catalyst in that area, what drives different reactions? And by doing that modeling, which really even ten years ago was physically impossible to do -- something that you think in massive data mining -- you might think in banking or retail. We bring that to the manufacturing environment and we found cases of 15 to 20 percent improvements in energy efficiency, in input cost utilization improvements by deploying these very sophisticated tools into core manufacturing environments.

On the innovation side of product, I'll give you another example. Aerospace is really one of the strands of Alcoa's DNA. From the very first airplane that flew on the Wright Brothers' flyer, it was Alcoa that came up with an aluminum alloy for the engine block so the plane could actually fly. And we've been innovating in aerospace all the way to

today. If you look at the latest generation of aircraft flying, the Boeing 787, the Airbus 8-350 carbon fiber structure, it was our fastener's business, anticipating before they even had the need, that there would be an electromagnetic management issue with these aircraft; otherwise, colloquially said, lightning strike if it gets hit by lightning.

It's our business that's always been on the cutting edge of fastening technology that developed the fastener that not only can bond a carbon fiber's skin to a titanium structure underneath, handle the thermal expansion issues, galvanic corrosion issues, but actually attracts the current from the lightning strike and then dissipates it into a conductive medium underneath. We anticipated that need. We got out in front of it, invested our dollars into it and created solutions for those companies so that when the need hit, we were there, ready to go, which has given us the leading position with a completely innovative brand new product that's got a huge amount of -- and we'll talk about it later, advanced manufacturing to make those kind of products and bring it into market.

So, at the core of what we do is continuously pushing the envelope of producing our cost structure or bringing new innovative products to market. And as long as we do that, we can stay globally competitive in a very challenging world.

MR. WEST: Actually, that is very interesting, to hear about

the innovation both on the process side as well as the product side. So Tony, you know, people don't always think of Pfizer as a manufacturing company, but yet, I know one third of your employees work in the manufacturing sector. So from your perspective, how have drug therapies changed? And how has this affect manufacturing?

MR. MADDALUNA: Okay. Well first of all, I want to thank you -- thank you for having me here. Second of all, I want to come to your plants (Laughter), because you know, I'm into manufacturing and it sounds really interesting. And thank you for aluminum -- for aluminum frames, because I have a nice Audi that has an aluminum frame, and it was designed --

MR. ROEGNER: We designed the aluminum frame (Laughter).

MR. MADDALUNA: And thank you, Johnny, for sponsoring. You know, this is a great opportunity for me. I think that when people think of pharmaceutical companies, they don't generally think about manufacturing. They think about, you know, the end product and what it does. And that’s very important, because obviously, we're an innovation-based company. I mean, Pfizer is -- the basic innovation and research is about $8 billion of our -- a year, about 15 percent of our revenue.

But for manufacturing, let me just say, we call ourselves

Pfizer Global Supply, because right now, in the manufacturing space and what we do -- we have an internal external globally integrated network. We have 56 plants around the world now. It's gone up and down through all the mergers we've done, and in our plants -- we'll talk a little bit about it, but they're very sophisticated. Things have changed over the years.

So you can see from my resume that I've been with Pfizer for a while. You know, like I said, I started when I was 10 years old in Brooklyn (Laughter). You know, that's my side story. And what's happened to therapies? So, we have about right now -- we supply Pfizer across all the consumer business, pharmaceutical business, about 21,000 SKUs. That's you know, the presentations you get or the pharmacist gets. And it's very complex, and we supply to about 175 countries.

I would say up until about maybe 10 years ago, you basically looked at handling chronic disease and the basic API or the Active Pharmaceutical Ingredient was a chemical synthesis. So Pfizer came out -- it was a chemical company back -- we're over 160 years old. Sorry, a little older than Alcoa. Yeah, it was a chemical company -- the confectioner -- they got together, and that's how they kind of -- you know, Charles Pfizer and his cousin, and that's what they put together. So we kind of came out of that business.

So what would happen in research is, and on the innovation

side is, they would come up with a compound, and they'd look for a therapeutic effect. And it's almost like shots on goal. You know? They'd see what the therapeutic effect is. But you know, five out of about 10,000 of those compounds actually made it into humans, and of those five, probably one became a product. So it's a very risky innovative business, and it costs about -- I'd say right now, it costs about $1.3 billion to bring a product to market from the beginning to end, and there's lots of failures along the way.

I just read about one this morning that was -- I get the news, Roche had a failure on one of their diabetes products, and a lot of disappointments, and that's all sunk costs. But the bottom line is, innovation is the driver. So what's happened to the products now -- you hear about, you know, biological, sub-bios. The small molecule products are chemical synthesis products. So you know, they're basically looking at something that we can do in a laboratory and then you know, put it into a chemical plant, where the bios are more natural products. We differentiate them by small molecule. You'll hear this said in the large molecule. And if I had a picture, you'd see a little car and a big 747. I mean, that's like the difference between the size of the molecules under a microscope in terms of relative size.

And the biological basically, are very complex processes.

So if you walked into one of our biological plants, you'd be amazed, you know, what you see. You know? It's the upstream process and the downstream process, but a lot of separation technologies that are very, very sophisticated, every expensive. And generally speaking, in the large molecule world, you design a process and a plant for the product. So it also adds to the risk factor, because if you don't make it multiple product, you've got a plant that you're kind of stuck with.

On the small molecule, now here's what's happening in Pfizer. And I'm really excited. There's one drug that we have right now that has breakthrough therapy with sort of a classification with the FDA, so that means we could advance it through the pipeline pretty quick. And that's a drug called palbociclib and it's for HER-2 negative breast cancer. That's personally meaningful for me for personal reasons, but that particular drug is a small molecule, and it was discovered because now, there's a much greater knowledge in deep biology. So now, we're applying deep biology and more precision medicine to the small molecule field.

So, what's happened as a result of that, these compounds are much more potent and you need less of them. So when we used to make -- so Lipitor was the biggest product in the world. You know, you make tons and tons of atorvastatin, which was the active for Lipitor. And

you know, that just went off patent recently, and it was for chronic disease.

The new therapies are more precision medicine, and you know, targeted towards certain gene type, targeted towards certain populations; you know, whatever the target is, and they're generally very high potency compounds, so you make less of them. So, we've shifted from on our API side to sort of like not really chemical plants, but large vessel plants to real smaller focused plants.

On the side, on the biologicals, it's a whole new different area because the education of the workforce is different. I mean, when you go through those plants, most of the operators are degreed persons, and they really need to know what they're doing. And there's automation throughout all the plants, but you really need people that can you know, work through the process. Also, what hasn't changed over the years, and it's actually gotten a little tighter, we're probably one of the most, if not the most regulated business in the industry. So it's with FDA and with all the different inspection agencies around the world, so we're around the world. And what we're finding is, that even in the emerging markets, the regulatory agencies are getting more sophisticated.

So there isn't a day that goes by that we're not being inspected somewhere in the world. So, what we do is very, very buttoned up, I guess you'd say, in terms of what our processes are. And from the

standpoint of how we do it, how we dress, how the facilities are designed, if you came into one of our plants, I think you know, you'd be surprised what you would see.

But I've been really pleased to be in this industry all of my life, just about, because we're in the well-being industry. My personal -- I guess my personal purpose in life is to you know, positive make -- or persistently make a positive difference. So I feel good when I go to work, even on Mondays sometimes (Laughter). And you know, I feel really motivated. So when we get a breakthrough therapy like palbociclib and others, it's what motivates our workforce. So you can go to any one of our plants and that's what excites us, and really the caring, even on the shop floor for what they're do -- they're not just putting bottles in boxes. They understand what they're really working on.

So, it's an industry that makes a difference. I think it's an important industry. We can get into why -- you know, what we need to do to protect it and keep it in the United States, also.

MR. WEST: That's exactly what I want to get into now.

MR. MADDALUNA: Okay.

MR. WEST: So clearly, each of your companies are innovating in different sorts of ways, but I'm sure there are various barriers to doing better, and these barriers could be a tax policy, regulatory issues,

energy, I know, is a big issue in the manufacturing sector. So Eric, I'll start with you. What are the biggest barriers that you're facing?

MR. ROEGNER: Yeah. Boy, we only have an hour?

(Laughter)

MR. ROEGNER: Let me just briefly touch on two, and I think that will trigger quite a bit of discussion. At the end of the day, manufacturing has several inputs, from the material you use, the labor that is involved, the energy, underlying processes and then the regulatory and tax environment you function in. For a company and particular a manufacturing company to be successful in the United States, you have to be globally competitive, which means each one of these elements, when they get added up in their entirety, means that you need to be able to make a product that's either lower cost or better than what could be sold somewhere else in the world.

And for us, since we tend to have a good chunk of our business in less differentiated like commodity products -- you can buy aluminum or alumina on the London Metals Exchange. And then, we also have very differentiated products. But through the manufacturing, we absolutely have to be competitive. Two that are things that the United States needs to get its hands around very, very forcefully, and hopefully sooner rather than later, are number one, energy. We have to have

competitive energy costs, whether that's natural gas, and there have been some benefits there.

In fact, given the Marcellus Utica shale boom, we were actually able to reopen a refinery in Point Comfort, Texas, that we've actually had to shut down due to high energy costs. Now, it's the third lowest cost facility in our operations, and that's a really nice benefit. But on the flip side, volatility and then higher prices in electricity, particularly where we see manufacturing in the more central parts of the country as capacities coming out of the market for a lot of different reasons, some of them driven by regulation, you don't see new capacity coming in, and then new charges associated with it. Electricity is a very major component of what we do, and as those costs continue to rise, and also there is increasing uncertainty around them, it really puts manufacturing at risk.

The second one is going to be the labor pool. And the two items I would highlight on this one -- number one: Link to stem education. Actually, what we really would like, and we were talking about the model in Germany, is trade and vocational school training. You don't need a four-year degree to work in our plants. Over 80 percent of the people that work in Alcoa, work in our production environments.

Having a two year degree to be a tradesperson, being a mechanic, an electrician, knowing how to run a CNC machine, knowing

how to do basic programming on a PLC, that is the kind of skill set that we need in our facilities, and we have a very difficult time finding qualified folks to do that in many of our locations; not all of them. There are some locations where we do it, but that's a systemic problem that we've got.

Now, the other problem, and this one is much more basic and underlying, is finding folks that actually qualify at a basic level to work in our facility. And here, two things are number one. Pass a drug test. The number of applicants we get that don't even pass the basic drug test; it varies by location, is staggeringly high. And then number two, just a basic math proficiency at the high school level. So, even before you get into a two year degree type of programs, if we can crack the code on that, we have literally hundreds to thousands of positions in the U.S. that could be filled that we have a real challenge with, just cracking the code on those issues.

MR. WEST: Tony, what are the big barriers you see?

MR. MADDALUNA: Well, you're going to be amazed when I tell you that, you know, your industry and our industry are no different in terms of what we do. So we have to be a globally competitive supply network. Absolutely. Especially when we get into emerging markets.

Pfizer's business is somewhat bifurcated from the standpoint that there's the innovative side, but we would call it, I guess, sort of the

value side. So a lot of our products are now generic. So we have to compete in that space, also, and that competes more on cost than -- like I say, I have to make the point, because it's very important, what we offer for Pfizer. So we're a critical element of Pfizer's success in the supply. Obviously, as the CFO says, if you don't have any product, you don't make any money.

But we have what we call our fundamental value proposition, which is quality and compliance, supply and cost. But for us, we absolutely cannot, and I'm sure it's true for you, too -- we can't compromise on quality and compliance. So as we balance that triangle, especially in the type of industry we're in, very difficult. So I'm not going to get into product shortages and all that kind of thing. But the bottom line is, we're in this business that's very, very volume based and generic based, and we're in the innovative side.

Now obviously, the innovative side is what drives, you know, Pfizer's success in the future. So, one of the biggest issues I think that we have on that side is intellectual property protection. So, we need laws that are solid and basically, laws that are reinforced globally, which is not happening. You know, we won't get into specifics, but not everybody honors IP. And that's a problem for us, because you know, what did I say before, 1.3 billion? We've had some big failures.

You know, there was a follow on to Lipitor, which is called torcetrapib. We invested a billion dollars in that drug, and it basically didn't make it. Robert's in the room who worked -- he worked in marketing. We had inhaled insulin. Inhaled insulin was a technical success, an innovation, but a commercial failure, I guess. We still have to understand that. Right? We wrote off $2.3 billion.

We have plants that we build, because we have to build them early in the process. So intellectual property and basically the protection of that is, when we make that investment, we need to know that there's going to be sort of an income stream that's going to pay for that investment, because people always complain about the cost of their drugs. Well you know, what you're really paying for is the innovation. Nobody wants to pay for that.

You know, you go around the world and you look at health systems, it's not the government that's doing research. I mean, we have you know, 32 research centers around the world, 22 of them in this country. And the way we're doing research now is different than we used to do it, but that's the lifeblood of the company. The other piece is the same thing. It's an educated workforce.

You know, when you go into our factories, certainly the biologicals, but all of them, they're all automated. I would say half of our

people out of high school have high school degrees. Fifteen percent of our people have post graduate degrees, so there's a very technical aspect to producing pharmaceuticals, and obviously, the control standard, but you know, it's very much process oriented and how we follow the processes and how we understand them.

So from the standpoint of workforce, I think what I just said to you is that our business is no different than your business.

I mean, the intellectual property, I'm sure, is important to you. Maybe we'll get into tax at some point, but tax is another issue.

MR. WEST: Okay. Let's move to the audience participation part of this. So if you have a question, raise your hand. There's a gentleman right here. We have somebody with a microphone who's coming up from behind you. If you can give us your name and your organization, please.

MR. HAYNES: I'm John Haynes and I'm an economical development consultant. And my question is, I think most young people and probably quite a few parents are totally unaware of the opportunities for people with technical capability, including people like welders, who can weld in an environment that is clean at the end of the job and so forth.

So the corollary to that would be that it's pretty hard to get people motivated to prepare for those careers that they don't know about

and their parents don't know about. So, what I'm wondering is if any of the panelists have any thoughts about this. And I would also mention that without a big manufacturing visibility, you know, even -- I had one mayor say recently that even though she knew a lot about the city, that she was surprised at how large their manufacturing workforce was, because again, there's no big plants in that city. It's stuff that people are doing in their garages.

So, how would you inform people so that some of this stem education would -- they would be more motivated at the age that they're exposed to?

MR. MADDALUNA: I just want to make a comment, because I was going to say before I thought about it when you said -- and I could even relate it you know, personally to my son. So I think, in this country, there's a lot of young, educated people here. The goal seems to be, everybody wants to go to college. And you know, how can you compete? They have better SAT scores.

And you go to college, you get a BS degree, and you say well that's not even enough anymore. You have to get an MBA or an advanced degree. You get out, and don't take this wrong, but a lot of people that I know get out of school and they're working in the shopping mall, because you know, there's just no jobs from the standpoint of what

they're doing.

There's been, I think, a little bit of a stigma around because of what people perceive, as to your point, what manufacturing is, those dirty, welding jobs or whatever they are. You know, just not the kind of job that you'd think you want. You want to go get an education. You see what's going on, especially in the financial industry, the consulting industry. All those things to me, you know, manufacturing generates wealth. I mean, you're taking something and making it into something. You're generating. It's the basis of the economy.

So for my son, I remember he used to follow me around when I worked in plants, and he loved it when I worked in plants. When I came to New York, we had a take your kid to work day, and he was 16. So I took him to the office, and basically, he spent all day. And at the end of the day, I said, "James, so what did you learn today?" And he said, well, dad -- he said, you know, I used to love it when I came to work with you in the plants. You know, it was great. I came here, and all you do is have meetings and talk on the phone. He said, "That's not for me."

(Laughter)

MR. MADDALUNA: So he went out and got a heating, air conditioning and electrical degree, and that's what he does. And you know, when you say that, it's like -- and I'll just tell you personally -- it's

like, so my daughter is a teacher. She went to university and he went to the technical degree. When you say that, it's almost like -- when I say it to people, it's oh, well that's okay. It's like, you know, there's a thing in this country about technical people and technical degrees versus college degrees.

And you know, I would certainly stem is all around. So you know, National Association of Manufacturers is really, really big on it with the institute, basically looking at how do we educate the workforce. It's a good question, though. How do you get it early on? I think you have to start early on and often to sort of educate parents about this. I mean, maybe it's going to happen naturally, because of what I just said. You know, you're investing all this money in college degrees, and people aren't getting jobs. That's going to be a little bit of a driver.

But there's no attractiveness in it. You know, I don't know how many of you have ever been in manufacturing plants, but I think you'd be surprised if you haven't been in one, about what you see. It's not the factory of the mayor, you know, looking for the smokestack in the city saying, gee, I don't know what's going on. You know, we have laboratories in New York City doing research. You wouldn't know that. Okay? But they're on the top floor of a building doing research, and they're highly technical.

And we have a manufacturing plant in Brooklyn that we sold. It was converted over to small manufacturing doing highly technical manufacturing. So you wouldn't see what you saw before. But you know, it really is the key, is how do you get the young people interested?

MR. WEST: Okay. Eric?

MR. ROEGNER: Yeah, I agree with your comments completely. Manufacturing today is very different than what you see in movies, on TV and the manufacturing of decades ago. To the specific question though, about how do you influence and communicate to younger folks, I'd say there's a bottom up issue and a top down issue. Just speaking for ourselves, we have locations all around the world and all working the country, in just about every part of the country.

What we have done historically as Alcoa is we work in our communities. We find universities nearby for undergraduate, graduate and post graduate degrees. We have a plant in Lafayette, Indiana. We work with Purdue in Cleveland, Ohio. We're working with (inaudible) in Western. And we have those kind of relationships around the country.

But at the same time we have that, we also partner with community colleges and trade schools in the area, so that they are training folks on the skills we need, whether it's programming PLCs, running CNCs, doing welding, electricians, maintenance work with our formal

apprenticeship programs through those, as well. So we will do that in sort of a local or regional basis, and you see these little hubs forming around the country near where our facilities are.

And actually, I think it's too naïve or short-sighted to say that that's an issue for the country, because there are parts of the country where people actually want to go into manufacturing. If you're in South Carolina, you're in Alabama, you're in parts of Texas, you're in parts of Arizona around Phoenix, you're in Southern California, and going into high tech manufacturing jobs is actually quite an attractive proposition. There's other places where it's not.

So that's a different perception issue that does require a top down or a little bit more work to try to address. And building on what we heard here earlier, I do think we have a systemic flaw in our expectations in this country that the road to success is a four year degree, because statistically, there are more, you could argue, higher paying jobs out there. I mean, if you are a qualified welder right now, and you are willing to locate to where either a manufacturing facility is or where oil and gas exploration is, you're talking nice, three digit salaries coming out of a two year school. And there are plenty of people with undergraduate degrees. It will take a long time before they're making that.

And so, there's got to be a little bit of a change in the

communication at our high school level and all the way down to you know, how our guidance counselors, student aid gets distributed. If there was as much opportunity or communication around getting a two year degree as a four year degree coming out of a guidance school, and also, maybe changing some of the incentives on student loans so that there was a little bit more pressure that you actually get a degree in a field that will employ you, and you actually graduate, instead of going into a four year program to just get in so that the money gets disbursed, but then people don't even graduate, and that's something that I really wish we would take on.

But to put in a real plug for this, manufacturing is absolutely key to the GDP growth of the United States, because for the most part, you can't export a service. What you export are products. You know, drugs, medical devices, aluminum, cars, whatever it is. That drives GDP growth. You want a case study? Look at Germany. They get there by exporting products. If we ever think we're going to get here or grow the U.S. by being a service economy, that's way too short-sighted.

Secondly, R&D dollars. Sixty-five percent of all of the R&D dollars spent in the United States are spent in fields associated with manufacturing that ultimately lead to a product that you can hold in your hand, ingest or use. Ninety percent of all the patents out there are related to manufacturing. And so, if we lose sight of that and how we

communicate to our children in secondary school education and then into vocational or two year schools or four year, we're really selling ourselves short, because we're selling ourselves something that's not true.

MR. WEST: Okay. Other questions? Bob?

SPEAKER: Eric, you mentioned drug testing. And if we are, in fact, moving towards de factor legalization of marijuana -- if we are, in fact, moving towards that, how do manufacturers cope with that?

MR. ROEGNER: Well, I wouldn't single out marijuana over any other thing. I mean, we have as much of an issue with alcohol abuse as we would with any other illicit drug.

SPEAKER: It's just an added --

MR. ROEGNER: Yeah, it's just another thing that's out there. It in no way lessens the requirements we have and the processes we go through when we're hiring new people, or as we you know, police our facilities today, if there's an incident or other things in our regular program. I think what it does, though, is it expands the cultural acceptance of the use of these kind of materials, so people -- if you think, well, now it's no longer elicit, shouldn't I be allowed to have used it a certain period of time before I come to the job?

Well, no. You're in a -- manufacturing is manufacturing. It's in the physical world. You are around equipment, whether it's highly

automated automation and robotics to forklifts to overhead cranes, and you have to have your wits about you. Look what happens when you don't have your wits about you and you take your eye off task just a little while. Bad things can happen, whether you're driving on the highway or whether you're in a manufacturing environment.

So, we need to work as a society and as employers out there to do all we can to educate, communicate, but also, ensure compliance to these rules and regulations.

MR. MADDALUNA: Well, I'd make a different comment, but the same vein. So we have impairment -- it's all about impairment. So we have impairment policies. So you know, it happens now, whether it's legal or illegal. You know, you have people coming under the influence of something. We do drug testing in some places. Some places, we can't do it, so it doesn't really matter, you know, what happens.

So we look for impairment to the point where -- so our supervisors are trained, you know, to look for that. Our coworkers with a lot of discussion, because safety is a very important part of what we do. And that's a buddy system kind of thing. So if your coworker -- and you'll see this in plants, you know, is not performing, generally speaking, you're going to hear about it, and that's how you get into it.

So even if it's legalized, to be coming in impaired -- I mean, I

get to work very early in New York, and I'm walking down the street, and not that I know what marijuana smells like (Laughter), but the bottom line is, it's on the sidewalk at six o'clock in the morning. These guys are construction workers going in -- who knows what they're doing? You know? They're probably putting in HVAC systems. You know?

(Laughter)

MR. ROEGNER: Yeah.

MR. MADDALUNA: They have all the aluminum they're bringing up. So it's about impairment. So even if it's legalized -- you know, alcohol is legal. So it's about how people show up to work.

MR. WEST: Over here, we have a question?

MS. NEGROPONTE: Diane Negroponte, the Brookings Institution. Salary is the main impetus between choosing between a desk job and a machine job. Would each of you please tell us what the comparative salaries for an accountant as opposed to a welder or someone working on the machine?

MR. MADDALUNA: Well, I could talk to the United States. So our average operator in a plant is -- just an operator working on a machine is somewhere, with benefits, probably the 60 to $80,000 a year range. And probably, they're relatively high paying jobs.

Now, I don't know the salary of an incoming accountant, but I

think it's lower than that. But what you have to look at -- and I was going to make this point before. So, you can come into a plant as a worker. All right? And you can come into a company as an accountant. The trajectory of your career is largely dependent on you. And we have the opportunity in both ends.

So, a lot of our supervisors and managers basically came out of the operator ranks. So they've either started out, you know, in manufacturing or running a machine. Maybe they have a technical degree. Maybe they have a two year degree. They'll go get some degree. We'll pay for that in the educational assistance program. And I can name several people -- you know, a lot of them certainly in our group, that came that way.

Our plant manager in Lincoln, Nebraska started out on the floor. And he got an accounting degree, became a finance person, got through finance, went back into manufacturing, learned more about manufacturing from the management side and became a plant manager, a very successful career. So to me, it's more individual related than it is the actual job you come in on.

MR. ROEGNER: Yeah, I agree with that exactly, and the numbers are very consistent. The two things I might add are that the more skilled your trade, if you know how to be -- in the quality world, for

example, to be a level two inspector, be a level three inspector, you're writing your own ticket and your career is fantastic. And you can get there by going through a two year degree program and then taking supplemental training.

If you are willing to be mobile and you're a welder or an electrician or a maintenance person, the sky is the limit, particularly if you're willing to work overtime. And you're going to have indexed wage growth potential that's significantly better than an office job. But at the end of the day, supply demand works in the labor force as it works elsewhere. And right now, supply, demand and balance is an over abundance of people that want white collar jobs and an under abundance of people that are willing to you know, roll their sleeves up a little bit and get out there on the shop floor, and money goes to where supply and demand is telling it to go.

MR. WEST: Okay, there's a woman right here who has her hand up. Yes? Yeah, we have a microphone coming over to you.

MS. FERRIS: My name is Claudia Ferris. I'm with George Mason University, PhD candidate. You mentioned -- what did you call it? Deep biology.

MR. VERGES: Right.

MS. FERRIS: And my sense is that one of the things that's

driving deep biology is an understanding of how interaction occur at that level. My dissertation is in the application of complexity science, but it's to the social systems. And I want to suggest to you that deep biology -- the concepts behind deep biology apply equally well to social interactions.

MR. MADDALUNA: Absolutely.

MS. FERRIS: Example: I did my undergraduate degree in physics. Why? Because my mother folded towels in a particular way, and when she explained to me how to get those towels folded right, she explained in terms of the relationship between the edges and yadda yadda -- how to get them perfect. She wasn't the scientist. She just thought it was beautiful in the way they looked in the closets. Same deal with cooking. Why you have to do things in a certain order. You can't put the baking soda or the baking powder in while you're mixing the eggs and oil. You know? That kind of thing.

I want to ask you if you're paying -- in terms of building a workforce, there's a certain kind of structural thinking that goes into technical ability. Right?

MR. MADDALUNA: Right.

MS. FERRIS: And it doesn't start in high school. It starts when you're at your mother's -- you know, kind of thing. Are you paying attention to the changes in our society at that level which have an impact

on the way people's thinking evolves?

MR. MADDALUNA: Yes, so first of all, I'd say I made brownies once and forgot to put the eggs in until they were in the oven.

(Laughter)

MR. MADDALUNA: Yeah, I'm a pretty good cook, but I'm not very good at making brownies.

MR. ROEGNER: Hockey pucks.

MR. MADDALUNA: Exactly (Laughter). They were really pretty (inaudible). I mean, it's really interesting. You know, that's an interesting observation, because I could speak personally. So for some reason, whatever happened to me growing up is I seem to be -- you know, I'm a chemical engineer by training, and I'm a very -- I knew I wanted to do that. I don't know, it's probably dumb. You know, early on, I played with my chemistry set.

But I've always been process oriented. You know? So I'm a process thinker. You have different kinds of thinkers in the world. I mean, there's process thinkers that are more linear engineers and you have more -- you know, sort of the -- I guess the holistic kind of thinking.

I don't know how you get the education down or how do you make that aware -- how can you make somebody that's not a process thinker become a process thinker? Left brain, right brain. I mean, I just

don't know how that happens. Not everybody is probably even suited to do engineering or whatever, you know, math, science, but more of the liberal arts. So with your education and what you're doing, you know, that's a problem -- it would be interesting to see your insights, because I have no idea how to answer that question.

MR. ROEGNER: Can I chime in with a thought --

MR. MADDALUNA: Yeah.

MR. ROEGNER: -- that's a slightly different look on that? At the end of the day, we are all blessed to be in this country. And those of us that have jobs and that can create employment and that are anchors in our communities have an associated responsibility. And some of us take it very seriously. And one of the things that we've been very blessed with in Alcoa is an incredible heart of our folks at all levels for service.

You know, we have our Alcoa Foundation that gives big grants, but our people contribute. And so, we as Alcoa aren't going to solve a nationwide systemic issue, but what we can do is we can draw a little ring around our facilities and where our employees work every day and get involved. And one of the areas that every one of our facilities does get in with in service, is education. And we actually go all the way down to K through 12 with charter schools and with schools in the inner-city.

I mean, my office is in Cleveland. We have a plant there that's in the inner-city of Cleveland, and we partner with K through 12 schools that are struggling, and our people will go and spend huge amounts of time tutoring and contributing and volunteering, and it builds a little bit of a personal bond that then, you watch these folks through. We have local scholarships that then will take folks in their, you know, sophomore, junior, senior year and try to get them in early to get them into a community college, et cetera.

So it's a little thing, but if we step up to those responsibilities and lead in service in our community the same we lead in innovation in our products or processes, that's one step in the right direction, that if enough people do it, it starts to close a little bit of the gap.

MR. MADDALUNA: I do have to add a comment to that, because you just reminded me or ticked a thought off. So in our plants, I talked before about people rising you know, and doing different things. What we've found is, you know, we can't -- I say I was plant manager for a number of years. If it came to my desk, it was too late, and I can't solve a problem. It has to be solved on the shop floor.

So this process thinking -- even though people come in as operators, whether they have it or not, you know, maybe they just got a job. For what we do, and we have a lot of six sigma training going on

throughout all of our facilities, so we have yellow belts, green belts, black belts. And by the way, those people are worth their weight in gold, and you know, some of them we lose, because once we train them, even if they're not four year degree people, they pretty much are in demand.

So they kind of developed that, but they have the answers. There's several problems I tried to solve once, and we (inaudible) to continuous improvement. And it was one problem, I remember, in the Puerto Rico plant where we thought it was pretty simple. You know, the scientist -- and the operator said no. He said, there's something wrong with this filter. You know? It's not filtering. It goes and it stops, and we found out it had the wrong material in it.

And just you know, the understanding and saying, okay, I know how this works. And so that develops, you know, once they come in. So to answer the question, how do you get them interested, I'm not sure how to answer that. But I know once they get in, basically, we involve everybody in our operation. You can't run an operation without involving everybody. Every job is important.

MR. WEST: There's a person right there, a woman with their hand up. If you can get the microphone to her. Yes?

MS. SHEPARD: Hi, Heidi Shepard with NIS Manufacturing Extension Partnership. I have a question going back to the innovation

aspect of what your companies do. How do you think that small and medium sized manufacturers could possibly learn from your innovation models or benefit from what you do? Perhaps your suppliers are somehow integrated in your innovation practices, or I'm looking out for the small and medium sized manufacturers. So I'm wondering if you had any words of wisdom on that. Thanks.

MR. ROEGNER: Well, I'll start off with that. Oddly enough, for being a very large company, we're composed of very many individuals. And innovation very rarely occurs in group think. Innovation oftentimes is sparked by one or two people who are getting together and have an idea, and then figuring out how to bring it to market.

Building on that, we as an organization, exist in supply chains. If you think about that old BASF add, we don't make the products we make. We make them better. Alcoa, advancing each generation, we end up working in the transportation chain, in packaging chain, consumer electronics chain. We work very closely with our customers, and we work with our suppliers. At any moment in time, there are always challenges we're trying to solve. Some, we take on ourselves and some we look for partners. Oftentimes, you know, innovative, small partners.

I'll give you an example right now. There is an emergent trend that you see and read about in the press called additive

manufacturing. We as Alcoa, have actually been in additive manufacturing for over a decade. It's been (inaudible) process in making investment castings over the blades and veins for air foils from molds and dyes and things we do. We actually additive manufacture on surface features and coatings.

But it's expanding into the material set that you can use, and it's expanding into the types of applications to final end products. There's no physical way right now, we can cover every potential avenue. Do you do an EB? Do you vapor deposition -- all the different ways you can do it, and there's so many different technologies out there. So we actually look to find other companies and other small partners that we can start to look at, partner with, potentially invest in, potentially buy.

And so linking in with a big company like ourselves or with our customers to solve a problem means the ecosystem actually will thrive when you get cooperation amongst many different sized players. Just big guys alone or just small guys alone will have a harder time than if you can get an ecosystem working together where you can get a lot of metabolic energy out there, and then right answers will emerge that much more quickly.

MR. MADDALUNA: I'm going to make the comment from two points on this. First of all, Pfizer itself -- if you looked at Pfizer a few

years ago, you'd see big research centers. One in Sandwich, one in Groton, a few others around the world. It got so big that you know, it was too big. I mean, so the interaction you're talking about, wasn't happening.

We've almost gone to a completely different model more akin to small and medium manufacturers. So we learned from the small biotechs that it might be great to have 50 scientists. You put them in a building somewhere and let them go. You know? Or 25 scientists. You let them go. Not these big centers that have all the development and everything staged on each floor. And I'd say that the small and medium manufacturers probably are -- you know, they're just as innovative and have just as big a chance -- certainly in my involvement with NAM -- you know, you see them all.

It's been a big education for me; 12,000 members across you know, mostly small and medium manufacturers. And I sit and talk with the folks there, you know, when I go to the meetings, and I'm amazed by some of the things they're doing. They're advancing in metals, you know, and fields that I'm not involved in. But the model almost is better in the small, and I think the big companies are actually going towards the small and the collaborations.

So we have CTI. So, Center for Therapeutic Innovation all over the country. People are clamoring to get into these things, not

necessarily on a university base, but also you know, there's small segmented groups. I just think that I don't see a differentiation. I guess I see a learning from the standpoint of -- you know, from the small companies.

MR. WEST: There's a person back there.

MR. JORDAN: Hi. My name is Jim Jordan. I work in -- I've been in the Navy most of my life, but I've worked in manufacturing a lot. Are you guys having problems with paying a livable wage in the United States that sort of moves you to expand outside the United States? That's sort of interest to me. Both companies, I'd like to -- both of you to address it. Thank you.

MR. MADDALUNA: Want me to go? Okay. So what we're finding is that we operate globally, so all over the world. We tend to, even in different markets, our jobs are a little more high paying in some cases. But we look for the market and what's there. And I would say that global competition wages is starting to equalize. It doesn't seem to be the driving factor. So we do what we --

He mentioned plant network strategies. So you know, we've ended up, because mergers and acquisitions, having a hundred plants, going up, going down, going up, going down. We had 30,000 employees. Now we have 22,000. You know? We've done that a couple of times over

the last 10 years. And we look at -- you know, wages is certainly one of the factors. But it's never the determining factor as to where a factory should be. It's just not as big a piece of the pie. Our biggest piece probably is you know, where we locate is -- I guess having the skilled and educated workforce, certainly on the bio side, and you pay for that. But I don't know about you guys, but the wage is differentiation.

MR. ROEGNER: Yeah. I think first off, Jim, I'd like to say thank you for your service. A career in the Navy is something to be very proud of. Thank you for that.

As we look, and I think completely echoing your comments -- when we decide to open a facility outside of the United States, the two overriding reasons why we do that are number one, market access.

MR. MADDALUNA: Right.

MR. ROEGNER: I mean, we have the largest rolling mill in Russia making can stock, because that's where you need to be to sell the can stock to the Russians for their aluminum cans. That's why we put that plant there.

Number 2 is for an advantaged position in one of those inputs we talked about. But in our business, that tends to be low cost energy or a low cost materials source. We have box site mines in Australia as opposed to the U.S., because it's a really good box site, and

it's really low cost and it's very close to China. Who's going to use it? Or in energy. We're involved in the largest integrated aluminum complex on earth right now in Saudi Arabia because of the access to stranded natural gas which can drive power plants in the production of the aluminum. Labor is an element, but it's not been the driving reason why we've put a facility outside of the U.S., in my memory.

MR. JORDAN: Well, in your perspective -- can I just follow up with a question? Because you really are fascinating people. From your perspective, what do you think is the cause of our fairly high unemployment rate in most of the areas, including North Carolina where I'm from?

MR. MADDALUNA: Well I mean, it's probably not making enough stuff and having it to export. I mean, so it's demand for our products from the standpoint of -- okay, Pfizer -- pharmaceutical products are a little bit different. I mean, it's just one of these things -- you know, even if you don't have the money, it's kind of difficult not to get your pharmaceutical, and how it gets paid for and all of that is a different story.

But you know, I live in South Carolina part-time, too, so the issue about South Carolina and Boeing and everybody there -- I mean, it became demand. I mean, that Boeing plant was put there for a reason, and it basically was, all of the sudden, you know, I guess the 787, I think is

being assembled there. And there was demand and there was a need. So the basic need for products I think is -- and the basic demand and then the whole economy itself is what's driving the unemployment. It's related.

This other issue that compounds -- you know, people out of the workforce, and all of the sudden, you can't get them back in, nobody brought this up. But I know for a fact -- I won't mention the company, but it's a small boat company that makes nice fishing boats. And my wife spent an afternoon there with the owner of the company who had 25 year employees they had to lay off in 2008. They wanted to hire them back, and they said no, we're not coming back. We're making more unemployment.

MR. ROEGNER: Yeah.

MR. MADDALUNA: So why do I want to go to work?

MR. WEST: Okay. We have time for one last question, if we can make this a quick question, and then we'll move to our next panel.

SPEAKER: Focusing on American manufacturing, and considering the obstacles you identified to your continued growth and success, how does the immigration debate factor into those concerns?

MR. MADDALUNA: Well, I mean, it's important, I think because -- certainly on the educated side. People come to this country, get educated and then leave. So what are they doing? We're educating

our competitors. I mean, there are much -- this is my personal view, and I think it's also the view of the company, we train, educate, work with you know, people in this country. There's a brain power that you know, needs to stay here. And I think I'm very much in favor of it from that standpoint.

MR. ROEGNER: You know, I think I can answer your question and that question in the same way, and that is, we will be successful at manufacturing in North America when we are globally competitive. Which means we can make a product at a lower cost or that's more differentiated than the alternatives.

MR. MADDALUNA: At high quality, of course.

MR. ROEGNER: At very high quality, delivered on time, and then we will succeed. And when it comes to labor, you need to have skilled labor, whether it's advanced degrees, and you don't want them to go to work with our competitors, or out on the shop floor, wherever that is. And anything we can do to promote bringing skilled labor in to the workforce, we want to do. You know?

And then similarly, and I'm going to echo a comment that's over here, we can't answer unemployment in the United States. But what I can tell you is, if you want to have a globally competitive manufacturing capability, it needs to be more attractive for someone to want to actually work in that environment than to not work in that environment. And as

long as we maintain situations where it's more attractive to not work than work, people on average, won't work.

MR. MADDALUNA: I think one quick comment. This is very personal, but so, from a standpoint of automobiles. So I was in Germany, and I'm a big Audi fan. So I have some Audis and I went there and I saw some factories that are great. But I've got to tell you that tonight, when I go home, I'm trading in my mini, which is a BMW for a Ford. So, you'd say why am I doing that? Well, because the product got better. And the product is innovative and the product got better.

So the innovation -- that's going to drive demand in this economy, also. You know? And probably the Ford -- the parts are made all over, but I'm buying a Ford and not you know, a foreign car.

MR. WEST: That's progress right there.

(Laughter)

MR. WEST: So we're out of time on this session, but I want to thank Tony and Eric for sharing their views, and then we'll invite our next panelist to come up here.

(Applause)

MR. TANKERSLEY: Thank you all. Welcome to the second panel. We're going to have a lot of fun, and I have a great couple of folks. It's a very different panel than your last one. I like to think we're

(inaudible), which in my world is a really good thing, and that also we're going to be a little more analytical about the broad macro experience than just through the micro, which was fascinating. So, think of this as you're pulling back the camera.

My name's Jim Tankersley. I cover economics for the *Washington Post*, and with me are two really, really smart people. Marc Levinson the manager of Transportation and Analysis for the Congressional Research Service, which writes all sort of reports that are fantastically helpful in my job, and Asha Balakrishnan is a research staff member for the IDA Science and Technology Policy Institute.

We're just going to jump in right away. Our panel is taking about: Is Manufacturing the Key to Recapturing America's Edge? And we're going to think about that question in two ways: First off, broad economics competitiveness question, but also in terms of the edge for the American worker, those 12 million unemployed people we were talking about on the last panel and the overall workforce that is looking to get ahead in the years to come.

So, I want to start with Marc. Can we talk about that workforce manufacturing was for so long this great driver of American jobs and prosperity that hasn't as much been the case. We had a little bit of an uptick in the recovery, but we've had a bad few months of job losses again

in manufacturing. What's the state of play with jobs and the future of manufacturing?

MR. LEVINSON: Well, it's an important point, Jim. The interest that people have in manufacturing stems in part from the association of manufacturing unemployment, and most of us at a certain age remember the days when a large proportion of the workforce was employed in manufacturing.

It's just not that way now. The statistics -- and you probably know them -- we've seen since the trough of the recession roughly at 20 percent increase in U.S. industrial production, and that's gone hand-in-hand with a 2 percent increase in manufacturing employment. So, when you ask the question, "How's manufacturing doing?" the answer depends on whom you're thinking about.

There are a couple of things that I would point out that are important to recognize when you're talking about this subject. One is that U.S. manufacturing is now extremely capital intensive. That wasn't raised explicitly in the previous panel, but both of the gentlemen who were on the previous panel work in industries where you have a large amount of equipment and not a large number of people on the factory floor. And that's become the norm in this country.

Just to give you an example, although it varies from year to

year, the U.S. steel industry produces about as much now as it did in 1980 and 1981. The labor force has dropped by 75 percent since then. So, you just don't need the workers on the factory floor the way you once did, and the connection between manufacturing and employment is much weaker than it used to be.

A second thing that I'd point out is that much of the job loss we've experienced in manufacturing over the past couple of decades has been in industries that had pretty low productivity growth. Those are the industries that are essentially forced out by more open international markets, and those industries aren't coming back. Those are industries that tended to have pretty high employment, and we're not going to see those jobs again.

Again, an example: You don't have to go back too many decades and the apparel industry in this country employed 1.4 million people. They were running sewing machines in New York garment lofts and in Alabama cut-and-sew plants. We're down from 1.4 million people in this industry to about 140,000. Why? Well, because this is an industry that was and is extremely difficult to automate. There haven't been very effective ways to bring capital to bear in making shirts and trousers and things like that, so it's an industry that migrated to places where wages were low. And there are several industries like that. Shoes are another

example. Toy manufacturing is another example. Those industries used to employ a lot of Americans. They don't anymore, and we're not likely to see those jobs coming back.

The third thing that is affecting the employment that's really quite significant here is we've seen vertical disintegration in manufacturing as in many other industries. What that means is that we don't have everything now under one roof. Many of the manufacturing companies we have, including those that were represented here, have gotten rid of what used to be a lot of their businesses, and they specialize in what they think they're good at, and that certainly depresses the number of manufacturing workers. You do have people out there who are employed in other sectors of the economy be it transport or services or whatever whose jobs are related to manufacturing, and they don't show up in the manufacturing statistics.

So, those are the three points I'd make. I think the bottom line here is that ensuring prosperity and ensuring continued growth in manufacturing output doesn't by itself do much in terms of employment.

MR. TANKERSLEY: So, Asha, let's pull back a little further and just ask: Why is this important? If manufacturing isn't necessarily going to put 12 million people back to work, can you give us sort of an overview of where we are in the sector and what it's adding to the

economy in recapturing its edge?

MS. BALAKRISHNAN: Sure. So, one would say that while manufacturing jobs may be decreasing and we've seen that decline -- and, as Marc pointed out, one of the things I'd like to also add to that is sort of the vertical disintegration creates maybe an inaccuracy in some of the data and the way we capture employment statistics, because we're no longer capturing those people who are in the transport sector or the service sector as part of the manufacturing sector, but they're critical to keeping a vibrant manufacturing sector. So, that's kind of one of my points that I'd like to make, that I think we need to be perhaps thinking about it, and I think people are doing this, in updating some of the data series that policymakers use very frequently to make policy decisions for a more globalized economy, because we're using data and the way we capture from 30, 40, 50 years ago. But that's not the way manufacturing is happening today. It's very embedded with services.

I'd say, in addition to that, research and development goes hand in hand with manufacturing, and I think there were some statistics quoted in the last session where something like 70 percent of business R&D investment is by manufacturing companies. The BRDIS Survey, which NSF reports on, basically states that 22 percent of companies in manufacturing (inaudible) reported at least one product or process

innovation last year versus 8 percent of nonmanufacturing companies. So, innovation is happening at these manufacturing companies. What we do also understand and what we've seen and what we have stories about is that if we don't continue to invest in and do R&D in colocation with manufacturing, then we're not going to be able to get to that next innovation. And so one of the reasons that manufacturing has decreased is not only because things like parallel industries have moved offshore but also because, quite frankly, we've gotten better at doing automation, and we've been able to take our productivity levels much higher by automating things. But what's that's supposed to mean is that there's supposed to be a spillover benefit of coming up with the newest robotics technology and the newer technologies, and if we don't do that here anymore, we're not going to be able to kind of harness that capability.

MR. TANKERSLEY: is that circle completing right now? Are we seeing those spillovers that the theory would expect us to see?

MS. BALAKRISHNAN: I would say that manufacturing is still contributing quite a bit to the economy, I think. As an industry, for every dollar invested you have $1.35 that manufacturing sort of spills over into the economy. That might be fluctuating slightly, but I think it's still higher than any other industry.

So, I'm not sure the circle is completing. I think we still need

to do a lot more to invest in R&D. Manufacturing companies need to invest in R&D. And I think that colocation is very important for that next product to be invented.

One story that I'm stealing a little bit from Willie Shih in some of the work that they have done at Harvard is this story of Kodak where Kodak basically decided to kind of invest more in the film technology and kind of kept the consumer digital camera technology on the side. They had a product, and they had a technology that they were investing in, but when they started to see that this was something that could possibly take off, there were no longer the suppliers that did flat panel displays and microelectronics and the things that they needed to continue that business and to really build it up. So, it was a labor force issue as well as a supplier-based issue, and that had tended to move offshore. So, they actually had to move some of their product development offshore as well. And so when that happens, you're not able to ride that next wave of innovation.

MR. TANKERSLEY: (Inaudible) on that relationship, Marc?

MR. LEVINSON: Yes. This issue of colocation is an interesting story, and I guess the question to be asked, for which I've not seen a satisfactory answer, is whether it's true. The assertion here, for those of you who aren't familiar with this debate, is that if you don't have

the physical manufacturing, then the intellectual part of the exercise -- the R&D, if you will -- will go away, that these somehow need to be in proximity, and so you can't keep one without the other. That claim is made by a lot of people.

The evidence for it is hard to find. You can certainly find examples of companies that had difficulty because they didn't have the manufacturing in proximity to their R&D. Then, again, you can find plenty of U.S. companies that have done quite well, even though their R&D is in one place and they make things elsewhere or they don't even make things at all.

You've probably had this experience. You know, ask any 20-year-old to name a manufacturer, and that person will tell you "Apple." Right? Well, Apple owns one factory in the entire world, and it seems to have done okay in the innovation department despite the fact that it doesn't have a plant next to its research center or despite the fact that it doesn't actually own the plants that make its goods or employ the people who make its goods. So, I think we see a lot of mixed stories here. And whether there's actually strong evidence that you need this physical proximity between R&D and manufacturing, to me the case is kind of open on that. I'm not convinced either way.

MR. TANKERSLEY: So, one of the counters to that would

be a human capital answer, correct?, that if you have people who are engaged in manufacturing who are high-skilled people who are figuring out shop floor innovations, that that just provides a human capital spillover for the rest of the economy? Those are people who, even if that plant closes or they move on, can go and be innovators in other spheres?

MR. LEVINSON: Well, it's partially a human capital story. It's also a problem solving story, okay? I mean, the story essentially tends to be that you've got these people who invented some great product or process, but it doesn't exactly work as planned, and if the factory is next door they can run over and get those problems solved and have everything operating. And if the factory isn't next door, then it's quite complicated, and maybe their idea doesn't work out so well. That is essentially the argument here. And, again, you see evidence of it working both ways in the real world. So, the extent to which colocation is actually critical is not clear to me.

MR. TANKERSLEY: And does the idea of manufacturing being essential -- and either of you jump in on this -- to America's sort of continued competiveness? Does that depend on the answer to the colocation question, or are there other reasons why it might be?

MR. LEVINSON: Do you want to start with that?

MS. BALAKRISHNAN: Sorry, can you repeat the question?

MR. TANKERSLEY: Yeah. Is it just the idea that we need manufacturing because it helps with the R&D, and that colocation is so critical for competitiveness? Or are there other reasons why just making things is helpful to competitiveness?

MS. BALAKRISHNAN: I would say let's take the colocation issue to the side. I think one thing about that is that perhaps it's very anecdotal, but at the same time I do believe, and this may be as biased from my background -- I'm a mechanical engineer by training, and I think that in order to invent things you need to know how to make them and work with your hands and be able to actually do the work in order to come up with the next innovation. So, whether or not you're coming up with that next innovation here or somewhere else, I think that it's very important to know how to make things. So, yes, I think innovation does happen in knowing how to make things and knowing how to -- I think in the last session it was mentioned that we have a service economy that's been growing, but I do think it's on the heels of a manufacturing economy. And if you don't know how to create something and create a product and export something, your services are kind of tied to that.

MR. LEVINSON: Let me respond in a somewhat different way to your question. The way people think about the role of manufacturing and the economy has changed somewhat, I think, over

time. And this is because the nature of manufacturing has changed over time. You know, there aren't a lot of products anymore that are made in one place from start to finish. The manufacturing process now is really a process along what economists call value chain, where you have different parts of the process perhaps done in different places, perhaps done in different countries. It gets very difficult to quantify in terms of understanding the economic impact. So, you may have a product that was developed in a U.S. lab with input from R&D centers in Switzerland and Japan, and then pieces of the manufacturing will be farmed out, essentially. You'll have inputs from Japan and Korea and Mexico, and the product may be assembled in Vietnam or whatever, and it gets very hard to understand what an American product is in that sort of world. And so the way economists tend to think about this now is where the economic benefit comes is capturing as much of the value of that product, trying to have the value added domestically, which is not necessarily the same as what we think of as physical production. It's not necessarily where the product is stamped or where the metal is cut or whether the bolts are screwed into the nuts or whatever. And so the distinction between manufacturing and nonmanufacturing is somewhat blurred in this world, and the question of what is made where is very unclear.

MR. TANKERSLEY: All right, let's shift a little bit. I want to

talk about policy, because long ago and far away, by which I mean, like, three election cycles ago, I covered politics in Ohio, and starting then and basically in every election I've covered since, all you hear about from politicians who are trying to appeal to middle-class voters is manufacturing's important; we're not doing enough to support it; and we need to do a better job. So -- gosh, I want to sort of start with the question: Are we doing the right things from a federal policy level to support manufacturing? And if not, what should we be doing?

MS. BALAKRISHNAN: So, I'm going to go back to R&D a little bit. I think that, you know, there have been several reports written in several administrations over the past 10, 15 years about the increased funding needed for R&D. I would say that that is a role for the federal government to be able to invest in R&D. The other thing I would say is that it needs to be a long-term investment. One of the problems personally, I think, with the budget cycles is that it's year to year and federal agencies just don't know what they're going to get in the next year. So, they can't plan ahead of time, and R&D doesn't happen in one year. You don't reap the benefits of research in one year. You sometimes don't even reap it in 10 years. So, in having a long-term strategy for investment into R&D is very important, and that's the role of the federal government.

I also think -- echoing a little bit from the recent work by the

Advanced Manufacturing Partnership and PCAST on manufacturing -- that there needs to be both a strategy and a set of technologies and enabling technologies that the U.S. government decides to support and invest in. And one of the indicators of that that we see is investment-insured infrastructure. This is sort of the argument of market failure -- you know, the U.S. needs to be investing or the government can invest in places where the markets can't pick it up and share an infrastructure and facilities. And we talked about that a little bit earlier how these are very capital-intensive, very expensive facilities. So, that is a place where the government can step in, and we see that in, you know, a $1 billion dollar request for shared infrastructure with these manufacturing innovation institutes in particular subject areas -- additive manufacturing, lightweight materials -- some of these areas where there is a belief that the R&D can help support and enable new innovations and technology.

MR. LEVINSON: Well, you know, I work for Congress, so I don't want to be jumping on anybody's particular bandwagon here. I do want to make one comment, though, about many of these proposals to improve manufacturing that do concern me, and that is that they're often sold in the context of creating manufacturing jobs. And I'm not sure that this is necessarily realistic.

For example, we're hearing now a lot about additive

manufacturing. I think people are familiar with this concept. The government has supported a project to promote additive manufacturing based out in Youngstown, Ohio, I believe. This is the idea that essentially you're using printers to make materials from the bottom up rather than using machine tools to slice and drill materials from the top down. And this is a real interesting idea. It's an innovation that is going to have a lot of implications.

It's not clear to me, though, whether additive manufacturing creates jobs. It may well not. Additive manufacturing is certainly going to create jobs for the programmers, because the printers that make these products are driven by software and you'll have to design -- you'll have to write a program, essentially, for each product you wish to make. It may create some jobs for material scientists, because the machinery can use different types of materials to make different types of products, and there's probably going to be a lot of experimentation in terms of what is the best material to make a particular product with. And there may be some work there. But the machines themselves are going to be computer driven. So, you're not going to have a lot of folks down on the factory floor tending these 3-D manufacturing machines, which is effectively what they are.

That doesn't mean that this is a bad idea. It doesn't mean that there's anything at all wrong with additive manufacturing. But it may

not do what some people have claimed it would do in terms of creating jobs for factory workers.

MR. TANKERSLEY: Right, which gets us back to that sort of first question of, is there a future in that. I mean, is this an idea -- and I'd love it if you would jump in on this, too, Asha -- is this an idea that a certain type of job with certain levels of skills is going away and that what we really need to be doing is training more people for the R&D jobs?

MS. BALAKRISHNAN: What I would say to that is it's very clear that as the manufacturing floor and the factory floors that you heard in the last session -- it doesn't look the way we conceive of it to look. It's not dirty. It's not -- everybody's not just sitting there working with their hands. I think it's very computer intensive. I think it's very IT heavy. I think that the typical manufacturing worker is going to have to be more of a troubleshooter in terms of something breaking down in IT and computing than they are necessarily going to be, you know, hitting nails and screwing things -- screwing bolts together.

So, I think the conception of a worker is no longer the same as it used to be. I also think that automation is continuing to happen. Investment in robotics and automated factories and factories of the future don't necessarily tend to have more people on the factory floor. So, you're going to be having a lot more people doing IT-intensive work modeling a

simulation-type of work, and so I do think there's an upscaling that's happening, and there have been reports and discussions on the fact that people are going to have to have different skills to be working on sort of the factories of the future.

MR. TANKERSLEY: I want to open it up to audience questions in just a minute. But before I do that, I wanted to ask each of you: Help us look ahead here. What's the future look like for advanced manufacturing, for manufacturing employment, for all of these questions we're talking about again as it relates to American competitiveness?

MR. LEVINSON: I would say a couple of things here. One is that to a certain extent, the United States here is on the leading edge. We tend to lament a lot the decline of manufacturing in the United States. It's worth taking a look internationally, you know? If you go back over the period 1991 to 2011, the decline in manufacturing employment in the United States was right in line with the decline of manufacturing employment in Japan and in Germany, a bit less than in France or in England. So, we're not an outlier here in making this transformation from an economy that's driven by a lot of people on the factory floor to a very advanced, very high-tech sector. I think that U.S. manufacturers have done better than those in a number of countries in terms of moving away from simple mass production. Most of our companies now don't simply

specialize in making a lot of one thing. That business has pretty much moved off shore. Why? Because there's not an opportunity to bring to bear the strengths that the United States has in terms of R&D and innovation, and it's simply more economical to build a big plant that's going to stamp out a million of the same thing every month in some other place. So, I think that we're well along in this transformation of manufacturing.

Really, I think the policy question that I hear constantly in this is what does this do for low-skilled workers? Where are they left in this? And on that front I really can't be encouraging. There's really nothing going on in manufacturing that is going to offer jobs for high school dropouts or, for that matter, even high school graduates who don't go on for further education.

For those of you who don't keep track of anniversaries, this year is the hundredth anniversary of Henry Ford's first assembly line in Hyland Park, and the number of workers -- as best I can tell from the government's data -- the number of people who actually work on assembly lines at this point in time is just a little bit over a million, okay? It's pretty small. It's well under 1 percent of the workforce. So, this traditional job of what manufacturing workers do -- this is pretty much on its way out, and we're really headed into a very different world, which has created a lot of

opportunities for some people, but it's not a situation that's going to create a lot of opportunities for people who don't have training and an ability to learn a lot of skills.

MR. TANKERSLEY: Asha.

MS. BALAKRISHNAN: I'm going to sort of echo a little bit about what Marc said. I do think that the way we look into the future is going to look very different than in the past, and one of the things that I think is inherently linked is this idea of manufacturing in services. I also think that computationally enabled workers are going to be very important for the future as well whether they be in the service sector or in the manufacturing sector. What I would love to see is, as a data wonk, more data on this change, to be able to capture some of these changes, because using the current systems that we have just doesn't capture the flavor of how globalization is changing in the look of manufacturing.

I would also say that in the future in the U.S., it may actually be that there are certain enabling technologies that hopefully do stay here and hopefully do get innovated. I mean, we are very good at innovating, and the sky isn't falling probably as -- it's not as dark as everybody thinks it is, partially because of the data issue I would say. But the U.S. manufacturing sector is still very vibrant, and one of the areas that we haven't touched on is small- and medium-size manufacturers, and, you

know, of the manufacturing establishments, 84 percent of them are small- and medium-size businesses, which is, I think, defined by 500 workers or less, and they represent 51 percent of manufacturing employment, the 11 or 12 million that we have. And so they are very, very critical to seeing the wave of the future, and they are more agile. These companies are more agile in innovating and in doing more product innovation. It may not necessarily result in the more traditional employment of a manufacturing worker, but it will probably result in, hopefully, sustained jobs in both manufacturing and services related.

MR. TANKERSLEY: Awesome.

Okay, so, let's start. I guess we'll start in the back, the gentleman in blue, and we've got a lot of time for questions.

MR. LINDSEY: Don Lindsey, George Washington University.

We don't hear much about after-market services, certainly, that take place -- ongoing repairs, coming up with new solutions. How much innovation can they place in the after-market servicing, and is it being captured in the data?

MR. LEVINSON: I think that's a good point. I mean, this is what people in business tend to think of to a certain extent as the Gillette model, right? You give away the razors and then over the next years you

sell a lot of blades. And there's a lot of this going on. I mean, you've got many companies now that really get a very large proportion of their revenues not actually making the products but maintaining the products, providing replacement parts for the products and look at it as an annuity. If you can get the customer hooked on your product, you've got 10 or 20 years of revenues coming in the door.

The extent to which those are captured in the statistics is quite unclear. The manufacturing statistics, not to bore you with the details, are based on two different kinds of surveys. One is establishments, and whether the workers show up as manufacturing workers depends entirely on the location where they're housed. So, if the workers who are doing to the sort of service you're talking about have their office in a factory -- maybe it's upstairs above the factory floor -- they'll show up as manufacturing workers. If they have their office in an office park away from the factory floor, they won't show up as manufacturing workers.

The other source, obviously, is the household survey; and, again, you don't know exactly how these workers think of themselves. If they're going to a factory every day, even though their job isn't production, they may well tell the surveyor that they're manufacturing workers. If they're actually not in the trenches of making things every day, they may

say, no, I do service and repair; and they may not show up as manufacturing workers. And so it's really hard statistically to put those together.

MS. BALAKRISHNAN: All I would say is I haven't seen, necessarily, data that's able to capture this after-market services as of yet.

MR. TANKERSLEY: Okay, right up here in the front.

MR. MALLOY: My name is Pat Malloy. I'm a trade lawyer.

I'm not an economist, but my understanding is the formula for GDP consists of investment consumption, government procurement, and net exports -- meaning that net export is the difference between imports and exports -- and that when you run a deficit in net export, it detracts from your GDP and job growth in this country.

My further understanding is most of the United States' trade deficit, which is massive -- over $3 trillion over the last 20 years -- most of it is in manufactured goods. So, we're consuming manufactured goods in this country.

There's a demand. But we're not making them; we're importing them, and that further puts us in an international debt situation because we're sending dollars out of the country, which are future claims on the American economy. I think the Chinese purchase of Smithfield is just a sign of what may be coming with all of these dollars now outside the

country controlled by a government like China.

So, I just wanted to get your understanding: Isn't manufacturing very important to this country to have a strategy so that we're not running these huge, massive ongoing trade deficits in manufactured goods?

MR. LEVINSON: I'm not going to express a view on the desirability of a manufacturing strategy or not. That's really not something I'm comfortable doing. I would point out something, though, with respect to the manufacturing trade numbers, which have become increasingly problematic. The reason for that is that an increasing share of the value of manufactured goods is not in the physical production, the actual transformation that occurs by assembly or stamping or molding or whatever, but it's in the intellectual property, and this doesn't show up very well in the trade data. So, if you take a computer that's imported into the United States, this will show up as an import based on the value of the computer. But much of the intellectual content in that computer -- the designs for the computer, the designs for the chips, whatever -- may have been created in the United States and licensed by a U.S. company to somebody in one country who licensed it to somebody in another country. It may or not have been within the same corporation. And we have no track of that chain. So, we actually can't say how much of the value of

that computer consisted of intellectual property that was originally generated by Americans here in the United States. And that makes the trade data not necessarily very helpful in terms of understanding the current situation in manufacturing.

MR. MALLOY: Despite what you're saying there, is it the fact that when we run these trade deficits, the dollars are now outside of the United States and owned by people who can come back in and purchase assets in this country?

MR. LEVINSON: Well, that's how the theory -- the theory says that that's how it's supposed to work, so then they can use those dollars to buy services or goods that we make here. I mean, tourism, for example, is a big American service account (inaudible) export.

MR. MALLOY: That would be an export.

MR. LEVINSON: Yes, that counts as an export, right, so if someone from Germany buys -- if we buy a German product and that dollar goes to Germany and then Germans come in and vacation in Florida, that's an export.

Let me try to explain this in one other way. There's a lot of attention now to attempting to measure the value added in manufactured products, and on the international standard the United States stacks up pretty well. If you take a look at U.S. exports, the share of the value of

U.S. exports that was added in the United States is much greater than the same figure for most other countries. So, if you're looking at U.S. exports, you're looking at probably somewhere between 70 to 80 percent of the value of having been added in the United States. If you're looking at Chinese exports, you may be looking at 30 percent of the value having been added in China. So, that won't be revealed by the trade data, and I think you just need to consider that in terms of understanding the economic impacts here.

MR. TANKERSLEY: All right, next question? All the way in the back there.

MR. BOUIS: Hi, my name is Jay Bouis. I'm with the Community College of Baltimore County, about an hour north of here. I run the manufacturing programs for the community college. And I just had a question related to your comments on R&D investment as related to investments by the education community.

Many former schools have made investments over the years, and they've shrunk. Community colleges and universities need to make an argument for investment, and that argument has been, of recent, good wages, good opportunities while in the past it was more about numbers, and you've already touched on that. But kind of underlying all that is what you might call the multiplier effect, and I think you've sort of

touched on it a little bit. And my question is: Does the panel think that this is a valid argument for educational institutions arguing for more investment in manufacturing training and manufacturing education? Can it be a viable argument when we say if we train one worker, a highly skilled worker, that person is actually helping support another person in advertising R&D and other investments? I'd just like to get the panel's comments.

MR. TANKERSLEY: Asha, do you want to start with that?

MS. BALAKRISHNAN: Sure. I think that the $1 to $1.35 spillover isn't necessarily supporting one worker, and it's going to -- you know, it's more of an investment-of-dollar argument. I do think, though, that -- I'll be very honest. I still haven't found really great data to help me understand the discussion of we're losing -- we have so many people who are unemployed who have skills and are not able to find jobs and reports from a lot of different organizations saying that we need more highly skilled workers. There are 600,000 unfilled jobs right now. I understand that -- the only thing I can say about that is I do think it's not as black as white as saying we have all these people that can't find jobs and we need high skills. I think it's much more narrow than that in certain fields, in certain areas. We need welders to do this very high-tech type of welding, and we cannot find those types of welders. So, I think that it's really a supply-and-demand model, but it's not -- you can't just put a big

generalization around it and say -- because it just doesn't make sense to me, where, you know, we do have high unemployment, a lot of people are being laid off, and at the same time we hear from a lot of manufacturers that "we're not able to find good people." I don't know if that answers your question.

MR. LEVINSON: But let me toss out one other thing in that regard. I'm not an education specialist, but there's something that I find pretty interesting in the employment data in manufacturing. If you can think of two basic kinds of associates degrees, one is an occupational degree, which essentially gives you a certification, okay? You're now qualified to do this. The other is what's known as an academic associates degree, which, among other things, entitles you to go on to a four-year college if you want to. What's happened over the past decade is a very divergent trend in employment among these two groups in manufacturing. Even though they've shed millions of workers, manufacturers have actually increased employment of people with academic associate degrees, while they have sharply decreased employment of people with occupational associate degrees.

Now, you may know better than I what to make of this, but one of the things you might think about here is that you presume a more academic associate degree focuses not just on skills but on reasoning and

thinking abilities, problem-solving abilities, and that those are things valued by manufacturers, and so they are more interested in hiring those people than they are interested in hiring people who have simply learned a skill and gotten a certificate that says I know this skill.

MR. TANKERSLEY: All right, next question. We'll go -- right there in the blue and the glasses.

SPEAKER: My name is Mumdrow. I'm with the Program on America and the Global Economy with the Woodrow Wilson Center, and during this discussion (inaudible) to the panel discussion before.

My question would be how you would define a manufacturing job, because it seems like there's a very blurry line between what was talked about before and what you mentioned as the factories of the future, and that touches on the education issue as well and also the value-added problem of definition with exports and how that relates back to what value is actually added.

So, manufacturing -- to me it seems like -- and this discussion covers two things, the production stages and also the stage that comes right before the production stage. So, innovating and producing the product, which also leads to the difference between academic and occupational education: Where would you draw the line, and what would you think is the impact it has on future employment?

MS. BALAKRISHNAN: I would say that the manufacturing job -- the part that becomes before manufacturing, and there are sort of two different things. There's the hypothetical that we're talking about and then there's the way the statistics bear out, and what I've been sort of saying is that they're different and they're diverging.

In terms of the step before sort of the production for that R&D space, that's not captured in the manufacturing occupation necessarily, so when you're talking about product development, R&D -- those are all considered services I believe. So, that might address this one concern.

I think when I'm talking about IT and computing and some of these other types of fields that are starting to become more and more important on the manufacturing factory floor, that would probably -- I'm not exactly sure where that would be captured, to be quite honest with you. It just depends on how that company is surveyed and how they respond to their surveys with respect to the employment on the factory floor.

So, I do think that there is a little bit of a conundrum here where the data may not be really keeping up with how manufacturing is really conceived of.

MR. LEVINSON: I think that's true, but even of the people who work in manufacturing establishments, only 39 percent of them

actually have anything to do with production, okay? Sixty-one percent of the people who work in manufacturing establishments do management, sales, finance, research, service, maintenance, transport. They don't actually make things. So, there's an awful lot that goes on in the manufacturing sector that is not directly related to physical production.

MS. BALAKRISHNAN: Also on that point, when you look at a manufacturing establishment, you can only be in one place, either manufacturing or not. So, a company -- let's say IBM -- is perhaps listed as a manufacturing establishment, but 70 percent of what they do is software services. So, it's not very clear that they're actually doing manufacturing the way we're thinking about it. But many other software services could be going to support manufacturing and production.

MR. TANKERSLEY: All right, the gentleman right behind our last questioner.

MR. SHECKER: Thank you. Elio Shecker with REME. I'm an economic consultant.

The first thing I want to do is make a comment (inaudible) the people from the previous panel who are urging me to become a welder, because apparently I can make over a hundred thousand dollars, and the ones on this panel are saying something completely different.

Besides the point, as we're talking about fortifying

manufacturing competitiveness at a global scale, I want to know: How would you define "competitiveness"? What metric are you using for that in order to assess the current state of our competitiveness? And after that, define whether or not we should be making any specific policies to address that.

MS. BALAKRISHNAN: That's a big question.

MR. LEVINSON: For my part, I don't use the word "competitiveness," because I think it's got the precise fuzziness that you're referring to. It's not really a term that's filled with meaning, so it's one I avoid using.

I'll pass on the policy question.

MS. BALAKRISHNAN: I would say I'm going to kind of echo back to you what I've seen people do to define "competitiveness," and it's not just one thing. So, I think by saying the U.S. is losing its competitive edge, it also has a lot of danger in saying that, because there are places that the U.S. does quite well by certain indicators, and there are areas that it may -- other countries may be doing things and rising up. And it may not be that the U.S. following it; it just might be that other countries are now getting better, so relatively speaking we're not looking as good compared to --

So, things like tax trade policy -- those are things that people

cite as places where competitiveness and growth and innovation are important. Areas of workforce development and skills training, those are other areas that people say are important -- R&D investment, time to market, IP policies. So, there is a whole host of indicators that people look at to try to assess the health of the nation, in which the U.S. is not -- the sky isn't falling in all of those indicators.

With respect to your welding sort of point, I think everybody's going to go out and look into welding programs at this point. (Laughter) But I think that it's also -- it's, again, this narrow, high-skill area where there may be a demand in a certain type of welding, and that might be very true. And I've heard that from other people, not just people on the last panel. I've heard that specifically about welders. At the same time, that can't translate to every other skill out there. So, I do think that when we look at supply and demand, it needs to be in a very sort of narrow occupational field.

MR. TANKERSLEY: I would answer your competitiveness question, because I'm sort of a professional pessimistic in economics writing right now with two things that I think should concern everyone about America economically. The first is that our potential GDP growth is falling. Our percent of GDP is falling. The sort of amount of economic output we think is possible for us to have is going down, some of which is

for demographic reasons but some of which isn't, and is really starting to concern a lot of economists.

The second is that median incomes in this country have stagnated and have done so for a long time. The median household income in America today is basically where it was at the end of the '80s, if you adjust for inflation. And that's very counter to the experience of the decades before that.

Those are the two things that when I think about the kind of America that I want my kid to grow up in concern me and that I think concern a lot of the economists that I talk to.

We probably have time for one more question. So, let's see, let's try to get someone who hasn't asked anything so far. The gentleman just right here, in the beard -- or back there.

SPEAKER: Yeah, I need some help in trying to figure out where we're going on this. It's either very helpful or very horrible.

MR. TANKERSLEY: It can be both.

SPEAKER: And it could be both. We need -- I hear that we need a paradigm shift in terms of the meaning of work, the meaning of money, the meaning of intellectual property, and even the meaning of the social contract. Statistics can be made to do anything you want, and we talked in some of the panels about the miracle of what happened to Kodak

rediscovering itself. But Kodak went bankrupt last year.

MR. TANKERSLEY: Right.

SPEAKER: And it's a mere shadow of its former self. Well, they basically -- all of Rochester, New York -- and now they've got a few hundred employees. Apple -- the distortion field that Steve Jobs had worked miracles, but now they've lost half their market capitalization.

Now, China and India and Japan think they're in more trouble than we are, even though we're number 5 in number of educated scientists and technicians in the world who speak English. So, how do we take this and make it into a renaissance rather than the end of history? Any ideas on what that paradigm shift of the meaning of work, the meaning of money and all those other things needs to be in order to survive ourselves so we don't just be selling hamburgers to each to each other.

MR. TANKERSLEY: Anyone?

MS. BALAKRISHNAN: Everybody's looking at me. (Laughter)

SPEAKER: This is for the moderator who studied economics at the *Washington Post* I guess. (Laughter)

MR. TANKERSLEY: So, I'm going to give you the best possible answer, which is a cliff hanger, which is that I actually have a

series on that very question that's going to come out in the fall. (Laughter) So, stay tuned. That's true, by the way. I didn't just invent a series for myself. The editors believe me.

But thank you all for coming and for your great questions. Thanks to a wonderful panel. You were fantastic.

Now my friend and former colleague, Sophie, bring your panel on up.

MS. QUINTON: Hi, everyone, it's been such a pleasure to be here all day, listening to such great discussions, and hopefully, we have an even better panel lined up for you to round out the end of the day. I have to confess, this is my first time moderating here at Brookings, and I'm not sure if the Brookings folks here knew when they contacted me that they were asking someone with a British accent to moderate a panel on American manufacturing (laughter), especially not for the 4th of July, as well.

But I have been here for over a decade, I'm a dual citizen, and I've been writing about a lot of these topics at National Journal and also for the Atlantic for a few years now, so I do belong on this stage. So this is our final panel of the day, we're going to focus on workplace education and manufacturing, which is kind of an interesting subset of the bigger discussion we've been having all day

about workforce training and how we can make sure that workers have the skills they need to really thrive in the advanced manufacturing economy.

So, to start out, I'd like to turn directly to my right, to Mr. John Hazen White, he's President of Taco, Inc., which makes pumps, valves and also something else -- oh, it's automation control equipment for HVAC systems, which is a company based in Rhode Island, but they have facilities all across the country. And Taco, Inc., has kind of made an interesting move; while other manufactures during the recession really cut back on employee education and training programs, Taco made a big investment in employee training.

So, John, could you tell us a little bit more about the Taco Learning Centers and how you, why you decided to make this investment at this time?

MR. WHITE: Surely. Back -- it's a family owned business, it's in its third generation with the fourth present here, actually, and so it's always had a bit of a paternalistic kind of overview, if you will. So, back in the late '80s, we were about a $30 million company at that time, and we began to hit some very difficult economic times, the north east was in a terrible recession in the late '80s and early '90s, and Taco actually was teetering on some

significant problems.

So, at the same time, so we restructured the company, and, long story short, a part of that was that we had the choice, the business did pick up eventually, and we had the choice of retraining or replacing our workforce. Because so many companies at that point in time, particularly in Rhode Island, had just gone poof. You know, Brown & Sharpe was gone, that was a great manufacturer in this country, Cleveland Twist Drill left, some of these high-tech manufacturing machining companies left or were gone.

So we had the option of replacing our workforce or retraining our workforce, and my dad, who was alive and involved in the business at the time, and I had a chat about that, and the decision was to retrain. So we created what went on to become the Taco Learning Center, which at first was just focused on workplace, skill-related programs, blueprint reading, gauge reading, quality programs, English as a second language, and has gone on, over time, to offer something like 150 cataloged courses up through an MBA program, in all kinds of things; English classes, literature classes, painting classes, cooking classes, all kinds of wellness and personal improvement things, as well as job related.

But what we've gained from this, and what it's all about

is the fact that, at $30 million in 1991, we had 500 employees, now we're at about $225 million and we have 500 employees. So a lot of what we heard this morning is absolutely true, there's been a tremendous move towards productivity and process improvement to allow growth as opposed to adding people. People are a very expensive part of the business, the most expensive, so we have found that training and providing opportunity for people and their families to grow and prosper has allowed us to keep -- oh, and, by the way, those 500 people are virtually the same 500 people, our average tenure is half a -- turnover a half a percent and our average tenure is 19 years, and that's all, I think, from providing opportunity for people.

MS. QUINTON: Yeah, it's an interesting program, and one thing that I've been wondering, maybe Congressman, you can help me with this next question. So, the fellow sitting in the center of our panel is Congressman David Cicilline, he's a Democrat from Rhode Island, and he's been one of the loudest voices in the House Democratic Caucus for the House, the House Democrats' Make it in America agenda. So, I mean, when we're talking about the things that employers can do to really help retrain workers, keep workers where they need to be to be more productive, is there anything that the federal government can do to help employers or incentivize them to

make more of these investments, or is this sort of, more of a local issue, a case by case issue?

MR. CICILLINE: No, there absolutely is a role for a federal government. I want to say it's great to be on this panel with Johnny White, it is --

MR. WHITE: It is. You know what? Somebody told me I look like an Easter egg --

MR. CICILLINE: Who said that?

MR. WHITE: -- and, you, your boots match your tie (laughter).

MR. CICILLINE: Yes, right.

MR. WHITE: We're actually very good friends for a long time.

MR. CICILLINE: But I think the example that Johnny just described of the Taco Learning Centers is really, it's very compelling evidence about the importance of investing in the workforce. It's hard to separate the Taco family, the Taco family and John Hazen White's parents have incredibly, they're icons in Rhode Island, great philanthropists and were incredibly generous. So you listened to that story about the Taco Learning Center, and you think, well, it's an extension of the incredibly wonderful family, just a nice thing to do.

But it's actually a really smart business decision in addition to that, because what he described is a workforce that is being retrained and being provided additional training that are improving their productivity, that are staying there, I mean, half of one percent turnover, that is almost unheard of. The cost of turnover in a company is obviously one of the biggest costs as you're retraining, in the first months of work, you're not getting full capacity because they don't have the skills yet, so this is a really brilliant business model in addition to being an extension of kind of who this family is.

And I think the federal government has absolutely an important role in Workforce Development, first providing resources, and there's been an effort, unfortunately, in the Congress to reduce the role of the federal government in funding of Workforce Development, which I think is a mistake. There was a proposal made called the Skills Act that would consolidate 35 programs, which sound like a great idea, but would freeze funding for the next seven years, which would obviously mean a cut over time. So I think we have to recognize there's a responsibility for the federal government to invest in workforce training. I think we have to be sure that the workforce training programs are effective so that there's real conversations between employers and the programs, whatever, or the skills that you

actually need for the workforce that you were trying to prepare yourself for so if there's a match.

You would be shocked to learn how little conversation happens between the employers and the development of the workforce training programs. And I think the third piece of it is that we have to recognize, you know, the manufacturing jobs today are not your mother and father's manufacturing jobs. It used to be you could get a high school education, walk down to your local manufacturing and you could get a good paying job for above non manufacturing wages, and you provide for your family. Those, they are much more sophisticated, they almost all require some post-secondary education.

And I think the part that we really have to be prepared for, and this is where workforce training can make a real difference is, that the next generation that we're seeing right now of manufacturing jobs really include a big component of art and design. The manufacturing that we're seeing now is really growing out of innovation and design, and when you think about what's happening with 3-D printing, this event of turning stem into steam to be sure that it is fully infused with art and design, because that's the next generation of workers that we need, not just the technical, develop technical skills, but that have that creative, innovative thinking, and

Workforce is the place where we can make a difference and sort of position ourselves to lead the world in this way.

So I think the federal government has an important role. Now, the advantages, the funding should come from the federal government, but I think all the good proposals look for the development and execution of the plan at the local level. That's the way the Workforce model is designed, I think it's the right way; provide the resources, but let the local governments, local business community, local chambers of commerce help develop those programs so they'll be most effective.

MS. QUINTON: I want to talk a little bit more about changing education needs in a minute, but before we get there, I have a somewhat related question for Elizabeth Jacobs, who is at the end of our panel, here, she's a Fellow in Governance Studies here at Brookings, and while she's researched a number of topics, most recently, she's been focusing on ways to help American families access economic opportunity.

So, Elizabeth, I noticed that you had written quite recently about the problems that young people face in today's labor market, and I wanted to ask a little bit about the issue that young workers face when they're trying to get entry level jobs in

manufacturing. I mean, in this sector, as in a lot of sectors, young people who are fresh out of high school, fresh out of college are being asked to show work experience. But it's hard to get work experience if you can't get a job in the first place. I mean, do you think that what we really need to see is a bigger focus on apprenticeship programs that are more open to taking on people with less experience, or is that sort of a model that is poplar in Germany, maybe not always the best fit here in the States?

MS. JACOBS: It's a great question, and the new unemployment, while we're not quite at Spanish levels or Greek levels, we have a huge unemployment problem here in the States, we have a lot of young people, obviously, both college and high school graduates who are trying to make it in the labor market, and are finding doors shut in their face for exactly the reasons you talked about; people want work experience in a tight labor market, and if you have a college degree or a high school degree, you probably don't have much work experience. And if you do have work experience, it's likely to be in relatively low wage jobs, maybe you've worked at McDonald's, maybe you've done some babysitting, but you're not on your way to an upwardly mobile career.

So I think programs like apprenticeship programs can be

really meaningful, because then they put young people, it takes a specific kind of young person, and you have to be willing to have the soft skills, the communication skills to start with, and you need to be willing to work hard, to show up every day, to be part of a very structured program. That's obviously not for everyone, but for a lot of people, and many more people than what the current programs are able to serve. I think there's a lot of demand for that kind of thing, and it really could put young people on track to an upwardly mobile career where they have both skills that are specific to a company, but also, hopefully, more generally applicable to a broader field.

Ideally, a growing field that's growing in demand, a well structured program would be one that the local businesses that the Congressman was speaking about have really gotten together and figured out, you know, this is the area where we want to be building an apprenticeship program, because we're going to see demand in the future, it's not just going to be a job for tomorrow, it's going to be a job going forward. I would say also that I think there's, this has been going on for a while, but it doesn't seem to quite ever pick up the steam I'd like to see it get, is these career and technical academies.

So not just starting after high school is done, not just starting after a student is done, maybe a community college degree,

but starting before that, whether it's in middle school or high school, and really kind of, again, working with the local business community, local community organizations and figuring out where the growth areas, in terms of where the economy is going in this region, and then putting together an education system at a local level that kind of connects students to that industry from a much younger age. So it's not just as you graduate from high school knowing algebra, if you're lucky, but you graduate actually, you know, having started building relationships with local businesses, having potentially interned on a shop floor, you've really started your apprenticeship at age 12, 13, 14, 15.

Honestly, I think, in Washington, sometimes lots of us have college degrees, we have graduate degrees, we have beyond that, we kind of forget that not everyone in this country is going to go to law school, right. It may seem that way in Washington, but that's not the ultimate path, and I don't think it should be, because we need people who are skilled at making things, innovating around things like art and design, and are creative in different ways than what you learn in a classroom.

So rather than thinking about college for all, I think the administration is kind of shifting this conversation to a credential of

some sort for all, and that conversation can really start much earlier than we often begin it.

MS. QUINTON: Yeah. John, you were nodding a lot there, what are your thoughts on that same topic?

MR. WHITE: Regarding?

MS. QUINTON: Regarding helping young people, in particular.

MR. WHITE: Oh. You know, we do not have an apprenticeship program, per se, because it becomes quite a technical, difficult to manage, it's a real program. We do have internship programs in which we bring in young folks in the summers or during the year, because there's so much to be gained from youthful thinking and so much to be gained for youth to know that they have capability, you know. But we do not have -- I think it's -- the way the Germans do this is quite interesting. I mean, these kids are in these factories doing maybe nothing to do with what the company does for a long, long time, but learning to work with their hands to develop some skills, yeah. I'll leave it at that, because we're not involved in the apprenticeship program, per se.

MR. CICILLINE: I think there's some really, there's really some good evidence about the value of apprenticeship

programs, both in creating the relationships, but also in helping to expose young people to different opportunities and career paths. But I think it is also part of a larger problem that is that we've got to get away from this notion, I think we've done it as a country for the last decade or more, we sort of disparage manufacturing. We say, you know, manufacturing is dirty, someone else is going to do it, and we're going to be a service economy.

And if a child came up and said Mom, Dad, I'm going to be a manufacturer, the parent would recoil and think, what? And that's beginning to change, because we have to return to that moment in our country's history, I think, where making things was an honored profession, and recognizing that it's a really important part of our rebuilding our national economy. And understanding that, particularly with the advent of things like 3-D printing, it's really going to change the way we make stuff over the next several decades in this world, not just our country. And I think understanding that every single child is not, shouldn't be told unless you go to college, you're a failure.

I used to, when I was married, I'd go to visit schools, and they would ask, in third, fourth grade, guys, who's going to college, and everyone would raise their hand, the principal would make sure they did. And it was a terrible message, it was suggesting to those

kids that unless that were the path they had chosen, somehow they wouldn't have a fulfilling, gratifying full life, and that's not true. There are lots of wonderful professions, particularly in manufacturing, where people make a good living, by the way, above non manufacturing wages, generally, and have great pride in what they're making and producing and selling all over the world.

And we need to sort of understand that in the way we design our education system and create career paths and that career and technical academies have manufacturing tracks so people can learn the skills to become a successful manufacturer, and value it the way that it should be valued in our economy.

MS. QUINTON: John, I want to ask a follow up question about the Taco Learning Centers and the kind of challenges that you face in your business. I mean, it sounds like a lot of what you've been focusing on is retraining workers. I mean, what exactly does that mean at your company? Does that mean giving people more computer skills, does it mean paying for them to get an Associate's degree in a new field? I mean, what does that mean for you?

MR. WHITE: Yeah. In the beginning, you know, as I said, it was pretty much of a skill related kind of a program, so we were just trying to give people basic skills with which they could stay

with the company. We began to invest heavily in productivity and automation process, and we didn't have a workforce that was really equipped for a lot of what we were beginning to do, so the attempt at the time was to give them some basic skills so that they would stay with us. We basically, when we created the Learning Center, we said sort of, here's the deal, we'll provide the facility and the resource for you to learn and grow, but you have to do it, it's up to you.

And we had, like, a 98 percent enrollment rate immediately, and that's remained consistent. But here's what I learned over time; people are the greatest asset a company like mine has. Not machinery, not equipment, not robotics; it's people. Because, when I buy a piece of equipment, no matter how sophisticated, it's obsolete immediately to something better. But there's one asset I have which is never, ever obsolete, and it's my people. And if we provide them -- so, at this point in time, the Learning Center is much broader in scope than job related programs, it involves summer camps for employee's children, it involves, as I said, wellness programs, gardening, painting, literature, whatever the people want.

Because not only is it, I think, a social responsibility, but it's a darn good idea to give people the chance to grow and develop.

It's very simple. It's expensive, and that's what scares people, but, boy, the return -- and I have never, ever, ever, in the 20 years we've had this program, have allowed a financial justification or analysis to be done on the Learning Center, because I just always thought when we do that, we cheapen it somehow. So I don't know what the return is, but it's pretty darn good.

MS. QUINTON: Yeah. Do you think it's easier for you to make this kind of investment that you're not really qualifying in dollars and cents as a family owned business, as opposed to a big global company that has to, every quarter, justify what they're doing to shareholders?

MR. CICILLINE: I had a debate with a guy once when I was giving a talk at a big convention, and it was three or four hundred people in this thing, and I was talking about the Learning Center, and this guy, in the end, said, he got quite aggressive with me. He was from a public company, and he said, you can't justify this. I said, I don't have to justify it, it's my company. (Laughter) So, at any rate, well, he actually made a point about it, though. I mean, public companies, you can't really put a definitive return, and they have stockholders that they're accountable to.

I think I would take that bet even if I was a public company,

because it's the right thing to do, and I think you could make a case for that, too. But I think it scares a lot of people. I also have seen companies with great programs, a company right down the street from us was, at one time, Rhode Island's greatest company, a manufacturing company similar to ours, who was sold, the owner died and the company was sold to a Wall Street group, a New York group. And the first thing they did was to close the learning facility, the second thing they did was to close the cafeteria, and the third thing they did was to file for bankruptcy.

I mean, I don't know what happened, it was the strangest thing I ever saw, we went this way, they went that way. And they were a company that we always aspired to be like, it was a very sad thing.

MS. QUINTON: It seems like what we're talking about, here, what we've really been talking about all day is changing human capital needs, and a new level of human capital investment required for the jobs that are still here in the United States, particularly jobs that are well paying. I mean, I want to talk about the employer role, here, and the sort of workplace role, but it seems like this is a much bigger challenge than one company can take on.

I mean, you might be able to train a high school graduate to be

a welder in your company, but trying to train them to write complicated software might be a little bit more of a challenge and a bigger investment. I mean, for the whole panel, do we need to really rethink the way we think about vocational training in the first place? I mean are we training for vocations that are no longer there?

MS. JACOBS: Well, I think two things, going back to something the Congressman was talking about earlier, that the manufacturing institute has, I can't remember, I don't know if they have a branding name for it yet, but I've heard Jennifer McNally, who is their president, talk about this rebranding of manufacturing for exactly the reasons we were talking about before, that people think about manufacturing as dirty, they think about it as old, and that that's really outdated, that it's actually, manufacturing is, it can be very sexy.

I mean, it really is about innovation and design and kind of all of the things that we think about the new economy being, is the future of manufacturing. But there's really a disconnect in terms of how the broader public thinks about it, and so I think that kind of gets at your question, because I think it is an issue of kind of a culture shift, and how do you make that happen? It can't just be, I mean, part of it is one company at a time, but that's not enough, there needs to be kind of a broader push behind it.

And I think one of the challenges to making that happen in the U.S. is that, unlike somewhere like Germany where you have a really tight relationship between business, unions and government that kind of come together and form real intermediaries and can be effective at kind of pushing cultural changes, and making policies with broad social impacts happen even when they might not necessarily benefit every single company or every single stake holder, they can kind of create this umbrella and build consensus. We don't have that in the same way in the States, the organization of businesses and the way that business operates in the States is very different from the way that some of our global competitors who have done better on this front have operated.

And so trying to figure out, I would argue trying to figure out policies that are kind of moving us in that direction is one way to think about things, as opposed to just, you know, putting funding into secretarial training programs, or putting funding into apprenticeships to always kind of have the eye on this bigger mission of trying to really have the federal government be at the forefront of generating this kind of intermediary role. And that can probably sound maybe a little bit wonky and high level, but I really do think, in terms of pushing the conversation forward and moving policy in the direction that I think

everyone on this panel would like to see it go, that that's a big part of what needs to happen.

MR. WHITE: And that was, to a point that was made on an earlier panel, that was the sort of force behind the creation of a national manufacturing strategy, to actually serve that convening role to bring in all the stakeholders and actually develop for our country is strategy and then a plan to do it. Because I think you're right, it doesn't exist sort of naturally, and so I think this idea of having a national manufacturing strategy is a really important part of it, which, includes, of course, the workforce training component.

MS. QUINTON: Yeah. Another thing that didn't really get discussed too much in earlier panels, though it did come up that's sort of interesting to me is the interplay of things like immigration reform in these bigger discussions around workforce training. I mean, you mentioned, John, one of the things you offer is English as a second language, which is probably something that more and more manufacturers are finding, you know, that they need to invest in as the workforce becomes more diverse and demographics change.

I mean, do you have any thoughts on that, on how, you know, if there are new challenges to training and bringing in a more diverse workforce?

MR. WHITE: Our workforce is, in the factory, anyway, is heavily immigrant populated. I would say, largely, well -- boy, at our employee banquet every year, it's like the United Nations kind of thing, it's the most wonderful thing in the world, but it's heavily southeast Asian, among others, but we do have a heavy -- so offering the English as a second language, actually, three or four levels of that, it's been important just to be able, going back a long time, to be able to, just basic communications. Not only skill related things, but basic policy communications, so, yeah, I just -- and I think with immigration reform, it's a lot more important.

MS. QUINTON: Do either of you two have any thoughts on that?

MR. CICILLINE: I think it's very important, we've heard very loudly from the business community and the immigration debate, which is really important, we heard a great CVO report just a week ago about the impact of immigration reform on our economy, how it will help us reduce the deficit and grow the economy, which I think everyone sort of instinctively knew but put some numbers to it. But I think, when we look at how do we, what are the kind of national policies that can support manufacturing, we have an immigration policy we need to fix, we need to really look in a serious way at K-12

education.

We used to lead the world in outcomes in K-12 education, that's no longer the case, and we really sort of workforce training begins in K-12, and so we have to really understand the urgent challenges there. And I think we also have to be willing to really invest in things like the manufacturing institutes and the Make It In America manufacturing, which is my bill, but really affirmatively invest in the creation of regional manufacturing strategies and fund them.

We have a culture in Washington where, right now, people are saying, A, we don't want to spend money, and B, we don't want to spend money sort of picking winners and losers. You hear this argument all the time. Well, the truth is, we do that all the time in the tax code, we pick lots of industries that we invest in. And this is a moment, frankly, where we should be really investing in manufacturing, wages are rising in Asia, costs of energy is still quite high, so transporting goods is high, there's some things happening that give us a unique moment in the next decade or so that, if we do the right things, change some policies here in Washington and make some important investments, I think we can really grow advanced manufacturing, in particular, for our country.

And this notion that the government shouldn't be doing

that is part of what we're fighting against in Washington, spending money or just playing a role in this area at all. And I think the case is very compelling that it will be an impactful time to do it, but it's been hard to get people to embrace this because of this sort of idea that we're picking winners and losers, or we don't have any money to spend on anything, which, of course, is not true.

MS. QUINTON: Before we go to audience Q&A, I'd like to ask you, and anyone can chime in on this, a question that I always like to ask when I interview, which is; is there anything that we should have talked about, either on this panel or today that has really stuck out to you as sort of a salient point, or maybe something that's a little surprising that doesn't get enough attention? Or have we pretty much covered all bases and we can open it to the audience?

MS. JACOBS: I would say, I mean, I worked on the Hill before I came to Brookings, and I was surprised, after conversation after conversation after conversation focusing on the economic crisis, particularly labor market issues, which was my portfolio, and Workforce Development didn't come up once. Which, I came to Brookings with sort of, on the top of my list of questions I had that, now that I was kind of back with a research hat on, as opposed to doing more specifically policy oriented work, the question of why, and

this time where you think that it would be on the table to really be kind of doubling down on, Workforce Development, because the economy is slowing down, you have a lot of people who are out of work, Workforce Development kind of seems like a win-win.

You can both keep people busy, keep people engaged with the labor market, potentially give them a little bit of money to keep them afloat, and then when the economy picks up again, have people really rearing to go, if not kind of speeding things up, and have the pace pick up even faster than it had been before the slow down. But it just wasn't on the table, and I don't think I have an answer to that question yet, which is why I still have plenty of work to do, but I think it's worth raising.

I mean, the Workforce Investment Act, which is the major federal vehicle for funding workforce development programs at the federal level, haven't been reauthorized for years. I mean, we rejiggered the way we did workforce investment under President Clinton, and then things kind of languished, and arguably, there's another round of rejiggering worth doing, but the conversation, for a variety of reasons that I'm sure the gentleman to my left could probably, off the record, divulge far more on than he'll be willing to divulge from a panel.

But, I mean, there are reasons for that, but I don't think the reasons are good enough for the conversation to be as stalled as it seems to have been. So I would just kind of flag that, that, instead, we've gotten sidetracked by this sort of obsession over the deficit, the likelihood that workforce development programs are going to have any more funding than they have now seems pretty slim when things, you would think, would really arguably should be going in exactly the opposite direction.

Funding is at the lowest level it's been in decades at exactly the time that you'd like to see it bumped up, if not on the rise, giving everything that anyone with their heads screwed on straight kind of understands about the direction the economy is going.

MR. CICILLINE: There's the problem.

MS. JACOBS: Yeah. So I would just sort of put all those things out there, because I think it would be a shame to let this panel go without getting that on the table.

MS. QUINTON: Do you have any thoughts?

MR. CICILLINE: Yeah, I think that's exactly right, and I think it's partly fuelled by this inability to distinguish spending and investment and sort of this notion that all government spending is exactly the same, and all of it is essentially bad. And I think that's part

of the challenge, all spending is not the same, and some investments that we make will lead to job generation and the growth of our economy and some won't, and this sort of inability to distinguish one from the other, I think, is one of the great challenges we face in Congress, is that there are a cohort of folks who just look at all government spending, and have this unnatural obsession with cutting spending, even at the expense of the growth of our economy, or the growth of jobs, or helping to reinvigorate manufacturing, and sort of making the case that, no, actually, there are different kinds of spending that will have different impacts, and this is one of those areas where we should be able the reach consensus that this is an investment that will lead to job growth and really is key, I think, to rebuilding our manufacturing economy.

MS. JACOBS: I would add to that, too, that a very traditional and arguably conservative way to think about the role of government in intervening economies is thinking about is there a market failure, and if so, what can the federal government or public spending, whether it's federal or otherwise, do to fix that? And I think the workforce development field is one where it's pretty easy to think about a whole bunch of market failures.

Not every company recognizes that, if they invest in

employees, they're going to retain those employees. Because the likelihood that you train an employee, and then somebody else sees that you've invested all this money in training this employee, and they poach that employee and take the person that you just spent all of these company resources on, they're gone, you've arguably wasted that money. That's kind of a classic market failure, where having public spending sort of cut back the cost for a private employer doing some of that training, because it's a public good what you're doing in training that employee. They become, you know, public good in the sense that they're good for any company out there that's going to hire them, they're creating value for the economy.

So, I mean, there are a bunch more kind of technical market failures that I could get into, but I think that kind of language, in terms of convincing people who aren't convinced right off the bat of the futility of public spending and the role for public spending on workforce development that the market failure frame is one that works pretty well in this space.

MS. QUINTON: I mean, I think the distinction between spending and investment is particularly pertinent when it comes to things like education and human capital, because, you know, if you see your workforces as cost, it's very easy to lay someone off and see

your costs go down. That's great, we've lowered our costs. But if you're investing in someone, it's kind of hard to quantify how that investment is going to pay off for you, the numbers are particularly fuzzy.

It's one of my quests as a reporter to find better numbers on that, so I can better understand it myself.

MR. CICILLINE: Can I just give you an example of how serious the problem is in Congress on that example? When we had our orientation for new members of Congress, the last panel was on education, and it was a great panel, and they showed us the final slides of where America was in K-12 education, and we led the 30 industrialized countries historically, we were always like at the top on seven indicators, and now we're near the bottom.

So this slide sort of was, in my mind, a call to action about how we need to invest and reform and do the right things by our system of public education. Well, the first hand went up from one of my colleagues from that famous Tea Party Caucus, and he said, can you tell us where in the Constitution the right to the Federal Department of Education to exist is reflected. And so that's the first place they went in the conversation about the urgent critical needs of fixing our education system, and that's what we're up against in large part, is not

just a basic disagreement about what is the role of government.

And so it's -- I'm asking you to feel bad for me, but it's tough, I say.

MS. QUINTON: And on that note, I think we're ready to do some audience Q&A, the gentleman in the pink shirt at the back.

MR. KENNEDY: Hi. Joe Kennedy, I'm an economic and legal consultant. And my impression, well, first, in order for something to be an investment, it has to produce a rate of return, not just cost money. And my impression of the literature on worker training is that government programs are not terribly effective and they haven't been terribly effective for several decades, and I can remember having similar conversations about the need to invest in worker training 20 years ago.

So I'd like to ask the panel, one, do you agree, sort of, with that assessment of the federal programs, and how can we make them better if we've been trying for the last two decades, and haven't really had a lot of success in improving performance? Thank you.

MR. CICILLINE: I don't agree with that assessment, I actually have seen many, many examples of people who have participated in good workforce training programs develop skills and then have been able to either secure or improve their job situation. So

I think there are lots and lots of good examples, I think it's a system that would benefit from reform. I think the most important thing is there needs to be a lot better coordination between the conversations between what employers need and what skills are being developed. And I think in the most successful programs there is close coordination for what the market is demanding, not just in that moment, but for the next five and ten years, and a lot more development and design of the programs by the private sector.

And so I think engaging the private sector, and what does the workforce training program look like, who provides it. I mean, I think the least successful programs are often ones that are actually administered by local and state governments -- actually run, but instead are administered but run by private industry who actually know the function or know the skill or know the talent, really good examples of what works successfully. But I think our country is filled with people who are gone through job training programs, workforce training programs have developed a skill and gotten a job because of it.

And I think what you described as sort of the general opposition we get all the time, oh, workforce training has been a failure. I don't think that's true. I think there's lots of improvement that needs to be made, and a lot better coordination, but I think reducing

the role of the federal government and providing resources for worker's training is not the answer, I think it's actually we need to be going in the opposite direction, it needs to be really effective, really accountable. But when I talk to employers, one of the things they say is, yeah, I could add positions, but I can't afford the training that's going to go with that new employee, that's an outlay of money that I have to write a check for, it's what prevents me, if I could get that training, I'd hire the employee.

I hear that a lot, and I think it's real, and I think there's a reason a lot of employers participate in it, because they find the training that's provided to be effective. That's not to say there's not improvement, but I think what you're saying is, the argument that is made against or for reducing substantially the federal investment and workforce training, and I think that's not an effective strategy.

MS. JACOBS: I would add to that, too, that I think a couple things. First of all, looking at which metric the evaluations are actually evaluating and if those match with what the program's aims were, I would put that as sort of number one, in terms of understanding whether it's an evaluation that sort of makes sense to take at face value, as far as deciding whether it should inform policy or not. And, number two, I think the time line that evaluations can

operate on versus the time line that some of these job training programs operate on, particularly good ones, it's often a very short kind of turnaround thing, and not looking at somebody's longer term career trajectory. So you don't necessarily, and this is a subset of the metric issue, you don't necessarily get, you're not evaluating what the program is for, you're kind of evaluating on a different time line.

And the third thing I would add, I think, and I may be wrong on this, but I think that the evaluations, the programs that have been the most successful are very expensive, and we just don't have that many programs that are funded up to the level to what the programs need to do to really be good, effective programs. I mean, a good effective program, particularly if you're talking about youth labor market entry, a lot of the people who aren't kind of easily transitioning into the labor market, have transportation issues, they have housing issues, they have child care issues, they have a whole life outside of just showing up to figure out how to do the job that might be their job eventually.

And they're really, again, because of this kind of culture of cutting, cutting, cutting, there aren't that many programs that provide those wrap around services in addition to the intensive job training piece. So whether we're evaluating the kinds of programs that

I think anyone who's really pushing reform and job training would like to see, you're not necessarily comparing apples to apples and looking at the big picture from the literature.

MS. QUINTON: Another question? The lady over there in black, directly in my line of vision.

MS. CERRETANI: Thank you. Alicia Cerretani with EIR Magazine. I wanted to raise something that I haven't yet heard be part of the discussion. I might have missed it in the second panel. But I don't think it's a coincidence that the net decline in American manufacturing has happened at the same time we've had a sharp increase in the financial services industry. And, if you take the 20th century of America, I think that, I would make the case that the two are opposed to one another, that often times, the financial services' speculative activity happens at the expense of long term investments. They're really two different kinds of making money, one is real wealth, and one's just money.

And, right now, we have a lot of money, but we don't have a lot of wealth, and that's why I think that they are diametrically opposed. And everyone knows the story, after the great depression, one of the first things that Roosevelt did, he got a Sicilian attorney, Ferdinand Pecora, brought JP Morgan to court and basically put on

the table all the ties that Wall Street had to Congress and these institutions that Roosevelt was trying to move for recovery. Then he passed Glass-Steagall, which is a bill in the House of Representatives, I think, is a cosponsor on there, there are 70 cosponsors. There's now a bill in the Senate.

My question is, do you really think that we can have a renaissance in manufacturing, with all of the implications, if the federal government does not exert its sovereignty over international finance bypassing Glass-Steagall, and then re -- what would be the right word -- reprioritizing where billions of dollars of money are going to be spent, i.e., in manufacturing, not in keeping bankrupt banks simply afloat? Do you really think that we can have manufacturing sector if -- just because Mr. White raised it, I thought that outlook was really important. I think, at the end of the day, the American people, regardless of what party you are, don't get a sense that the federal government thinks that the people are the most important resource of a nation, that they still think, oh, we have to deal with Wall Street, they do make money, they tell us if we pass Glass-Steagall, we're going to wreck the whole economy, even though they wrecked the whole economy.

So, at the end of the day, the federal government needs

to assert its power, not in a regulatory burden some way, but a power over super national finance. That's my question.

MS. QUINTON: I'm not sure how it connected the world of manufacturing and the world of financial services, maybe our panelists have some more thoughts on that. But I do think that question ties into sort of a bigger picture that is quite important, which is that we're seeing a lot of productivity gains in the economy today going into capital and into the stock market rather than into people and into labor. It's great for GDP, it might not be that great for the average person who is living on an income.

So, yeah, that's sort of my thought on that question. What do you all think?

MR. CICILLINE: I think you're right, I think part of the challenge is, we should be trying to figure out ways, for example, in our tax code, we reward the gains that are made in the kinds of financial services that you're describing. We treat them more generously in our tax code than someone who grows a manufacturing facility and realized a gain. That's an odd notion. I mean, imagine if we flipped it and we actually gave a tax advantage for someone who's building a manufacturing facility and give a less favorable tax treatment for people who are leveraging hedge funds.

I mean, we do just the opposite. So is it a big surprise that the part of the economy that's growing is the place that you have the capital markets and the hedge funds, and the part that's shrinking is the man -- I mean, that's part, that's just one example. So I think you're right, we need to be thinking about the way we use public policy to promote the actual activity we want to promote, which is long term growth of things like manufacturing.

MR. WHITE: Yes, it's really an interesting point you bring up, the connection between these two things. Because, from my perspective, leaving the government and everything else out of it, just looking back, and this came up a little earlier, I think in this panel, actually, about the need for higher income quickly, okay. You know, a lot of the move towards the financial services and some of the different businesses other than manufacturing comes from, I think, the fact that, going back in history, certainly before my time, our parents, a lot of our parents had very difficult lives.

They had hard jobs, manual jobs, particularly those coming out of the depression and whatnot, and so I think there was a long period of time in which everybody's desire was to have their kids do better, right? Therefore, the whole notion of going on to college being an expectation of a real desire on behalf of the parents. Now

it's almost an entitlement from the current generation. But, therein, it became a disconnect because there became bills, there became debt associated with it, so maybe the thought of stepping into a manufacturing job wasn't quick enough pay or a just return for the time spent being educated.

So I think finances have had something to do with pushing people out of manufacturing. Just, that's a very, sort of, ground level approach to that question, but I think it's a really interesting point.

MS. QUINTON: Do you have a thought, Elizabeth?

MS. JACOBS: I would just reiterate a point that Mr. White made earlier about the difference between a family owned company and a multinational corporation. A family owned company can really base things on the people and what the right thing to do is, and arguably, a multinational corporation should be able to do that, but because they're responsible first to shareholders. And because of the way that's evolved in recent times, in terms of meeting your responsibility to shareholders means turning over a profit quickly, there's not that much incentive in that structure to really invest in something that reaps long term returns like training.

So I think, and this is kind of an indirect way of getting at

your question, I'm going dodge the actual, you know, sovereignty over the banks question. But, more broadly, I do think, in the same way that we've talked about the need for kind of a cultural shift in the way we think about education and manufacturing and career and technical training, that there's the same need for a shift in terms of corporate responsibility and what it means to do business in the U.S. whether you're a family owned company or a multinational. I think that we're really, we're seeing what happens when multinationals operate, and the way they've operated, it doesn't work forever, things can kind of fall apart and you have to figure out where to pick up the pieces and start over.

And I'd like to think that, maybe, there's some space for kind of a shift in the corporate responsibility debate, as well.

MS. QUINTON: I think that is a shift that is taking place. I mean, the gentleman who, up here at the beginning of the day, had a lot to say about the importance of training and investing in folks. So that's something to keep in mind, as well. The gentleman with the mustache.

MR. WHITE: That's half the room.

MS. QUINTON: I know, I can't -- I'm trying to get people from all over.

MR. STRATTON: Thank you. I'm Myron Stratton with the National Academies. I wanted to ask what you think should be the government role in stimulating innovation in manufacturing, and have we moved beyond market failures as the rationale or reason for government intervention, and how would you implement that role, how would you make it operational?

MR. CICILLINE: We're actually, in the House Democratic Caucus, we're working on an innovation agenda right now, but I do think the President has put forth a very interesting proposal in the manufacturing space to create regional organizations to sort of compete for investments to spur innovation and manufacturing. I think there are lots of places the government does it, and I think it's appropriate. It not only has value for manufacturing and a growing economy, it also has value for insuring that we position the United States to be a leader in innovation in the world.

And we use our tax code and the adoption of a budget as a set of priorities, a set of important values that we have, a set of important investments we make, and I think anyone who's looked at this thoughtfully recognized that innovation and being sure that we are investing as a nation in innovation and spurring entrepreneurship and innovation is a key part of making sure we remain competitive as a

world economy. So I think it's absolutely something we should continue to do, and we should grow our investment in it.

MS. JACOBS: I know this is a place where the immigration debate matters a lot, I mean, it was stand alone and it's been folded into the conversation this idea that if you come to the United States from another country and you get a PhD from an American university, we should let you stay. I mean, the number of Silicon Valley innovators who are immigrants is astounding.

And so, from an innovation perspective, I think that's another piece where the government really, through regulation, can do a lot to do much better than we're doing now, rather than kind of kicking out some of the potential brightest lights for the economy people who are creating not only incredible value on a global level, but also creating jobs on a local level. We can keep those people here and let them build what they're going to build in the U.S. as opposed to sending them back.

MR. WHITE: Can I add one thing to that? A little off, maybe not right down to your point, but I still believe, firmly believe that America is the greatest innovative society in the world. And I say that, not necessarily from a factual data standpoint, I say that as a very proud American. And I think what our government was intended

for was to help support this country. And so I think their support in the area of innovation, because innovation is expensive, and it's difficult.

I mean, those guys this morning, my gosh, what he was talking about -- you missed that -- but the billions that they drop on failures in the drug business, the legitimate drug business, is incredible (laughter). So I think that the, not everybody can do that, and so I think the support that our government can give to innovation and technology and development, and to market, you know, activities is really important, somehow. But it has to be monitored and not scandalized. I can remember, and, I'm sorry, I'm way off track now, but it's my show, right? (Laughter) No, I'm kidding, that was a very arrogant kind --

MS. QUINTON: John is a trustee here.

MR. WHITE: Sorry about that. He's responsible for me. But I remember my first job when I got out of college was in the Bay area in California, I lived in the east Bay, and those were the boom times of solar, and we were in the pump business, so we were selling pumps and controls and things to the solar business. Well, there was a huge tax credit benefits to putting in solar, so people were getting a solar system for $16,000, it was really worth about $3,000, and they got a pool with it, or they got a satellite TV or something.

It was, every scam in the book was run on that, and Reagan squished that when he came into office, which was the right thing to do. But, so you have to control these things, but I think it's a really, there's some benefit to be had. Sorry.

MS. QUINTON: Oh, no, go for it. I think we have time for one or two more questions. The gentleman in the black jacket.

MR. MALLOY: Yeah. Pat Malloy, I was formerly a General Counsel at the Senate Banking Committee, so I think you're on to something very important when you're talking about the broader corporate governance issue. You know, 30 years ago, we had the stakeholder theory of capitalism; that the corporation was responsible for its employees, its community, its shareholders and others. And then we morphed into their shareholder value-only theory of corporate governance that other countries could incentivize through under priced currency subsidies for the outsourcing of American production and the increase in the trade deficit; it's all related.

So I was struck by Mr. White talking between his private company employing people and investing in them, and the public company closing up shop and firing people. So I think, and Ms. Jacobs has talked about this as a broader issue, and the Congressman has talked about a national manufacturing strategy, you

can't deal with your trade deficit without dealing with this broader issue, so I think this panel has been terrific in putting those points together.

MS. QUINTON: Great. Well, thank you, sir, for the statement. That's great, because it gives us time for more questions. The gentleman in the blue shirt in the back.

MR. ROBINSON: Hi, I'm Ben Robinson, I'm an intern at the Metropolitan Policy Program here at Brookings, and we've been doing some work on advanced manufacturing, as well. And something that we've been seeing on the ground in places that we've been talking with employers, and this has been a hallmark of the economic recovery in general, which is a bit sad, is the growth in temporary work. We've been seeing a lot of growth in temporary work, even in manufacturing, so I kind of want to see what your thoughts are on that. It kind of goes against the grain of workforce investment.

While that is happening, there still are some really great examples of companies like yours that invest in their workers, and there's a great Hitachi Foundation case studies of really great examples of companies that invest in their workforce, so if you're interesting in looking for that, I found that really helpful. But I just kind

of what to know what your thoughts are on the growth in temporary work and what it means for manufacturing and the workforce investment in manufacturing.

MS. QUINTON: That's a great point.

MR. WHITE: I think that that's going to increase. By the way, there are certain real advantages to temporary employees in the case of seasonal businesses and whatnot. I can see, we've tried to steer clear of it, because you don't really have the full attention of the person if they're a temporary employee. But I think, in response to the health care program and the cost that that may inflict, which I don't think all are known yet, we've tried to analyze that as well as we can. It's sustainable for us, but this is a way for people to get around that a little bit, and I think we're going to see more temporary employment.

MS. QUINTON: And this is particularly a problem sort of at a low wage of the income scale, you know, people who aren't making a lot of money to start with, and now having a less attractive set of jobs, even in manufacturing, which historically has always been a sector that people think of as a place where folks can come in at a low level and move up and make a decent wage.

Does anyone have any more thoughts on that?

MS. JACOBS: I wonder whether, and this is just some

speculation, but I wonder whether temporary work isn't all that different from the increase in the use of part time work that we've seen over time. I mean, part time work avoids a lot of the same expenses as having a full time worker, you don't have to provide benefits the same way, even if you're a company that actually does provide good benefits and a good wage to workers, which many companies don't, even for their full time workers.

But, if you are, using part time workers lets you get around that, so I wonder, I mean, temporary, shifting to a temporary model versus part time kind of adds insult to injury, I guess, because you're not even there permanently part time. But I think the strategy of companies saving money on labor costs by kind of recategorizing workers is an old one, and I wonder whether, if temporary work is kind of a new level of bad or whether it's just kind of a new strategy to do the same kind of thing that we've been seeing for a while.

Which is not at all to make an excuse for it, it's part of a broader problem that's very definitely not good for workers, and arguably not good for the economy as a whole. But whether it's a new problem or whether it's a new name for something that we've been trying to figure out how to deal with for quite some time, it's not totally clear to me.

MS. QUINTON: I think we have time for one more question. The gentleman in the front row.

MR. MANN: Thank you. Bob Mann with Taco. I have a question about manufacturing and national security. Does the government have a policy -- you talked about a national manufacturing strategy, if we had one. Is there a concern on the government's part and responsibility that we retain strategic industries for national security purposes? If so, are we acting on that?

MR. CICILLINE: I think there is no question that we have a responsibility to do that. We do it in the way the government contracts in certain industries, but I think people have not given enough thought to the long term consequences of not protecting and strengthening the manufacturing sector in our economy. That, you know, what you're talking about are what will be the implications for national security over time, and I think it is just one more reason that we should make manufacturing a national priority, and that we should have a set of policies, both tax policies, workforce policies, education policies that really support the growth and strength in manufacturing because of those implications.

MS. QUINTON: Well, on that note, I think we are out of time. Thank you all so much for joining us today (applause), thank

you to our panelists, and a big thank you to the Brookings Institution for hosting this great event.

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