THE BROOKINGS INSTITUTION

THE DIGITALIZATION OF THE AMERICAN WORKFORCE: HOW METROS CAN BUILD AN INCLUSIVE LABOR MARKET

Washington, D.C.

Thursday, December 7, 2017

Welcome:

AMY LIU
Vice President and Director, Metropolitan Policy Program
The Brookings Institution

Presentation:

MARK MURO
Senior Fellow and Policy Director, Metropolitan Policy Program
The Brookings Institution

Panel Discussion:

MODERATOR: STEVE LeVINE
Future Editor, Axios
Senior Fellow, Foresight, Strategy and Risks Initiative
The Atlantic Council

ELIZABETH LINDSEY
Executive Director
Byte Back

BYRON AUGUSTE
Chief Executive Officer and Co-Founder
Opportunity@Work

JEFF MAZUR
Executive Director
LaunchCode

ROBIN LaCHAPELLE
Vice President, Human Resources, MedImmune
U.S. HR Country Lead, AstraZeneca

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P R O C E E D I N G S

MS. LIU: Great. Good afternoon. I want to welcome all of you and those on the webcast to Brookings. I am really looking forward to today's topic and to hearing from all the speakers we have assembled. The subject today is the digitalization of the American workforce, or #digitalskills. And this is important because this topic is at the heart of our program at Brookings' agenda over the next couple years. We want to help cities radically adapt to the disruption in today's economy so they can create more opportunities for more people. And the urgency to adapt is great. Digitalization is upending today and tomorrow's opportunity structure. It is transforming industries, changing the mix of jobs created, shifting the demand for skills and redistributing where tech growth occurs in the nation.

And amid all this churn, not all people or all communities are gaining and racial disparities remain stark at a time when our nation will be more multi-ethnic and multi-racial, not less.

Now, Christopher Mims of The Wall Street Journal recently published a column where he cited the wisdom of Melvin Kranzberg, professor of History of Technology at Georgia Institute of Tech. And Kranzberg offered this insight: "Technology is neither good nor bad, nor is it neutral." In other words, the impact of technology depends on context. I want to emphasize the latter part of that principle, nor is it neutral. That to me is the inflection point we are in today. If it's not neutral, then what is it? Well, digital technologies and the way we deploy them ought to reflect our values. It must be a force for good. It must create more opportunities than it destroys. It must lift up the hopes and aspirations of more children, of more families, more communities across the nation. And that is why I like this new report put together by the stellar Brookings team of Mark Muro, Sifan Liu, Jacob Whiton, and Sid Kulkarni.

Rather than simply sound alarms about the coming technologies, it shows how the increasing digital content of occupations and industries can improve the

productivity of some firms and can improve wages for low and mid-skill workers if we can help them get on the onramp to the right jobs to the middle class. So we can do more to ensure that rapid digitalization is opportunity enhancing.

And that is the purpose of the panel discussion we're going to provide today. We are going to hear from some nonprofit and some private sector leaders on their efforts to help workers, both new entrants to the labor force and incumbent workers reskill and adapt to this digital moment. And that conversation will be ably moderated by Steve LeVine of Axios. In short, I think we simply need more intentional efforts to make this digital age the opportunity age.

And without further ado, I am now going to hand our program over to a great friend and scholar, Mark Muro. Thank you.

(Applause)

MR. MURO: Good afternoon. Thank you, Amy. Thank you all for joining us, and thank you all of you in the Twittersphere and online where given the trend that we're discussing there's a huge audience out there as well.

I'm Mark Muro, senior fellow at Brookings. I have a simple question to help us get started this afternoon. Let's all just ask ourselves how is the presence of nearly 200 million -- yeah, hundreds of millions of computers in America's offices, stores, hospitals, and garages changing the world of work?

I ask this because I think that we're scrambling, frankly, to adapt to a dramatic transformation that we don't fully understand, even though we're in the middle of it. Digitalization is changing everything as various controversies about big tech suggests but that is especially true in the labor market. And yet, I think for all of the hype, for all of the reflection on these issues, we still aren't really coming to grips with even the basic trends around us. And we need to.

So what I want to do is highlight some brand new work from Brookings on how digital technologies are changing the talent equation. We're especially interested

in the labor market. So along these lines I'm going to say some things about what digitalization is and why it matters, walk you through a few big picture trends that I think will set up the conversation. Then we're going to focus briefly on what this means for the education and workforce development needed to give more people a leg up amid these trends.

So let's start with what digitalization is and why it matters. Basically, digitalization is the pervasive application of software and IT to every field to transform business operations and add value. So it's a very general, large enabling power. Why does the trend matter so much? It matters hugely because digital technology is special. It's not just one technology among many; it is what economists call platform technology and enabling technology. Digital technology has special power because its core capabilities, the collection, storage, management, exchange, and use of information amplify the ability of workers and firms to add value.

In this regard, the explosion of digital tools is transforming nearly every industry. On the technology side, mobile networks, apps, cloud computing, artificial intelligence, are enabling the scale-up of a plethora of digitally-enabled business models ranging from ubiquitous ecommerce to the gig economy to industry 4.0 virtual-to-real manufacturing, to eHealth and all of its incredibly exploding new forms. And now artificial intelligence is available as a service. It's becoming ubiquitous. It's not an owned activity; it's an online service made available to all companies and will be.

As to the workplace, it's being remade, too. Cloud-based enterprise management platforms, like Salesforce, are ubiquitous, loved and hated by all. Social collaboration tools, like Slack and Skype are ubiquitous. Online matching platforms shape the entire world around us, and the rise to the platform economy in general is this. So in this regard, a period of rapid technology change is creating a lot of flux in the economy. On the positive side, significant opportunities for individuals, firms, industries, are there for the taking, and I'm going to touch on a couple of those because digital

empowers. That is an absolute fact. On the more concerning side, two distinct type of challenge are stressing the labor market. At the higher end, the nation is struggling with actual shortages of IT and computer workers. BLS says the nation is going to need 100,000 new IT workers every year in the next decade but it's only producing 60,000, so there's a deficit there. At the middle and lower end, far too few workers possess basic online skills. It's hard to believe this but the OECD recently reported that nearly one-quarter of Americans -- and these are not solely older Americans, many of them are young Americans -- either don't know how to use a computer or can do little more than do email online. Without doubt, these are big questions to look at here.

So let's look at our new analysis and what we're finding nationally. And here I want to give again a shout out to Sifan Liu and Jacob Whiton on my team who have worked so hard with me on this.

So basically what we've done is use a very granular Department of Labor dataset based on thousands of interviews with workers, direct interviews -- this isn't modeling or anything like that -- to rate the digital content of some 540 occupations from one to 100. To give you a feel, software developers you can see come out top of the list with a score of 94. Registered nurses about 55. So that's a middle digital activity. And then construction workers come in at 17. It's interesting that it's 17 rather than one or zero. So everything is digital.

In short, so then once we've done this, for an easier analysis sorting the occupations into high, medium, and low, where high might include writing a program to scan a computer disc for viruses, 33 to 60 is medium. It might include using basic office productivity software regularly in one's job. Below 33 is low digital demands, low, or no digital skill. So we've built up a pretty novel file of task-based data on the changing nature of work based on what people actually do, or at least say they actually do. So I think that is an advantage of this kind of work.

What have we found? Well, the first thing to say is that the share of jobs

-- that digitalization is proceeding really fast. Looking in aggregate nationally at all jobs, the share of jobs with high or medium-level digital content has increased rapidly since 2002. In 2002, just 45 percent of jobs require high or medium digital skills; now 71 percent do. That means just 29 percent of jobs are now accessible for someone with low or no digital skills. So the jobs accessible to those with few skills are dwindling. The access points are moving upwards.

And here's another look at what this looks like. Here you can see how selected occupations have been moving rapidly up the digital scale between 2002 and 2016. Nothing stays the same. Everything has elevated and moved upward. Customer service representatives, that big yellow ball in the middle because it's a big occupation, went from 25 to 61 in the last. So this is a middle class, accessible job but it now requires, you know, now a substantial digital readiness.

And you can see in general the biggest changes are occurring across the bottom and middle of the occupational distribution -- nursing, dental assistants, sales, retail occupations. Again, those are racing upwards, too. So while we've been captivated by the high end, and we had a lot to say about that. I think we have major training challenges at the top of the scale, a lot has been happening below it and we need to think about that, too.

So this is all important because digital technologies, as many scholars have suggested for now quite a while, have tremendous capacity to both empower the workforce and divide it. This flows from the power of digital technologies to augment productivity, what I was saying earlier, augment the productivity of those possessing higher order creative skills and to substitute for the work of those doing rote work.

In any event, you can see here that digital skills bring big benefits to the workers that have them, namely through increased wages. Here you can see that highly digital jobs pay more than twice what low digital positions do in annual wages. And an important addition here, higher digital jobs do correlate with somewhat greater resilience

in the face of automation, something our panelists will talk about a bit. So lots of reasons to acquire as many digital skills as one can as early as one can.

In like fashion, the more highly digital an industry is the more productive it likely is and the better it likely pays. Here you can see that. Tech adopting industries to the top. You can see the higher scores to the top are clearly performing better on this measure. Tech, they tend to pay better. There are other measures of productivity to show them performing better. So you can see at the top it'll say professional scientific services, finance and insurance, media, Steve, management and companies and enterprises, all doing well, performing better, and are populated by people with higher digital skills. MedImmune is likely up at the top there. So again, this is a tremendous indication of the power of these technologies to transform not only people's eyes but the course of firms and industries.

And yet, just as digitalization empowers some workers, industries, and places, it also seems to polarize outcomes. This has been a persistent finding over the last couple -- a decade or so. For one thing, the uneven distribution of digital skills inevitably translates into disparate participation in the best paying industries that we've been talking about which exacerbates economic disparities.

Here you can see just the skill variation across groups -- Asian, White, Black, and Latino. Women with slightly higher median preparation but we're going to see, you know, I think that -- I think when we go into certain industry status that is subject to particular fields. But you can see that the know-how is not evenly distributed. You know, women are a special case here. Their higher mean digital scores and historical orientation to help and helping work has yielded significant overrepresentation. This is probably good for them in the middle of the indecent paying middle-skill occupations in industries, but they're underrepresented in certain, you know, harder science fields that we've been hearing about a lot in the news.

Likewise, you can see here the underrepresentation of Black and Latino

workers in the most highly digital industries. Black workers have managed to toehold in middle skilled health areas but are underrepresented at the top. And meanwhile, Latinos heavily overrepresented in the lowest digital jobs -- agriculture, buildings and grounds maintenance, construction. So again, digital skill turns out to be a quite revealing way to assess the fortunes and prospects of groups. What's more, the same tendency of digital skills to empower and divide is playing out across space and I'm going to say that I think this is one of the kind of secret histories or secret drivers of some of the spatial challenges we're facing in the country right now.

The thing I want to say here though is that digitalization is happening everywhere in space but not evenly and that, too, has to do with the inherent nature of digital economies. Metro areas, in this respect you can see very substantially on the degree of their overall digitalization, the presence of critical high digital jobs and workers, which is the measure here, you have those in that upper echelon, the share of workers ranges from 38 percent in San Jose to 15 percent in Stockton and is in the twenties in places like Columbus, Philly, St. Louis, Nashville. So there is a substantial variation across places. Washington ranks number two with 31 percent of its workers highly digital, and here, too, the digitalization trend may be helping to increase the divergence of cities' economic well-being.

We've talked about this in the context of the BA attainment is the main driver, but I think there's increasing evidence that technical skills particularly accentuate these dynamics. So you can see here a scatter plot looking at the largest hundred metros high digital shares mapped against their average wages, you get the drift of the metros with the highest shares of highly digital workers to the right -- San Jose, Washington, D.C., Seattle, for instance -- are the ones with the highest mean annual wages. And by contrast, places with low digital skills, like Las Vegas, or Stockton, California, deliver annual wage levels way, way lower.

Don't want to be deterministic here but this is a strong correlation, strong

evidence statistically about this, nor is this all highly technical workers are concentrating on the most digital metros; that is the higher a place's share of highly digital workers, the more the share is increasing. So in that sense, the digital rich are getting richer. There is a pull away going on among the most digitally -- most digitally into (inaudible) places.

So this all adds, I think, for an incentive for regions to cities to get serious about their digital skills pools. The bottom line here, differences in technology adoption are playing a very big role in shaping outcomes for people, industries, and regions. Likewise, the economic inclusion and success that all places hope for, all people hope for, now depends heavily on digital participation.

So where does this leave us? These are a few of the trends. You can dig into this much more online on our website. We have full data available for all places and for all of these occupations.

But let's just talk about how this touches down here in Greater Washington as a way to begin to set up our panel and a conversation about thinking about how business educators and the workforce development organizations should respond. Well, to start with, here's the region's digital dashboard. You can see there's a highly digital metro, as I was saying, second highest share of highly digital workers among large workers. Six hundred fifty six thousand highly digital jobs, 31 percent of the workforce. Only 28 percent of the region's jobs are no or low digital. If you dig in a bit more deeply, you can see that the region faces I think two fairly distinct digital skills issues. Towards the upper right you can see a group of bubbles reflecting some of the highly digital occupations that groups like the Greater Washington partnership are highlighting as a critical issue here. The growing occupations are projected to generate tens of thousands of job openings in the next decade but see that they have quite high digital scores. So this is a growth area in the country, in many cities, and especially in ours.

At the same time, lower down, a bit lower to the left you can see bubbles

reflecting the region's opportunity jobs, critical onramp jobs that pay above average wages to those without a bachelor's degree. We've developed a measure of this inspired by one of my colleagues Chad Shearer to get a handle on this other space. With often middle-tier digital scores, these occupations ranging from radiology technicians and RNs to office and sales people, to office administrators, present a different challenge. They're upscaling so fast that less educated or marginalized workers are having trouble keeping up. So there's a real -- so we have two distinct issues in this space and I think we've largely talked about only one of the issues historically. So I think our hope is to try to broaden this discussion.

Now, let's just talk about the catch-up issue. You can see this here, dozens of metros' most important on-ramp jobs here are seeing very fast digitalization. The blue bars are their scores in 2002. Orange is in 2016. You can see physical therapist assistants more than doubled from 20 to 44; RNs, 38 to 55; dental lab technicians, 10 to 35. These are bedrock jobs of middle class aspiration and you can see that they are simply demanding more.

So our data I think raised two main digital skill challenges for D.C. and most regions. They asked how can the region expand its high-skilled IT talent pipeline to support more growth and diversity in its high-end health defense and tech industries, for instance, but then secondly, how can the area help its lower skilled workers catch up and hook onto the region's increasing digital onramp jobs with the sense that participating in a digital environment is a route to middle class success.

So, and these issues pertain I think to most metros, so we've tried to work out a rough outline of some of the kinds of strategies that matter. On the one hand, this digital IT talent pipeline agenda. On the other hand, that of basic digital connection, especially for underrepresented groups.

In terms of the IT professional pipeline, I think it's coming into focus. Again, we as a society, and I think this region has begun to think about this pretty

thoroughly. I think this is about employers working more closely with universities and community colleges to develop, align relevant professional degree programs. It's about scaling up nontraditional, accelerated learning models. Whether it be competency-based learning through apprenticeships or the boot camps and code skills that have inundated and captured people's imaginations. And I do think an ironically improved IT pipeline is likely going to require some form of universal K-12 computer science exposure and instruction. Virginia is moving on this. Maryland and D.C. not so much. I think this is an important thing for the region to think about.

Across all this agenda there is solid worth going on in the region's defense and health companies partner in deep ways with institutions like University of Maryland or UMBC to create degree programs, mentorship opportunities, whether in cybersecurity or health analytics or logistics. So we need much more of this with a stronger focus on including underrepresented populations but I think we've begun the work on this direction.

Turning to the broader inclusion challenge, I would say this has received less attention and is becoming an imperative as well. Companies, educators, nonprofits need to develop unprecedented initiatives I think that mount super relevant compelling exposure campaigns in schools and the media, really scale up hands-on experiences with modern office tools as a matter of course in high schools, and then heavily expand the kind of entry level tech training Elizabeth Lindsey's Bite Back organization which we'll be hearing about provide to allow underrepresented populations to go into say computer support or network technician roles. She'll tell us more about this.

I almost think to hear that the best thing the region can do would be to get every teenager exposed to Salesforce, lord forbid, or SAP or Microsoft office simply as an initial connection to a skill that matters much more than maybe we think, that is one of the skills that is differentiating people's experiences.

Which brings me to my last point. In the end, we really need to succeed

in ensuring that workers here can flourish in the next decades. We will need to make sure that they get along with more digital help, digital skills, more a sense of helping, of ability to do what the machines can't do. Human traits are going to matter much more now because the error of astronomical computation speed means humans must focus on what we are that computers aren't. And so I just want to say that while we do much more to teach digital skills, we need to get better at cultivating inherently human ones, too -- adaptability, curiosity, social intelligence, teamwork, creativity, and entrepreneurship. Rote won't make it now so it's got to be a collaboration between digitally empowered -- digital machines and digitally empowered workers who know how to work with the machines. So it's becoming clear that the greatest education needs may not actually be just the mastery of more and different computer skills, so that matter is going to be important. The work ahead is going to be much more about getting better at managing change and finding new ways to add value.

So that's enough. I think I've laid out a broad platform for a conversation now. Thanks for listening. I'm looking forward to the discussion which is going to be moderated starting right now by Steve LeVine of Axios. He will introduce --

(Applause)

MR. LEVINE: Welcome. Welcome this afternoon. What a privilege it is to be at Brookings to moderate this panel on the digitalization of the workforce. We have been trying as a community of journalists, think tanks, and countries around the world to get our arms around this shift that Mark so well articulated in his presentation. At Axios, we have a vertical called the future of work. I hope everyone subscribes to the weekly newsletter. We only really understood over the last year, even though this trend is really decades long, we only understood the real ramifications of it over the last year and that's when we've seen how these changes in economies and in jobs can impact societies across the world, political systems around the world, and geopolitics. And that's really the huge contribution that the Brookings team has brought to the conversation and that's

to fill in the space. In fact, we don't understand what is really going on. We don't understand -- we know something is going on. We know it's big and it's roiling everything, but we don't know the pace that it's going at, and we don't know how big it will ultimately become. And in the end, we don't know the answer to the question, is this time different? Is this technological revolution that we're seeing now the same as the others that we've seen through times since the Luddites in the beginning of the 19th century? Is it the same as those, in other words, the normal economic churn will organically fill jobs, everyone will be employed, or is this technological revolution so fast and so profound that we're really going to be in trouble?

And so I'm thrilled at the panel we have together today to discuss. We have at the end we have Robin LaChapelle, and she is vice president of human resources at MedImmune. She previously was at Capital One, a vice president there, too, and also at Lockheed Martin.

We've got Byron Auguste. Is that the correct pronunciation?

MR. AUGUSTE: That's how the French pronounce it. We pronounce it Auguste.

MR. LEVINE: Auguste?

MR. AUGUSTE: Yeah.

MR. LEVINE: That's how I'm going to pronounce it.

MR. AUGUSTE: The Romans pronounced it Augustus. Everyone has their way.

MR. LEVINE: Okay. Who -- thank you, Byron -- who is CEO at Opportunity@Work, and for two years worked on the Council on Economic Advisors in the Obama administration.

And then we have Jeff Mazur, who is the executive director at LaunchCode.

And finally, Elizabeth Lindsey, executive director at Byte Back.

We're going to start with Robin. And Robin, can you just give a high-level view? Mark did a very good job at laying out the statistics. What does digitalization look like? And can you give us the arc, the historical arc?

MS. LACHAPELLE: I think he did an excellent job laying that out. It's moving so fast that I think it's really difficult to put a pinpoint on where we are in the curve is what it feels like in industry. When I look at the broad industries I've served, and then I'll certainly speak on the current one where I am now which is in biotech life sciences, I think the confluence of trying to get products to the market as fast as we can and what technology can bring to doing that with the equation then that says take human interference out. And I think that is a conundrum that we all have and, you know, greater good are you serving and at which time?

So as I look at what has happened in digitalization, there's probably not a job that we don't ask, so your chart quite resonates that there really is not any job that doesn't have some sort of technology component, whether it's from the salesforce that we used to have. We turned in -- if you even look probably five, seven years ago, they weren't walking around. At this point today, I could open up my iPad and tell you every call that's been made, every doctor that's written a script, everything that's happened in the industry. And we do really look for that and people who will adapt to that technology with us because it's also the way that we communicate. When we look at a huge diversified workforce of 6,000 sales people in the field every day, it's the one way I can get to them. So it cuts down the path of when I used to mail them, you know, features and benefits, or when they used to leave behind, to be quite honest, even as you look at the expectation of being green or being efficient in how you work, we don't leave pamphlets anymore. You know, if you go to your health provider, they're not really there anymore. They want our labels to be smaller. We submitted in the last three weeks, I'm very proud, a new oncology drug, and the FDA took our 7,000 page submission all electronically. So they didn't want us to actually write and bring them any paper. That's

how they review and that's how they've modified their input. Because what we believe we accomplished in that is the cycle time for review now has cut down tremendously. So our speed to market, which is what they're asking for us and how it's impacting R&D every day is getting faster.

So what that means for jobs where humans used to intervene or used to be writing scripts for us or be in the labs documenting, it's all automated on iPads now and the user information.

The greatest wave we're seeing is also wearables. So if you look at what's happening on the West Coast, I just spent a few weeks out there in our San Francisco area. And I was at a conference of biotech and brilliant I will say, and children I probably realize now I could have birthed are developing wearables. Why? Because they're diabetics and they don't want to walk around with insulin pumping into them. They have developed a pinpoint that will go into them and sell a technology.

We don't need to see a doctor in some cases for some of our studies anymore, so it's not just lower level jobs being impacted; it's really all roles are really shifting in such a dynamic way. And the reason being is when we do patient studies, we used to wait for a patient to come into a doctor, be diagnosed, and then we would put them into our study. And then they come back monthly and we take all the vitals, and now what we can do is we can get vitals right off an iPhone. You can get them right off their wearables.

So the beauty of that is it's easier for patients to be in our study. It's easier for us to get a drug to market, but we've cut out a lot of the human interaction. So I think the great question that you have asked, Mark, and I think is the one is, but where is it that you cannot replace the human interaction?

And so as we look at that from a skillset standpoint, and I even look at my own function in human resources, they've developed Avatars, which I was surprised, that you can call in now, and when you say I have an issue with my payroll or some of the

basic pieces that people were handling, you actually are not talking to a human being anymore, which is a whole group of companies, big and small, who are developing tremendous technology, that does make my company more efficient. But the pieces they can't replace is when a human has a question and it isn't a yes or no, or an "I got it, I will go execute the task." And so find areas where the analytical skills and the thinking that will be enabled by data or technology, I don't know that that will ever go away. And I worry that some are ambitious. I'm applauding that they are, but I guess maybe when I look at the industry, I think those pieces, the creativity around the innovation when I look at the aerospace and defense industry of designing a satellite is never going to go away. You can have artificial intelligence that can help you, you might have a 3D printer that can actually give you a part or could assemble something, but someone has to come with the ideas, and someone has to analyze why it's working well and why it isn't to even make the technology applicable.

So I think those are definitely the pieces that we continue to look at. But how do you bring that up and make that accessible to all is a very fair question? We have spent time a lot in our industry on the high-end sciences, high-end technology there's no doubt. When we look at that we need bioinformatics who can take in large amounts of data, understand why the human heart isn't working the way it should and what we can do to cure that. But where we haven't had a lot of as much exposure and we're working down through the chains, getting people interested in science and technology, even in the high schools, but they're coming with some of the basic skills. I'm happy to report we hosted 50 high school students from Montgomery County this year, and primarily from the underserved schools, and they came and taught us a bit about how we could improve our technology and our presentations and we were working in the labs. They are coming out even at the lower levels quite adept in the IT space. So the question is, how can we have that more pervasive? And I think on behalf of industry, and you did talk about the greater Washington partnership, it's a question we're asking.

So I'm pleased to be sitting next to firms who focus on that every day, to really learn and ask the open question, how can industry be the best partner in making sure that we have our doors open, we're thinking in the right way? And to be honest, we're proactively crafting the workforce opportunities that we should be instead of falling into them by the sheer nature of what happens with the force around us.

MR. LEVINE: Thanks.

MS. LACHAPELLE: Sure.

MR. LEVINE: Thanks, Robin.

Byron, I wanted to ask you to talk about Opportunity@Work, how you're going at the problems that Robin laid out, but I think you wanted to dig into a little bit into the Brookings report. Do you want to go ahead and do that?

MR. AUGUSTE: Yeah, I think -- well, I'm happy to talk about Opportunity@Work and could do that later but I mean, I think this is a big topic and I think that on the whole our conversation about this topic, the future of work, you know, digital skills, all this in general, is really actually very far off the mark and we're not understanding it will. I think part of why we're not understanding it is because the most important thing about understanding the future of work is actually to understand the present of work, and how do our institutions actually work today, and what are the incentives, what are the policies, practices that are faced across the socioeconomic spectrum of people at work? And I think one of the reasons why it's so surprising, right, and sort of Axios, you know, this is the year of the future of work, I mean, for the last 20 years there's half the country that has been in no doubt, right, they've been under a tremendous amount of economic stress, sort of a 20-year recession for half the country. So it's not -- if you don't understand why, right, these pieces are happening, it's very hard to understand how they will work in the future. I do think the past is also helpful and you've asked, you know, is this time different?

So let me put a slightly different narrative around it. First of all, I think

what is true, I mean, the digitalization, the extent of it, absolutely correct. And in fact, it points to more fundamental changes because it's not just the skill level; it allows for modularity in business processes so you can reconfigure them much more quickly. So it sort of creates a system that is much more at sort of a technical and substantive level, much more prone to innovation. And by the way, where more and more people can be innovators.

So the first thing we're missing is that we assume that this is something that naturally somehow empowers sort of the top of the economic pyramid, but there's nothing natural about that, right? There's every reason in a world in which you can sort of modularize economic activities that you could have much more innovation and therefore, much more value added. And if the system is working properly, reward for people at the front lines. Right? Your call centers, your warehouses, et cetera.

So I think a lot of what we assume -- so, I mean, even this panel we've already started to talk about technology as if it's a force of nature, a natural phenomenon, like it's gravity; it's not. And the deployment of technology certainly isn't. That is a set of institutional choices that are mediated by economic incentives. They're mediated by certain cultural assumptions, by a whole bunch of different things. So, I mean, we need to start in the right place.

So I would say a few things we do know beyond that it's a big deal, which I definitely agree with. The second thing we know is that rising productivity is a good thing; right? I mean, if you have sort of more ability to sort of produce things faster, better, more customized that people want more, it's a good thing. That's why we don't live in caves anymore; right? That's why we have skyscrapers and all that. So you want that. The question is, how do you get it? Because one way you can get it over a very narrow period of time is you can take your same business processes and just turn the crank and lower costs; right? So the fundamental business model of enterprise software, add software, remove labor, ca-ching, ca-ching, repeat, right, and go on down the line.

So that's all you do.

I mean, by the way, there's still some benefit to doing that, like, you know, it does create value. People spend on other things. You get more personal trainers and whatnot. So it's not like it's nothing. But an even more powerful way of innovation and productivity improvement is faster time to market, more customization. You know, sort of even in services, cognitive behavioral therapy for everyone from the person doing the bedpan so that you have a lower morbidity. You are happier in elder care. I mean, there are many, many ways to create value. That's sort of the numerator part of the productivity equation; right? It's not just about reducing costs or labor costs; it's about making everything work better, making it more valuable to people. They pay more. So if we think about a system that can drive that sort of innovation through digitalization, which it's naturally I think suited to do, well, then you can have more productivity, you can have more jobs, and you can have higher wages; right? You can have all that. So just to understand the possibilities, those are all possible.

So my father, in 1970 -- so this has been going on for decades -- he was a shipping clerk in a kosher food company in Detroit. And there were three nonfamily members in the company. Two carried stuff, boxes around, and the other one broke them down. That was my dad. And he saw an ad in the newspaper which we had back in 1970, newspapers, for -- to learn COBALT, right, which is the mainframe software, the operating system language for IBM mainframes, which at that time there was a huge demand taking off that said you could write your ticket. So for some reason my dad, who had never worked in an office, who had dropped out of college as a literature major after a year, just thought he could maybe do this. He quit his job and he did this. And it turned out he could. You know, my mom worked at Detroit Edison. She got him a job shadow there in the MIS department and they finally gave him a job and that was sort of the trajectory of my family into middle class, the American middle class.

So that was 1970. And today, still to this day, 40 percent of IT workers

don't have college degrees, including 20 percent of developers because they didn't teach it in college. And by the way, they still barely teach it in college. So there wasn't that barrier. So ask yourself, if someone like my father, today, in 2017, what would be his prospects of getting into this field? He had never worked in an office. He didn't have a college degree. They would be very, very poor, much worse than in 1970.

So the equation here is not a technology equation. The equation is, right, what's the basis on which we hire? What's the basis on which we consider who gets trained in these skills? And just as another -- and even in the data you can see, you know, you were showing the data that showed that White Americans had like a 48 digital score and Black Americans 44. Well, by my math, that's like an eight percent discount for black people, whereas like black income are like a 25 percent discount. So white and black weather is like, what is it, an 89 percent discount; right? I mean, so if you want to have a level playing field on digital skills, bring it on, right, from the standpoint of equity. We'd be in a lot better shape. And in fact, you know the guys Catalyst in Baltimore. They're an IT services company. They hire entirely based on skills, performance. They don't care where you went to school, any of that stuff; right? They're very, very competitive. They make almost twice as much money as their Main Street competitors. Why? Because since they get people of any sort, they have a much lower turnover rate. They have been onboarding, but they're not just getting the person with the best degrees who then get poached in 18 months. They retain them and they do a great job. They've been growing, and Metro Baltimore is about 27 percent African-American. Their developers are 25 percent African-American, their software developers. And this is high-end stuff. This is product development.

The point is talent is far more equally distributed than opportunity is. So what we should be worried about is not that poor people, black people, whatever, can't keep up; what we should be worried about is the institutions we have that say, okay, you saw this thing that said, you know, 100,000 jobs needed but only this many college

graduates in computer science, why do you have to be a college graduate in computer science to get that job? And I'll tell you what; black people are underrepresented by like 70 percent; right? And women are underrepresented massively in those degrees. But is that the skillset you need to do these jobs? There is no evidence for that. In fact, there's a lot of evidence to the contrary.

So if we make an institutional choice that says you have to have a bachelor's degree in computer science to get those jobs, well, then don't complain about the skills gap because you just defined your way into the skills gap; right? What if instead you said, show what you can do and the job will look for you; right? What if everyone had a chance to demonstrate their skills and so instead if I apply for 100 jobs and 100 employers have to decide whether to deploy their shareholders' capital, right, to the cost -- the time, the opportunity cost of assessing my skills just in case I'm the one of 1,000 applicants they want to hire, which is a ridiculous system. What if instead any of us could demonstrate our skills and the employers who needed those skills could go to us. Well, that sounds like magic except we've done it over and over -- eBay, Airbnb, et cetera. This is a thing we can do.

So I would just say that everyone should take a step back and say, if you're treating technology as a force of nature, stop. If anything you say that technology is going to automatically do, think again how could it do the opposite? Because it can; right? We use it. And ask yourself, what needs to change in our institutions and the incentives in our economic system and our education and our human capital development pipeline for these amazing, positive, enabling changes to actually benefit our economy from the standpoint of innovation and inclusion because they absolutely can. And if they don't, shame on us.

Over to you. Thanks.

MR. LEVINE: Thanks, Byron.

So we do have --

(Applause)

MR. LEVINE: Well deserved.

We do have degree inflation where an increasing number of jobs have a degree requirement that previous didn't. We also have a stigma in our society around having a degree, not having a degree.

Jeff, so can you talk about, you are in the LaunchCode?

MR. MAZUR: Yes.

MR. LEVINE: You're in the training business. So can you talk about that? And also, just how are you attacking --

MR. MAZUR: Sure.

MR. LEVINE: -- the trends we're talking about?

MR. MAZUR: Yeah, so I think to say we're in the training business probably doesn't quite capture the entirety of it, Steve. In much the same way that Byron laid out the sort of global problem, LaunchCode is about trying to peel up small corners of that in places we were to actually provide practical solutions that start to do those things. So Byron, you know, kind of looked at the same stat that I saw as we went through Mark's presentation where 100,000 jobs every year that are these IT digital jobs, whereas we have 60,000 people each year who are getting these IT degrees and computer science degrees.

MR. LEVINE: And half of them are going into finance.

MR. MAZUR: Fair enough. Make the gap even more profound.

MR. LEVINE: Right.

MR. MAZUR: But again, those aren't environmental conditions that we're just dealing with; those are largely choices that we've chosen to impose upon ourselves by things like requiring a computer science degree to move into one of these middle to high-tech jobs. And so we're focused on looking at those jobs like software developer, software engineer, UI/UX developer, web developer, jobs that usually if you

look at postings, anywhere from 74 to 87 percent of those jobs require a computer science degree, and saying the real reason why there's a gap and why we're not making full use of the human capital that's out there is because we're imposing these requirements on ourselves when they don't really make any sense. And to some degree, industry itself repeatedly tells us that those requirements don't make any sense. When you survey CIOs and who are chief human resources who deal in tech hiring all the time, in large numbers they tell you that degree programs are doing a poor job at preparing people for the sorts of skills and work that they need done. And so you set up this really bizarre paradox where you're saying, hey, let's put this requirement up, and at the same time we know this requirement tells us nothing about the person's ability and skill to actually do the job and do it well. It's silly. And so we know there's all other sorts of functions that that degree serves that aren't actually a proxy for someone's ability or willingness to do the job, and LaunchCode is about saying how do we remove those considerations and focus back in, as Byron said, on the things that we should be really focused on, which is whether someone has the skill, the ability, the aptitude, the drive to do the job and do it well and to fill that gap. We know that to the extent we rely on the traditional hiring pathways and the traditional training mechanisms that we've relied on forever to fill these jobs that we're never going to close the gap. It just continues to expand.

And so what are the opportunities we have to adjust those things, to both build the nontraditional pathway and provide nontraditional skill building opportunities so that people can actually move in and fill that gap? And LaunchCode, just as one, again, small example, a nonprofit that is small that works -- founded in St. Louis and we work in now St. Louis, Kansas City, Seattle, Portland, Miami, and Tampa, so we're just touching a small corner of this, but we try to address this in two ways. One, there are people out there who have the skill to do the job already, who developed that skill from nontraditional channels. They're self-taught. They learned online. They just cobbled things together

from YouTube videos. They learned wherever or in a more traditional program, a college, a community college program or what have you but don't have the contacts, the ability, the know-how to convert that level of skill into actual career path jobs. They don't know how to make that connection. And so LaunchCode -- and this sphere of what we do exists to identify those people, evaluate them, validate the skill, and then over here aggregate demand among employers who have a need for people just like this and then make that connection. And use some other tools and models to de-risk that transaction for employers so that they can kind of get over the hump of looking at nontraditional talent and use that as a way to solve problems on both ends of that, to start to fill this gap that employers have at a very profound level in some of these software development and other high-skilled tech jobs and solve this problem for jobseekers and learners over here where they have skill or they have aptitude and don't have the ability to put that to work in a career path job.

The other component that sort of runs parallel along with this is the recognition that this is a finite pool of people over here who have the skill already that we can connect and so we have to provide, in our case, free, accessible scaling models that on an accelerated basis provide the skills for people to actually step into those jobs so that we can make that connection for them and they can start to fill the gap. We know that a lot of the disparity that we see in terms of what the tech workforce looks like from an inclusion standpoint is a function of the fact that there's a huge disparity in people's access to high-quality skills that can get them into these sorts of jobs.

So again, to the extent that you rely on experience in the workforce to fill these jobs, to the extent that you rely on a college degree, you're, again, imposing all those same limitations that Byron noted that, yeah, five percent, fewer than five percent of college science degree graduates black. Fewer than 20 percent of CS degree holders or graduates are women. So you're just going to bootstrap all those same problems we have in the tech workforce today to the extent you continue to rely on those things. So

that's the way we sort of address the problem, Steve.

MR. LEVINE: Very good. Thank you, Jeff.

Elizabeth, up until now we've been speaking almost entirely of high-level, high-skilled tech jobs. You deal with on the low level what before we came up on stage we called the losers. Can you talk about what you are doing to bring these people into tech jobs?

MS. LINDSEY: Absolutely. My name is Elizabeth Lindsey and I'm the executive director of Byte Back, and we are a nonprofit based here in D.C. And we work with those one in six Americans that mark mentioned who really have limited access to technology and limited tech skills. We teach 700 adults every year here in D.C., and the largest component of our students are folks who have basically no ability to use a computer. In their daily lives they don't have exposure to computers or to technology. So in their first class at Byte Back we're teaching them how to turn on a computer and how to use a mouse, which actually takes a few courses to really get that.

It was astounding to me when I started at Byte Back two and a half years ago that this is happening in this city. We have hundreds of people every year who come to us. We are one organization, whereas this is one of the most highly educated metros in the country and it is one of the metros that has the highest digitalization score as Mark mentioned. And this has become such an acute issue because it is very hard to participate in society today, let alone find a good job without tech skills. So I think about every day all the ways I use technology in my life from using my iPhone for my alarm clock to taking Ubers, to paying at places with my credit card on a Square. All of these things that are not only things that I'm using as a consumer that people in the workforce are utilizing. And the report had mentioned that Square has proliferated things like using tablets when you go to a store and there will be people walking around with tablets to check you out. And if you don't know how to use a tablet, if you've never used a computer, it can be really hard even to get those entry level jobs.

And one of the things I also loved about this report is that it talked about how -- and Mark showed that amazing graph that showed how jobs that used to be relatively low skilled are now medium skilled. And if we aren't having these types of conversations looking at the choices of employers as well as us really being dedicated to thinking about the millions of people who are completely left out, then the inequality in terms of race, gender, and just general inequality that we see that is so pervasive, is not going to get better. Our students primarily live in wards five, seven, and eight here in D.C., which are the most low income wards and are almost entirely African-American. And so we really see that these issues do fall across gender and race line as most issues do. And I am proud to say we truly have changed people's lives. In a few months, people who really had very limited tech skills and who were homeless come to us and in a few months are able to learn how to use a computer, get a certification, and then move into living wage careers. And tech is one of the dwindling number of sectors where you can get a living wage sector without a college degree.

MR. LEVINE: Great. Thanks.

This is the point you made and Jeff, really everyone made this point that the picture that Mark painted with his slides was a future if we've got polarization now and a divide now and soaring inequality, that's a picture much worse.

MS. LINDSEY: Absolutely.

MR. LEVINE: Much worse picture.

Robin, can I ask you, we're going to try to do one more round and then open it up to the audience.

Robin, the points that Elizabeth made, this is a moving target. The jobs that are available on the lower level, we saw that chart from 2002 until now, the incline was like that, the difference between the types of jobs. How fast is the work moving in terms of those jobs that are available today and how long they're going to be available before those people getting those jobs have to get upskilled?

MS. LACHAPELLE: Yeah, I mean, I think they are moving. They are moving in terms of the numbers of them. They're moving in terms of the placement in the world of them being handed around that. I think there are other parts of the world that have stepped in to fill some of those jobs I think is a problem that we focus on. We are bringing a lot back and looking at that. I think there's major initiatives to do that.

I think the beauty of the stepping stone though is if there is an ability to master the entry level digital that says there is an ability to master and have motivation to do more, and that's where we've taken the premise. So we do have people who have come in and come in as a first job and they do accelerate. So when you find that we build on that. So we've been investing in programs to accelerate that. So while I think that you will find the first stepping stone jobs might slip away, but I think that's the history we've seen anyway. When you look at early manufacturing, right, the first jobs looked very different than the second ones, but the ability to have a workforce that has an even continuum, that can continue to rise I think is a point we're trying to make and look to see where that opportunity lies.

MR. LEVINE: In terms of like one of the beginning jobs that people talk about are working on an IT desk, on a help desk, but these are being automated. These kinds of jobs.

Elizabeth, do the students who come in -- do you call them students or clients?

MS. LINDSEY: We call them students. Yes.

MR. LEVINE: When they're coming in, do they know that almost as soon as they step into the door they've got to work and also learn to move up the ladder very quickly?

MS. LINDSEY: It's a great question. I think most don't know that. We do a lot of work to help them to realize that, and we also see ourselves as a pathway to other types of IT jobs. We in this world spend a lot of time talking about the potential of

things like coding boot camps which are absolutely incredible. However, many of those one in six Americans, again, don't have the skills that they would need to even -- they couldn't walk into a coding boot camp and sit down at a computer and immediately start participating in the class. They don't have the tech skills there. And so I think that's a piece of the conversation that we often forget. We're like, oh, coding boot camps are the solution to this problem. Everyone can become a software developer. Also, not everyone wants to be a software developer. Like, I wouldn't want to be a software developer. But, you know, even that requires more like a medium level of skills that so many people don't have.

The other interesting thing I think, and Robin and I have been talking about the fact that so many of these jobs are automated, what we've found is that with smaller businesses and in the nonprofit sector as well, they're not quite there yet automating them.

MR. LEVINE: That's right.

MS. LINDSEY: And so it's interesting. It makes our job a little harder because it's hard to find employers who are like we need 100 help desk technicians, but there are employers that need one or two and they're years away from automation.

MR. LEVINE: Byron?

MR. AUGUSTE: Yes?

MR. LEVINE: In terms of what government should do, what at this stage is a beginning, smart public policy? You're sitting -- if Donald Trump called today would you go?

Okay, you don't have to answer that.

Okay. What policy -- what are a couple policies that the administration should adopt now?

MR. AUGUSTE: Well, I think that there are -- it's funny. In a lot of domains, government policy has a tremendous impact, and it does have some

meaningful impact here. But it's very different. So, like to take healthcare policy, I mean, already in this country, in public sectors, spending on healthcare is like 55, you know, trending to 60 percent in the spend. The reimbursement rules of the Center for Medicare and Medicaid Services are followed largely by the private sector. But in the labor market that's not true. I mean, government's role, we talk about -- in Washington, we talk about job training programs every few years. We sort of get, you know, heated about, you know, do we rationalize our job training programs? But frankly, I mean, by a generous interpretation job training programs are like $20 billion. Companies spend $500 billion a year on training. Payroll is $9 trillion a year, which is what actually drives the whole system. So actually, you know, changes in employer practices that weren't legislated by anyone, right, I mean, was there a law passed that said that two-thirds of new jobs for secretaries require a bachelor's degree? There was not, right, but 20 percent of secretaries have a bachelor's degree but two-thirds of the new jobs in their field require it and then we wonder why they're feeling stuck in their jobs. So in other words, 80 percent of them, no matter how much they in the workplace keep up with the latest technology. They are still assumed if they don't have a bachelor's degree not to be able to do that. And that's not a government rule. So maybe in the Q&A I'd go back to some of the policy things because I actually think some of the long term, fundamental policy things are quite important. But in the near term, what matters most to this opportunity has much more to do with the shape of the labor market, and it really is a market. If you think about it as a program or a curriculum, you are missing the boat. It's a market. There's a demand side, there's a supply side. There's a microstructure of demand. So on the demand side, which is I think by far the one that we spend the least time on and the one that's got the biggest need for change, companies say they need skills, and of course it's true. When you're doing your final round interviews, you're doing performance tasks, all of that, you really want skills. But who gets to that final round? Right? If the screening is what is your resume history, if you don't have a time machine in your back pocket, right, there's

no way to solve that problem. That's not even a demand signal; that's a search algorithm.

So in other words, first of all, and what Opportunity@Work does to your earlier question, Opportunity@Work is creating a utility for the labor market that facing employers what it says is, if you commit that we can get you workers with the skills, job applicants with the skills in a pool that you can recruit from but you have to promise not to then say, oh, they're great but they don't have a college degree or they don't have this or that or the other. You have all these other channels where you do that. That's fine. But you might want to change that, too, but here's a lane, and you need to have one where if you can do the job you can get the job, period. And there's a way to do it.

And so what we can do is replace all that screening with demonstration. So from the job seeker's side the way it works is you come. There are a variety of ways you can get there. Through organizations like these or on your own or through a school, and you can demonstrate. Like, let's say a 30-minute demonstration, sort of self-paced. Let's say it was for a quality assurance test. It would be a series of three websites. They're mock websites. There's errors in the websites. You find the errors; you write the tickets. That's literally what the job entails. It's not a multiple choice test. It's not an aptitude test. It's like can you do it. Here's a sample of the job. If you don't have it you get feedback, right, and some tools. You might need to work on it. If you do have it then you can create a profile. We call it a career passport and you're eligible for mock interviews. And mock interviews are conducted by volunteers who are people who in their job they hire people for these jobs. And in 30-minute chunks of volunteering their private time, they can just put a 30-minute chunk on their calendar. It automatically schedules, matches the schedule, they can change the trajectory of another person's life because the person on the other end is someone who, because they don't have that pedigree, probably wouldn't get an interview at your company. Number two, when you interview them, say you're hiring a manager at Amazon, you don't have to say, are we

going to hire you over all the Stanford people who are applying for the same job? No. You'd say, if I could hire you or not, right, to do a job, could you do it? Yes. And then third, then they vouch for you. If you actually can demonstrate that, now you're validated, now you're in the pool, and you're going to get hired. You might get hired by Amazon. More likely you're going to get hired by Cedars-Sinai Hospital or wholesaling or a small company that otherwise wouldn't have any way to find you; right? And so that's how you get -- and, by the way, if you're not ready you get feedback there, too. Which, I mean, one of the frustrating things about job search is you don't get any feedback, right, because you can't because of all the regulatory issues. And it's amazing for the volunteers, too. And what we've experienced is there's this huge pool of people who know how this works who don't have any way to help and they want to help. And so that can actually scale nationwide. We're aiming for a million people in the next 10 years. We have 4,500 so far, but there's definitely that opportunity.

I want to say one other thing about not everyone wants to be a software developer. So first of all, it's not just for software development; it's in all areas of IT to start with but it's going to be beyond that. So Tech Hire is the brand of this thing, the local brand, but we are Opportunity@Work. We are not TechHire.org any more than Amazon.com was Books.com. It never was. The point is, just like Books, there's a great entry point for this kind of market. IT jobs are a terrific entry point for this validated hiring. Why? So we're already seeing people coming and their technical skills are not quite there but they've got amazing interpersonal skills, right, and all that, and you say, well, have you thought about going into technical sales? Well, they didn't even know there was such a job, right, but they can pay just as well. So the point is everybody can be good at something; nobody is good at everything. So if we continue to have these rifle shot solutions where it's like, oh, yeah, maybe you can be a software developer. Well, maybe you can. Right? Maybe you can work at Amazon. Well, maybe you can, but maybe you can't. But the point is we should have a system where people can crash the

boards, try their best, go for it, and if it happens to be their vision of what they're going for is not the thing that ultimately -- it doesn't matter. It's kind of like what happened when in the thirties you introduced the SAT in college admissions. Prior to that the only way to get into a selective college is to go to a selective high school. Go to Choate, headmaster Choate writes a letter to the dean of admissions for Dartmouth and says here's who we're recommending. But then we had the high school movement. Then we had 15-20,000 high schools and the Ivy and Seven Sisters are only going to 200 high schools. So how did you end up solving that problem? Through the Scholastic Aptitude Test and ultimately the PSATs and the APs and so forth, so someone could demonstrate, right, an aptitude. We think that the advanced placement tests are actually kind of a very good analog to what we're doing. The reason you get college credit worth thousands of dollars if you pass, you know, four or five on the AP exam, is because they're actually a demonstration of college level work in that field, in an extremely wide range of fields. The same thing here. It's a demonstration, a 30-minute sample, and then interview of the skills for work.

So what we are doing, the three levels of impact are number one, as Jeff was saying, people who actually can do this can get the job; right? Even if they didn't go to exactly the right school or they dropped out or whatever happened, or they learned it on the job -- a lot of people learn this on the job. A lot of secretaries, receptionists learn IT in a small business because there is no IT department, but then see them try to apply for a job, a career path job in IT and they don't even get a look; right?

So, but then the second one is now you can get high-signal feedback to community colleges, right, to (inaudible), to all these different programs because now -- before, if someone can't get the job, they're not considered, how do you know if your training worked or not? You don't. You can say it failed but they were never considered. So now you know they can get considered, so you start to get specific feedback. Delaware Tech in Delaware sort of didn't have that great a reputation. As it turned out,

their computer science associate's degree was pretty good. It had missed databases and, you know, big data and all that. And so once that was identified, and they were actually pretty strong in the other areas, Capital One worked with them on behalf of 60 other Delaware companies, and now these companies are hiring from there. In Rhode Island, the community college there system -- it's actually got a great reforming leader right now -- hasn't been great historically but you know what? The Newport campus had a terrific cybersecurity program, right, that the nuclear submarine industry had been investing in for 30 years, and then when the banks in Providence were trying to get cybersecurity skills, they were looking everywhere but that campus. Right? But once you started running this thing through Tech Hire they could see that there was that value. And in fact, we got state appropriations to expand that program because there was a need. But now you know. You have the data.

And then the final layer of impact is this larger question of innovation. I said earlier that the assumption that technology is necessarily going to help create more value at the top and help immiserate the bottom, that's not a good assumption. Artificial intelligence doesn't actually want to replace jobs as a technology. Most of what you see, classification and so forth, these are parts of jobs, not whole jobs. Artificial intelligence naturally wants to augment humans. It wants to complement humans. That's a natural course of the next 10-20 years. And to the extent it doesn't, it's because we don't have the economic incentives and structures to do it. So if we can create a mass market where you can actually put new innovation de-biasing artificial intelligence, accelerated learning, to a mass market of people as agents, not as sort of commodities in a company's production function, well, then you can actually have innovation for inclusion; right? You can have innovation that creates more opportunities systematically on purpose and have a feedback loop that allows that.

So that's what we're doing. LaunchCode has been a great partner. Elizabeth and I were just talking about what we can do in D.C., and you know, the

Greater Washington partnership, which so many of those companies do great work individually, but it's actually not a problem that companies can solve individually by themselves. It's a market-based collective action problem and our problem in America is that the government can't keep up with the market and companies don't have departments of collective action. All right? So there needs to be a bridge, a utility, intermediary to make that market work but we know how to do that as a general thing, so we just need to apply it here.

MR. LEVINE: Jeff, one thing is a big theme of the report is not necessarily that IT jobs are in huge demand but that all jobs -- all jobs are going to have a digital component.

MR. MAZUR: Sure.

MR. LEVINE: That's the point. And so when people are training they need to train for whatever job it is. They need to have some kind of baseline digital skills. So I wanted to ask you just a couple things briefly. So one is one of the slides has women with better digital skills than men. So why do you have coder girls? Why not have coder guys?

MR. MAZUR: Right. Sure.

MR. LEVINE: And then the second thing, what about this broader theme of digitalization across the board? Is this something that you're attacking?

MR. MAZUR: Yeah, sure. So you mentioned Coder Girl, one of our training programs. This is a program that's for women, by women, to provide not only technical skilling whereby women who work in the field are providing technical skills to women learners, but as Steve notes, one of the functions that we find is that women who go through one of our programs who are at a level of job readiness in terms of technical skills already oftentimes lag behind their male counterparts in their readiness to apply for jobs and willingness to apply for jobs for reasons that are entirely unrelated to their level of technical skill. They're related to not understanding or having other sort of cultural

concerns about whether they're ready to do this, how they will fit in, in an industry that has been largely male dominated. And so Coder Girl is partially about providing technical skills but it's also about recognizing that particularly if you're trying to address longstanding needs within underserved communities in the tech marketplace, that you have to provide other supports that are nontechnical to show people other people who look like them who have a shared experience who have gone through the same journey who can help them sort of navigate the things that are entirely unrelated to whether or not you can code in Java or do any of the just rote technical pieces of the job. So that's why Coder Girl exists and why we like to have programs like that that are geared towards providing nontechnical pieces of job readiness.

In terms of broader sort of adoption of technical skills across job functions, I think that's going to be one of the industry trends that we find, and I think you'll have this weird effect as more and more industries and more and more job types that typically haven't been digital or technologized in the past become technologized, it is, okay, now we've got a broad scale that's more broadly found but I think you'll actually find within each industry, within each sector you will then have the proliferation of niche technologies that then will provide another challenge to us. So you can no longer solve this whole problem by just training gads of Java developers who will then go into their separate lanes and do their thing; you'll have to have people who can then develop these additional skillsets and more niche technologies that are specific to the industry or the job that they're doing. And then how does that then impact your ability to bring new people into that workforce process? Is it just going to be people who are already in that lane who are going to build those additional new skills in a niche technology that will then take those jobs or can you have, again, accessible, accelerated skilling opportunities outside for people who are on the outside looking in who can quickly get those skills so that those new niche technologies that are developed are actually an opportunity for new people to come into the system so we can continue to draw down that gap by bringing new people

in. I think that's one of the really neat things that's going to happen and will be in effect of this broadening of the digital skill set.

MR. LEVINE: I have about 100 other questions but I'm not going to ask any of them. So let's take questions. I'll call on people. Before you answer -- before you ask your question, please identify who you are.

Where are the microphones? Oh, here we go. Right here. This man right here.

MR. APGAR: Sandy Apgar, CSIS.

Given this region's dependence on the military in all its forms and the contract community as well, and the fact that roughly 50 metros also have such economic dependence, does the Brookings database and your experience relate directly or correlate directly with the military demographics or is there a way to segment and extract from Mark's data to do just that?

MR. LEVINE: Great. Let me take -- put up hands. Let me take one more question. This lady right back there. Thank you.

MS. WOMACK: Hello. My name is Nicholina Womack. I am the executive director for Future InDesign. I came out here for this from Salt Lake City, Utah.

First and foremost, I just want to say that it's very refreshing that we have data now to back up the work that we've been doing. Our organization is very similar to the three of your organizations and thank you for that because now I don't feel alone in the world. Because it does feel very alone, and especially in Utah. We're trying to really position ourselves as the next Silicon Slopes is the tagline that they're using. I know.

However, we really, our mission is in part, and what I'd like to find out from you is we really do believe that there's a juxtaposition between the constraints of intergenerational poverty and the lack of a skilled labor force. There is a huge opportunity to create a pipeline of talent and we've seen in our pilot cohort amazing success with a young lady who is a refugee, a young man who is undocumented, another

young lady whose family is immigrant, they're all doing successfully well now that we've prepared them in our training program to go into a boot camp. And they are --

MR. LEVINE: What is the question?

MS. WOMACK: So the question is, what we're trying to -- sorry, I needed to put that context -- is aggregating the private sector and the companies to come to the table because we're working with them to say let's put them in an apprenticeship. You don't have to hire them right away. Let's get them an internship. Let's get them an apprenticeship. And if they're good you can bring them on.

I'd like to understand in your three organizations how you're dealing with that, what your success is looking like, what are some of the strategies that you are finding successful in getting the private sector to overlook the four-year degree?

MR. LEVINE: Okay. Who wants to take the military question? Does anyone? Okay, Byron will take that. And the second question, one person should take it. Okay, Jeff.

Byron first.

MR. AUGUSTE: Well, I would say on the military side there's a number of dimensions to it. One is, of course, there's a lot of sort of technology itself, ready the actuals or operations in the military and the associated contractors. And I think it's definitely the case that a lot of -- so we're working, we've got 70 communities under the Tech Hire banner and I think the pattern would be that in maybe about a quarter of them, the military and sort of supplier presence is a very big factor in the tech pipeline. That's true in Southern California. That's true in Rhode Island. That's true in San Antonio. It's true in a number of places and obviously in Washington, D.C. So that's one dimension we do see it.

What you see also is that the pattern of how you get a job is a little different. The certifications, right, and they have much more power in the context of the government contractor environment. So something that might be an indicator of having --

you've done a course. You've taken a test. You have a certain skillset. A lot of places that are purely commercial markets, they don't care about that very much but if you're a supplier to the government they do care about it a lot. It creates a permission structure to do it. So that's both a barrier in some cases but it's also an opportunity for people who otherwise don't have the college degrees and everything to do that. So I think that's a big deal. And I will say veterans have been a pretty big part as a third factor, have been a pretty big source of our pipeline. There's a huge Iraq-Afghanistan generation, and I think one of the big successes of this country is the degree to which we've moved the needle on the terrible outcomes originally when people were coming out of Afghanistan and Iraq to actually have gotten their levels of unemployment to about the right level, but I don't think we fully realize the talent because again, we treat people too much as widgets and there are no exceptions. So I think it's a big factor and that's how I would explain the contours of it.

MR. LEVINE: Great. Thank you, Byron.

Jeff?

MR. MAZUR: Yeah. So our organization certainly, and I expect Elizabeth's and yours, part of the motivation I'm sure from the beginning has been to create social impact and change people's lives and help people. In terms of outreach and development of meaningful relationships with employer partners and getting people to take people who come from our programs, the social impact is an absolute worst argument to try and make with employers; right? This cannot be a function of corporate social responsibility. It can't be about giving people a chance. It can't be about any sort of charitable impulse. It has to be about demonstrating in a meaningful and demonstrable way that the people who you are bringing to them are people who are just left behind by the typical practices, not that they're different in some meaningful way.

MR. LEVINE: We talk about overlook talent, and one of the things our employers say a lot is that, hey, we would never have seen these people in the gray.

That's what you need to say.

MS. LINDSEY: That's exactly right.

MR. MAZUR: That's exactly right. So demonstration that that's the case and, you know, remembering that it's still -- in order for these things to sustain and for them to work over the long term, the only way they work is for the employer to actually see this as a viable and growing source of talent for their organization, not something that they're just doing to kind of feel good for a day about what they've done.

So that's the best piece of advice that we've found from our experience in building those relationships. And then I think the key is once you've done that, we're finding now that, you know, our organization isn't that old, about four years old, now relationships with employers who have profound need that are willing to work with us at scale to take, you know, one of our big employers take 100 people from LaunchCode next year as developers. And an intelligence agency, the National Geospatial Intelligence Agency is going to hire 170 people as LaunchCoders over the next couple of years. So once you've shown that you can find those people and that your method for identifying skill and talent is there, then the sky is the limit in terms of how you can move the needle and how many lives you can impact.

MS. LACHAPELLE: I think that's the glass half full of the chart that you showed about industry acknowledging that they need hundreds of thousands of people and thinking that the degrees, which is the misclassification of how to think about it (inaudible). You walk in. You lay that chart down and say you have a problem. And even you know you have a problem. And I'm one of the few people who can actually help you solve it and redefine it. That's your in because to your point, I mean, you hope companies are socially responsible but they're in business. And so, but I think that's the material question and you validate it because they do recognize that problem.

We talk about the war on talent and they talk about high levels and low levels. We don't have a solution, but with the power of all of what we're doing, you can

bring one. And I think that really will open the door and help people here in a different way to help you do that.

There was a conversation Jeff and I had -- we just met today -- and he said, you know, I think as a small organization it's very hard to go talk to 18 organizations. It could take you a year. And so I said, why don't I help you think about a Greater Washington partnership? You can hit 20 CEOs, 20 heads of HR. We sit on those committees -- that's why we were a founder and a sponsorship -- to say how can we deeply find the right organizations and accelerate and give scale to organizations who can't find it on their own? And they're in all the metropolitan areas. So please reach out and we can really help to connect. I think business does want to; I think they don't know how.

MR. LEVINE: That's a big takeaway from today.

We are getting really short. Can we take more questions? We can take more questions. Okay. We're taking a couple more questions. Be brief. Be concise. Okay. This lady here and this lady in the front has been asking from the beginning.

MS. PASKA: Hi, I'm Cindy Paska from the Council of Scientific Society Presidents.

The issue that Byron has mentioned, you've all mentioned, is the one that says you can't get into an office. There are algorithms that lock out those who don't have degrees. What are the ideas that you have to address those algorithms and maybe overcome them so that there's another way to look at it?

MR. LEVINE: Thank you.

Who else here? Let's get this woman right here.

MS. SEGERO: Thank you so much for your presentation. My name is Rosemary Segero. I'm the president of a profit and demand, profit organization. We focus on small and medium businesses and on manufacturing.

Looking at your presentation, how do small businesses come into this

digital -- I come from Africa, Kenya. Kenya is one of the countries that is digitalized. In fact, we are supposed to be talking about global digitalization. When you look at (inaudible) we cannot do everything by (inaudible). We have people with (inaudible). The (inaudible) is there but how do we get to these people (inaudible) the diabetic people that won't be covered, and how do you look at cybersecurity? You are in the middle of -- somebody, you're talking to a medical doctor and then the digital goes off. What happens to that person? How are you looking into all that and how can we work with you on looking at small and medium businesses (inaudible) and Washington, D.C.? Thank you.

MR. LEVINE: Thank you.

One more question. Go to this side.

MS. HEGEWISCH: Thank you. My name is Ariane Hegewisch from the Institute for Women's Policy Research and we're just starting a program on gender and the future of work and digitalization.

You said women are more involved in digitalization in their occupations. There's been a huge change over the last 12 years or 14 years of the survey, yet the wage gap has not budged at all. So is this going to impact equality and earnings in terms of gender differences? How is it those who manufacture IT skills will earn much more and women who use it and have to use it more indirectly or (inaudible)? So what with gender, basically. Big question but short.

MR. LEVINE: Great. Great, thank you.

Okay. I'm going to squeeze in a fourth. Right here. Because of the face. There was a face made.

MS. LACHAPELLE: You're compelling.

SPEAKER: Thank you. My name is Kay and I'm with Rema Consulting.

To me, when I was watching this lovely slide show, one of the things that stuck out to me was that map of the United States and how in some cities things are

going to be great. There's such demand for all these jobs but in these other cities they're out of luck. They really need to work on getting their people skills. That way those people are going to be able to get the jobs. And you even mentioned that this trend is accelerating, that these two things are tied together.

So my question for the panel is what can cities do to help in this very challenging situation? I think it ties into so much of the larger national dialogue we have right now around the division between our metropolitan areas and the rest of the country? So, yeah.

MR. LEVINE: Thank you. Thank you. We'll call it there.

Who wants to take the algorithm question? Is anyone --

MR. AUGUSTE: I could do the algorithm and the small business together because they're very related.

MR. LEVINE: Okay, good. That's good.

Who wants to take this question here?

MS. LACHAPELLE: I mean, I'm happy to discuss --

MR. LEVINE: Okay, great.

MS. LINDSEY: The city one.

MR. LEVINE: And city. Okay.

Byron?

MR. AUGUSTE: I think the heart of the algorithm problem is to really have a marker of a demonstrated competency; right? And then a credential is something that should essentially preserve that over time. Right now a lot of the things we call credentialed degrees are markers of many other things. They're markers of affluence; right? What can you afford? Like, how much time can you take off? Like, many, many other things. Seat time, et cetera. So what we want is a marker that you can get to anyway in principle. Maybe the best way to do it is through a school but you don't have to do it that way. So that's a very important thing. And then you can embed it in these

systems because it's true that most of the tens of millions of people, of job applications a year are screened out by software. They don't ever -- they're not ever seen by a human; right? It's an algorithm. It's the algorithm that's meant to, broadly speaking, reflect what a company things is a way to narrow the pool because you can't interview 3,000 people. You have to narrow it in some way. That's not nefarious. But the question is what way do you do it? And if you narrow it based on say a college degree in a world in which our colleges are seen as selective based on how many people they can exclude, right, per U.S. News and World Report, I mean, you basically bake in a whole system of quality, demonstrate quality that requires exclusion, right, to create a signal. But a signal that says I can accomplish this to this level of competence, define a set of things, well, there's no theoretical limit to how many people can do that which is good because there's no limit to (inaudible) work there is to do, right, in the world actually.

So I think there's two things. What we say to the companies we're working with, we have to make it -- we have some companies that come in and -- they care. They see the value and they'll put some extra effort, and frankly, we couldn't -- I mean, all of our validations are done with companies. Like our software developers with Amazon, with Pinterest, and with PNC Bank Corp, for example, and all of them we do with companies because that's the only way you can do it. But what we say is we shouldn't have to do it for every single company because what it takes to demonstrate a competence for one company shouldn't be different. So that's the key, is to have companies being willing to sort of accept it, and what we don't say is we know better than you who you want to hire. We say we can create a pool that you're not seeing and then you consider it. Right? So just getting you to the sort of final round if you will. Right? So that's what we do.

And then to make it even easier, some companies want to sort of try to embed in their system, and it's pretty easy. I mean, you can just go, you see a pool, you can look through the profiles, but we're talking to, under NEA, with applicant tracking

system software providers about being able to embed that in their software. So actually, a company could then just turn on the inclusion module, right, in each thing and it's going to make it that much easier for a company to do it. And you know, LinkedIn, we have like a strong partnership there and with GitHub to sort of be able to demonstrate. I mean, we have the tools to do it. It's a question of wiring it together.

And so, I mean, it's clear, right, that we have a company here who really would like to do it but is it right to expect that company to develop a whole system for themselves? That's unreasonable. That's not their business. So the question is how do you set up a utility to allow it to do it, which is the key to the small business question. Because the small businesses are even more unable to set up their own system and even unable to sort of just send up a flag. Amazon as a single company can say I'm hiring and like 50,000 people apply but, right, those businesses can't. So part of what we're doing is having both the big branded businesses and the smaller businesses, right, on the platform. And by the way, we expect tens of thousands of the smaller businesses to get there through the supplier portals. So Walmart, who is a participant in this, they have tens of thousands of small businesses coming to them every week to see pricing and specifications, so now they can see here's a way to get overlooked talent; right? So in other words, use the infrastructure of the system we have. Our tagline is "rewire the U.S. labor market." And when I say that people say, oh, that's a cool tagline. What are you actually doing? Well, spoiler alert, what we're actually doing is rewiring the U.S. labor market because that's what you need. You have the pieces but they don't work the right way and they don't work for the people we're talking about. Which by the way isn't five percent of the country; it's 50 percent of the country, which is why as a market it's also very valuable. So I think companies are absolutely going to want to do it.

MR. LEVINE: Thank you.

Robin?

MS. LACHAPELLE: Yes, I will take a moment.

I think if I rephrase and make sure I understand your question around certainly women and accelerating women into these pools of talent, we spent a lot of time on that inside our company and outside our company, I think there is a disparity today certainly of those that develop high-end -- develop software and those that use it. There is no doubt. I think when we look within jobs there's probably some equality of pay. I think the issue we have is how do we get more women into those level of jobs where they can get equal pay with the level of skills they're bringing.

And we've done a lot of work. I think you hit -- earlier on the panel I think we hit on it a bit when Jeff was talking about some work they do. Why do you have a Coder Girl training is because they need to be skilled to ask for it, to negotiate it, and demand it. And I think oftentimes when we do a lot of work, we had a summit with our own company. We had 4,000 this year at our Women's Summit, which is made up of women and men because we need advocates for it as well. And what we spent on it and our theme of our summit was "Empower Yourself." The knowledge is out there and we've done a lot of coaching with our teams. Now, as a company for the good of the company we look at it every year. We signed the Equality for Pay Initiative within the U.S. with other great companies here and we absolutely believe it. So we don't (inaudible) but what we want to do is make sure whether they're with our company or any company, you should demand right what you should get for your skills. And I think that's a skill they don't have. So even when they get the technical skills, what we're finding, and I see it. I see it in the female scientists who come into an organization and we're very blessed that we actually run our organization. We have 50/50 men and women and we're actually 50 white and nonwhite in our organization. It's not anything I take credit for building; it's the legacy of the organization I joined three years ago which is a wonderful thing.

So it gives us the power. We really talk about inclusion in our company versus can I get my numbers looking right. So we really focus a lot on inclusion. How do

we empower everybody? Where is that acceleration? And we look at that. We look at that in our promotion numbers. We look at that in our mix of training. We look at that in our mix of who we're looking at in our pools. But I do think that companies need help. There's no doubt. When we look at the mass of inundation we get of resumes and how we put our jobs out there, we have been trained to go after the best; right? They measure on that. That was the tagline for 10 years. I want the best talent in the industry. And the reality is they don't stay. They don't really want to be there oftentimes and they're going to leave you at some point. So I think the move to stability in your workforce with people who are skilled to what you need, that you can invest in, that are motivated to be with you, is the future of where companies need to go because that's what you need. You can have a few best who will hop in and hop out and they're interesting, but you can't run a company on that. And I think that's where people need to come back off of a bit. But people jumped on that bandwagon. That's what they wanted. And then how they defined the best became let me go find the list of the best universities, the list of the best -- we still do it, the best companies to work for. You will see we actually don't submit on that. Why? Because we're the best company to work for everybody. I'm not the best company to work for the top 10 people who want to read Fortune Magazine. And that's okay, and there is accolades for that and I understand why companies do that. I think they've broadened their criteria of why and how do you treat your employees, which I think is a better innovation than what it had before. If you go back and look 15 years ago it was who were the top paying jobs and those were the best companies you could be at. I think people want more in their job. I think people should demand more from their companies and their job. You want to be a company that serves the whole population. You want to be a company that is observant of social issues; right? We have green technology. We rewired for solar. Why? Not because (inaudible) wanted to make a list, because we legitimately believe we use a lot of power in our labs. I want to be responsible in how we do that.

So I think that is how we can help women. And I'm happy to have a conversation about that. I don't think that I could sit up here and say there's a solution yet but I think it is one that needs one fast.

(Applause)

MR. LEVINE: Very, very brief.

MS. LINDSEY: So I'm answering the question about cities and how can cities participate and really make change.

There was a great conversation here a few weeks ago about the dozens of cities that were competing to get Amazon HQ2 and I think one thing that the cities can do on the demand side or demand for labor side is really focus on bringing in companies that are like what you described. Companies that do care about inclusion that really want to make a social impact. And then on the side in terms of training and supporting the workforce, I think here in D.C., as a D.C.-based nonprofit, we are extremely supported by our local government. So we get a huge chunk of our funding from the D.C. Office of the Chief Technology Officer. There's an entire program that's just around bringing low income folks, getting them skills, getting them tech skills. We are part of a partnership with the Washington, D.C. Economic Partnership where we train individuals to then apply for a scholarship and get fully funded coding training. So I think that there are ways that local governments can work with the nonprofits, work with employers, employers that are getting incentives from cities, getting tax breaks, and really say how can we ensure that not only are our residents trained and ready but really push companies to be thinking more creatively about how to bring in people and diverse populations.

MR. LEVINE: Thank you. Thank you to the panel.

Mark Muro is going to make closing remarks.

MR. MURO: I just wanted to thank everyone here. Great panel. Thank all of you for your concentration and great questions.

I'll just say one thing about, I think cities have to think this is an issue and

I think the best thing they can do is not try to solve it themselves but in networks with people like Byron, Jeff, Elizabeth. You know, I think some of the best models are bringing in these kind of plug-and-play solutions that these organizations are working out new ways to do this. So anyway, I just wanted to thank you all.

Just also want to forecast more work coming along these lines. Work by Bill Fry, a great demographer here on millennial questions and how that affects the labor market. We will be releasing a big report in the first quarter on how these and other issues are affecting the opportunity prospects of older industrial cities. Opportunity jobs. What jobs exist that can give people entry yet allow a decent living and a pathway to move forward?

So I just wanted to flag all that. Thanks so much for joining us. So thank you.

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