

George:

Hi! Welcome to the Global Opportunity Initiative Podcast Series. I'm. George Westerman, Your host. Our guest today is Ben Armstrong, Ben is the executive director and a research scientist at MIT's Industrial Performance Center, where he also co-leads the Work of the Future initiative. Ben's research and teaching examine how workers, firms, and regions adapt to technological change. His current projects include

- a national plan for the U.S. manufacturing workforce in partnership with the Department of Defense,
- as well as a regional playbook developing lessons for struggling regional economies in the United States.

Ben welcome ben. First, can you tell us a little about what your research entails?

Ben:

Well, my research focus is on wages in manufacturing and the evolution of wage rates and essentially why some jobs earn higher wages than others on the factory floor. But it also looks at the relationship between technological change and job quality in manufacturing as well as just the challenges of automation. So the challenges of automation extend beyond manufacturing, of course, and I study it in manufacturing and health care.

And then yeah, so I think why I'm interested in job challenges in manufacturing is mostly because manufacturers are interested in it. So over time when manufacturing was declining between 1979 and about 2008, 2009, manufacturers weren't that interested in recruitment and retention because they didn't have the money to recruit and retain. So workforce issues were pretty low on the totem pole of priorities for US manufacturers.

And at the same time during that period, you see the silent killer becomes the atrophying of the workforce ecosystem, that there's less and less investment in developing technical skills and trying to promote manufacturing careers. Fewer and fewer young people are going into those careers. So it's this ticking time bomb such that when manufacturing starts to expand again in about 2010, manufacturers begin to realize, oh shoot, we have this big problem that we need to recruit the next generation of workers if we're going to expand.

And what they found when they tried to start recruiting those workers is that they needed to totally reorganize the way that they recruited and retained, developed skills, and also the way that they thought about retention, because turnover started to go up. The life cycle of a manufacturing career today looks a lot different than it did previously because turnover across industries is much higher. People spend less time in individual careers. So that transformation of how manufacturing firms relate to their workers is really interesting to me and it's a top priority for them. So it means that my research hopefully can matter or help shape some of the views of companies that I work with.

George:

You used the word “atrophy.” that’s an interesting way to describe the current situation. Can you explain what you mean a bit more for our audience?

Ben:

Yeah, when you have-- just you could think about infrastructure in former industrial cities. That if an infrastructure is built for 3 million people and your city shrinks to 1 million people, then a lot of that infrastructure is no longer going to be used or you're not going to be able to afford to maintain it and then you're going to have other problems. You look at the water system in Flint and other issues in the Detroit area as one example.

Similarly, with an ecosystem in manufacturing, historically there were vocational high schools, various programs, unions that supported training, and good job opportunities and high improved work conditions. And when you get declining union membership, you get declining interest in those vocational programs and you get fewer extension programs or consulting firms that might be surrounding big manufacturers and their suppliers. You have less support for manufacturers when they want to grow and they want to develop new products or technologies. And it's going to be harder for them to find the skills necessary to expand.

So that I feel like is the environment that I've been studying in recent years is a product of the atrophying of this old system that was pretty vibrant. In my work, I show that there have really been two equilibria in manufacturing over time. The equilibrium between the post war period, so about 1947 is the date when I start measuring, to the early 1980s is a period in which wages are growing alongside growth in productivity, growth in value added, and growth in job availability for manufacturing workers. That's a pretty good picture. That's the picture that we all we'd all like to see.

And then over time, the picture has been flattened wages, flat technology adoption, and flat value added. So in the second picture with no growth in manufacturing, no one's really winning. I mean, maybe there are some folks capturing rents and in that scenario. But workers aren't winning and firm owners aren't winning on average in that scenario. So my work by focusing on the workforce and really trying to get to a new positive equilibrium where wages can rise alongside productivity and technology adoption.

George:

OK, so the story that I hear you telling is that when there was this equilibrium between demand for skills and the people that had the skills, this worked for everyone. And then something happened in the '80s where that equilibrium went away. And it sounds like you have more demand for jobs than have jobs available. And so that turns against the workers. And so I could think about things like there's globalization, there's offshoring. What else was causing that in the '80s to shift this equilibrium?

Ben:

Well, there's some global competition story here. In the early '80s, it's from Japan primarily. And then there's a policy story where there's disinvestment in US industry and from the communities that produce manufactured goods in the US from the Reagan administration. And there was a concerted effort in the '70s to say, hey, the future of the country is in the South and the West. The future of the country is in services.

And essentially, the idea was in the Reagan administration that the markets are pointing toward America's competitive advantage in services. So let's welcome this trend and let's support it with our training institutions. Whatever non-market investments we make can support this trend of people and of investment to the South and the West and their comparative advantages. And in the short term, this was advantageous to certain communities, certain companies.

But in the long term over multiple decades, I think it's pretty clear that the disinvestment or essentially the abandonment of many communities in the Midwest and their associated industries work to the strategic disadvantage of the United States in terms of national security. And it also contributed to the hollowing out of middle wage jobs.

George:

So Ben, can you tell us, your background is really interesting for somebody who studies these manufacturing workforce issues. Tell us a little bit about your career and how you got into the kinds of topics you're in now.

Ben:

There's no logic to it really, so I won't-- if there is logic, it might be hidden. So I won't try to draw a straight line. But after finishing college, I took an entry level job in Silicon Valley and bounced around jobs in the tech sector trying to learn what was happening in this very fast paced, high growth world of software startups and big companies that seemed to be the model of what so many other companies were trying to follow in terms of how they treated their workers, the growth that they were after, their creativity.

So I felt like an observer, a paid observer in that world for several years before going back to graduate school. I was always pretty sure that I wanted to go back to graduate school and get my PhD, although the allure of tech startups was strong for a moment there. And I came back to do my PhD at MIT. I was actually admitted to do a PhD focused on political economy in sub-Saharan Africa focused on the role of taxation in state building.

And my PhD advisor, who I was planning to be my PhD advisor, was leaving at MIT for personal reasons right when I was coming in to study. So I was essentially a student without an advisor and rethinking a lot of my interests, in part because I was doing work in sub-Saharan Africa in Ethiopia as part of a nonprofit I was leading. And I was mugged on the street and I was knocked unconscious and had nothing, no passport, no phone, no computer, and I was in this foreign place and didn't really feel that I belonged or was doing good work, necessarily, when I was there.

So I was rethinking a lot of things and remembering my roots and the political economy challenges in the place where I'm from. I'm from a town outside Chicago and I have family connections to the automotive industry. So I started thinking about the struggles of places in the industrial Midwest and economic development challenges associated with them that were different than the economic development challenges that I was focused on in Africa but still very real and very important and I think often overlooked.

So my PhD work then focused on why some former industrial communities continued to struggle while other industrial communities were able to adapt to economic change. That led me to do work on Pittsburgh and Cleveland and Albany and Rochester and now other regions. That was my first major research project.

And then after my PhD, I became interested in a number of other challenges, not least of which was the collapse of the American middle class. And I was influenced a lot by David Autor's work, and others' work, including folks like Matthew Desmond, who do really important and interesting ethnographic and qualitative studies of social and economic problems in the United States.

And I wanted to dig deeper on what was driving the hollowing out of the middle class but also where middle wage jobs would come from in the next 50, 100 years. So a lot of my personal interests are trying to do research with impact in the region. Kind of the regional story is trying to help regions get the tools to create better jobs so that they can rebuild after multiple decades of struggling.

And then my personal interests in workforce issues is to figure out how we might in the United-- I'm focusing on the United States, but I think the hollowing out problem is broader in many OECD countries. And it's a question of how we might reverse this trend of a declining relative share of middle wage jobs. Of course, when you put it like that a declining relative share of middle wage jobs, that has a real nice ring to it. So I might not be the best person to market this, but I'm definitely interested in strengthening the middle.

George:

So clearly one of the points that I believe you're making is that the hollowing out of manufacturing contributes-- it's a big contributor to the hollowing out of the middle class. And then you talk-- let me say that again. So clearly this idea that hollowing out of manufacturing contributes to the hollowing out of the middle class is important. You mentioned some of the things that are happening here in the US. What does that look like in other parts of the world? Are they the same contributing factors or is something else going on?

Ben:

I want to put a big disclaimer on this where I'm a consumer of research in other parts of the world more than a generator of research in other parts of the world. So I'll give my outsider's take. And I think that some of these challenges in places like France and the UK and I think to a lesser extent Germany are similar where they're trade related and perhaps they're technology

related. And I think that some of the challenges that I focus on, which is slow technology adoption and difficulty recruiting and retaining workers who are driving productivity increases, that those might be similar as well.

Where the United States differs, at least over the last 10 years, is that places like Germany and other EU countries have been growing their productivity since the Great Recession, whereas in the United States, employment's been growing, but productivity has been declining because value added and technology adoption has been pretty flat. Technology adoption has also been flat, at least if you look at robots, in European countries. Really the only place where robot adoption has been increasing dramatically is China.

But in the US, we have I think some deeper issues. And this goes back to the atrophying of the ecosystem and the minimalist role of the federal government in supporting manufacturing growth that I think our problems are probably more severe. But again, that's my heavily caveated take given my limited knowledge of the OECD manufacturing context.

And also it's important to note that a lot of-- let's just take EU countries. They're involved in different industries that have varied workforce needs and wage structures and the like. So when we talk about manufacturing, I think it's important to put heavy quotes around manufacturing because aerospace and textiles are vastly different industries. And really it's almost silly to put them in the same category, because just from a workforce perspective, you could make double the wages in aerospace than you make in textiles in the same country.

So the jobs are very different. The technologies are very different. And the only real thing that ties you together is that you're producing something physical. So it's tough to say, to compare, let's say, in an Eastern European country with lower value added manufacturing to a France that has a big high value added aerospace industry, for example.

George:

So Ben, you've talked about the developing and rich nations. But you also have this role running the Industrial Performance Center. And so the IPC deals with Brazil and other countries that are not quite rich world yet. So what are you learning from that part of the world about workforce and manufacturing?

Ben:

My colleague Tim Sturgeon has been leading an effort called the Global Research Network that has done a survey in multiple countries asking the same questions about technology adoption and some workforce issues comparing Malaysia, Turkey, and Brazil. And those results aren't out yet, but I do think that from that effort, we'll learn a lot more about middle income countries and their patterns of technology adoption and the consequences for the workforce.

I think one of the overarching findings that we've learned and that others have learned from places like China, and I think this applies in Brazil, is that whereas there might be some automation anxiety or some concern about the consequences of automation for jobs in the

United States and the EU, that's not present in places like Brazil or China. Automation is really associated with a big upside for productivity and for growth without the downside of, hey, what will this mean for displacement?

And there's more evidence now I think than ever that even in the US, we should be adopting this, I would say, cautionary optimism about new technology adoption, that technology adoption at the firm level is associated with growth for those firms, and that there are organizational strategies that firms might be able to use to ensure that those technologies can be beneficial to workers.

George:

OK. Well, so that's a strong point, that technology adoption should be good for the bosses and the workers. But at the same time, so much of the US manufacturing base is these small employers. And you've told me some very interesting things on the challenges that these smaller employers have in technology adoption. Can you share a little bit of that?

Ben:

Yeah. So I should be clear that small and large firms have challenges with technology adoption. The challenges are somewhat different. But I don't want to paint this picture that large firms are running lights out production and they're incredibly efficient and their productivity is increasing dramatically whereas small firms are left in the dust. Large firms are also struggling to extract big productivity gains outside of automotive, which is heavily automated, high robot adoption. There are still a lot of opportunities, I think, for productivity gains in automation even within automotive, I think.

So if we look overall, large and small firms, productivity has declined in manufacturing since 2010 in the US. So I'll start with that qualifier. But small firms are a peculiar and I think really interesting challenge. They make up 98% of SMEs, I think this is the number, with fewer than 500 employees. Depending how you define a small firm, it's maybe half and half of overall manufacturing employees in small versus large firms or small versus large establishments.

And small firms, one of the driving differences, one of the differentiating factors is ownership structure and growth. Let's say ownership structure and risk tolerance. So a lot of family owned firms that have a lower risk profile and are satisfied with lower growth over time.

And what essentially that means in the operation of these small firms is that they're not investing heavily in new technology or new hires or skill development to pursue new areas of business. If they have a niche and they have margin in that niche, they could accept and really just rest on these successful product lines that they might have developed over time.

It's also important to note that a big chunk of these small firms in the regions we've studied, about 40% of them, have at least one defense contract. So the federal government is playing a big role in supporting this industrial base of small and medium manufacturers. And these defense contracts typically have higher margins than firms might get in the commercial markets.

So I don't want to overgeneralize, but I think what we see is a risk averse profile of a lot of small firms, a lot of relationships with the federal government providing defense related goods, and a lot of niche production where the only type of firm that can do this particular type of work, they have long term contracts, and they're not really in a position where they're pressured to grow or to compete.

So it's a situation where the market isn't necessarily working as it should. And that is one of the explanations, I think, in my mind of why technology adoption has been so low and productivity growth, we haven't seen the productivity growth that we might expect in an era where there's a lot of new technology that's available to, let's say, automate and improve productivity. And it just hasn't come to pass.

George:

The owners are saying, why do I need to grow? Things are going fine. Why do I need to take on the risk of growing? Is that what I'm hearing?

Ben:

Well, it's the growth profile in my head. So it's why do I need to grow faster, perhaps. Because some of these companies, they're growing and they're profitable. So from a family owned business perspective, it's saying I'm making money. I'm supporting perhaps the next generation. A lot of firms have challenges with succession planning. So the next generation might not be interested in manufacturing, which is part and parcel of the broader workforce problems that a lot of these firms face is they worry that the next generation just isn't interested in manufacturing.

So these challenges, I don't think-- none of these companies are anti-growth. If you gave them a really good opportunity that fit their existing capabilities, sure they'd jump on it. But what I'm suggesting is that-- and what's really been striking to me given my limited experience in the software world where growth is everything, your company is willing to take big risks to grow and invest a lot of money with very little certainty in growth opportunities, new product development, et cetera, I see so few companies in manufacturing willing to take far smaller risks to grow. Perhaps even looking into adjacent product lines or adjacent industries. That's just not really in the vocabulary of a lot of the companies that I've studied.

And to some that might be OK. They're like, well, these manufacturers, they're stable. They're reliable companies. We don't want them to be taking big risks. But from my perspective looking at the long term stagnation of US manufacturing, there needs to be some engine for calculated risk in the industry if the industry plans to compete and grow over time. And right now what I see is a lot of stability and very little risk tolerance.

George:

One of the things that's fascinating from your background is you're a political scientist studying research with an economic lens. How much is this technological and how much of this is political what's causing these trends?

Ben:

Well, there are certainly trade policies that have affected the evolution of US manufacturing. And you can look at trade policies and labor policies beginning in the '80s as well as the similar policies or policies I would say in the same paradigm that accelerated in the '90s, including NAFTA, that had huge impact on particular industries in the competitiveness of certain industries in US manufacturing. And I think along the same period, you see trends in defense procurement, which also has affected how US manufacturers can compete.

And what I think is interesting to see over time is that beginning in the 1980s, it became clear that in certain industries, the US just couldn't compete on wages with first Japan and then China and places like Vietnam and Malaysia, et cetera where it's like, OK, well, we can be more productive than our global competitors. But we still can't compete because our costs of labor are so high.

And the response I think for a while was downward pressure on US manufacturing wages. The idea that, OK, we need to go into the South. We need to work with a non-union workforce, because if we're even going to come close to competing, we've got to avoid increasing manufacturing wages, wages on the factory floor. So for a long time, and really what you see is adjusted for inflation, wage levels today are pretty similar to what they were in the '80s in manufacturing.

And just to put a fine point on it, in the 1960s, if you don't have a college degree, so the person kind of stepping out of a vocational high school or a community college in the 1960s would make 40% more in manufacturing than they would in another industry. So it's a really good job. Huge premium in manufacturing in the 1960s.

And that premium has just decayed over time, such that today in Massachusetts, you step out of a vocational high school or a community college, you're going to make less on average in manufacturing than you'd make in a non-manufacturing career. So manufacturing used to be, and we could put it with a capital G, Good job for someone without a college degree. And today it's just comparable to other jobs.

And I think one of the drivers of that change is this Downward pressure on wages for companies trying to compete on wages. And the evolution of manufacturing business is that, OK, now companies realize in many industries, they can't really compete on wages. So they need to compete on something else. They need to compete on quality or on service or really on reliability and productivity. So they've recognized, hey, we need higher wages, because we need much more skilled and reliable people.

And we need to compete for talent domestically. We can't just take the person who's willing to accept minimum wage, because that's going to lead to high turnover and not good performance.

Not because there's anything wrong with that person, but because we know from efficiency wage theory that there's going to be different performance if you pay one person \$20 versus paying them \$10 an hour.

So I think that there's a whole bundle of issues here with how the business model of manufacturing has changed as manufacturing in the US has declined. It's really fascinating to me. And that business model really has affected how manufacturers are approaching their workforce and what they want out of their workforce.

And some manufacturers have been faster to adjust than others. I talked to some that kind of realize they're in an old paradigm where they're recruiting people the way they would have 25, 30 years ago, but they realize they need to change and they just don't really have a model for how to change. Because what change looks like is you've got to redesign jobs.

What a machinist used to do and how a machine is used to be trained is no longer relevant, particularly if you're going to be paying that machine it's \$30 an hour as opposed to 15. So these questions around how to recruit, how to redesign jobs I think are all really important and I hope kind of exciting from your perspective, George, given. You work on workforce education and these issues of skill development.

George:

Why is it taking-- if this trend has changed starting somewhere around 2010 where people started paying attention, why are we now almost 13 years into this and many of the manufacturers haven't quite caught up?

Ben:

I wish I had a good answer. I mean, OK, so how I have thought about it is I think you're right that this has been a long time and we could look in retrospect to these business leaders, these people leading small businesses and say, you should have seen this in the '80s and '90s, you should have started to change and you should either-- by now you should either have changed or you should be out of business.

And the irony to me is that there have been a lot of manufacturers that have gone out of business. So I think one is a lot of the companies that even might have tried to change were unable to. And the companies that did survive that we see today and that we can study and observe and that show up in the data, they survived and kind of they were able to grab on to life rafts that might include the Department of Defense that are looking for different qualities than the market.

Or they might have kind of burrowed into a niche where they're able to provide something, a part of maybe their legacy product mix that is really important, has a high margin, and doesn't require the types of technologies or skills that are no longer available. So I call a lot of these firms that are able to survive with comparatively low wages and low technology, they're survivor firms. They're not in a growth mentality or growth crouch. They're in a survivor mentality.

George:

You study the difference between what should look like similar jobs and some earn a higher wage than others. Can you give us some hints on what makes the job a higher wage job versus a lower wage job?

Ben:

Yes. So I have recently been doing this work in US manufacturing over time looking at the microdata from the census and taking censuses over a long period. And through the census, we're able to assemble hundreds of thousands of manufacturing job profiles across different industries with different education levels and in different occupations.

And how I've characterized these data are really three tiers of manufacturing work. There's a lower tier, which are really assembly jobs and operator jobs that are more likely to just have a high school degree. And these jobs are pretty low wage and oftentimes are more at the entry level. And in some firms you can move up from those jobs into the second tier, which includes technicians and more precision production work and kind of supervisory roles.

But in other jobs, if you're in assembly, that's kind of where you're going to stay. And the second tier makes significantly higher wages, something on the order of maybe 20% higher per hour, and has a band, a distribution where you could end up making high five figures, even six figures in those roles. Depends on the geography.

And then the third tier are really engineering roles. And typically we think about engineering roles as requiring a college degree. But it turns out, and this varies by geography, again, that in manufacturing, about a quarter of engineers in US manufacturing do not have a college degree. So there's a big chunk of people without a college degree. They make significantly less than the engineers with a college degree, but they make significantly more than the technicians or precision production workers without a college degree. So their educational peers, they're making a lot more in that third tier. It's a big jump to get into that engineering role.

So I think these tiers raise a number of questions. One is how do you move up the ladder from tier one to tier three and what's the role of additional credentials or education in moving up that ladder? And then B is at the firm level, what are the organizational characteristics of a firm that would promote a high school graduate to be an engineer? And what skills are they looking for? And where do those skills come from? Are they coming from apprenticeship on the factory floor? Do they come from night classes? Could they come from an MIT micromasters?

So all of those are really interesting because that non-degreed engineer, those 25% of manufacturing engineers, that's a really good job. That's a really good middle wage job. It's actually kind of a high wage job for someone with only a high school degree. And one of the findings or kind of policy focal points for me is, OK, how do we expand the ladder to those types of careers?

Now, you asked what are the sources of variation? Why might someone in a similar position, let's say, in that first tier make more than another person? One axis of variation is industry. So like I said, there's huge variation between at the top end aerospace and at the bottom end textiles or food processing, for example, in manufacturing.

And there's an interesting distribution that in some cases, in some industries, you have really high wages at the second tier. And in some industries, you actually have pretty low wages for technicians but high wages for assembly work. So you can kind of see through these wage patterns which industries really value certain types of occupations and require more skills for certain tasks than others.

And then finally, another axis of variation is education. So there's an education premium across all these occupations. People with more education earn higher wages. The big education premium is going from a high school graduate to having some college. And we can't really tell in the data whether it's an associate's degree, a certificate, or whatever else. We just know they have more than a college-- or sorry, more than a high school degree. And then in the first two tiers, having a college degree doesn't make that much of a difference over some college. The premium is pretty low. The biggest is there's an advantage to some college over just high school.

And what I think is interesting is that I think about it. If you're, let's say, in a low wage manufacturing career, let's say you're doing assembly in a food factory, a food processing factory, would it be more advantageous for you to go to school to get a two year degree and then go back into food processing in a similar role or would it be more advantageous for you to go switch industries?

And in many cases, it's more advantageous to switch industries into a high wage industry, because the gap between industries is higher than the education premium. Now of course, it would be better to do both, to move up and to move across. But I do think the size of the gap between industries was really striking to me.

George:

We've been dancing around this idea of unions and the role of unions in training, in wages, in middle class health. What's your thinking on the role of unions here?

Ben:

I don't have an easy, clean answer. I think that there are cases where unions-- I mean, we can look at European cases where worker representation and sectoral bargaining is critically important for industries in transition and helps these industries identify what skills they need to grow and to compete.

So I think the role of unions in figuring out how to implement flexicurity in Denmark is really important and instructive. I think about both unions but also workers councils, which can be separate from unions in Germany, as a way of figuring out how to coordinate the demand for

skills with the supply of skills, which is something we haven't quite figured out in US manufacturing.

So I think that these other countries give us some great ideas, although I wouldn't say the US is prepared to adopt any model wholesale of how worker voice and worker representation might look in the United States. Union density in the United States is pretty darn low in US manufacturing. There are still union factories, a lot in defense contracting, for example.

And I think that although union representation can be advantageous in terms of wages and support for workers' rights, I think a lot of-- you saw a lot of challenges for workers' rights during the early stages of the pandemic where unions can stand up for workers when they feel like they're at risk of being exploited or abused, which I think is really positive. But there's also when companies are trying to adopt new technologies or redesign jobs, I think also it's important to have a partner that is flexible and can see benefits for workers in that technology adoption.

So I'm excited about some large unions and their involvement in conversations about new technologies and how they're going to affect workers. But the strongest examples I know of for long term, durable cooperation between labor and management still come from other countries.

George:

OK. Thank you. Well, Ben, it's always so great to talk to you, because you've got this wonderful perspective on not only the US but these concepts apply to other parts of the world also. So I want to just thank you for being with us and sharing your knowledge.

Ben:

Thanks so much. I really appreciate the invitation.

George:

Ben I want to thank you again for taking time with us. I learned so much and hopefully our listeners have as well. As always, if you have any questions or comments, or if you just want to talk about this work or any other work. You can write to us at GOI Dash Info at Mit dot Edu. Thanks, and have a good day.