

Changing the Face(s) of Manufacturing

Shawn Moylan

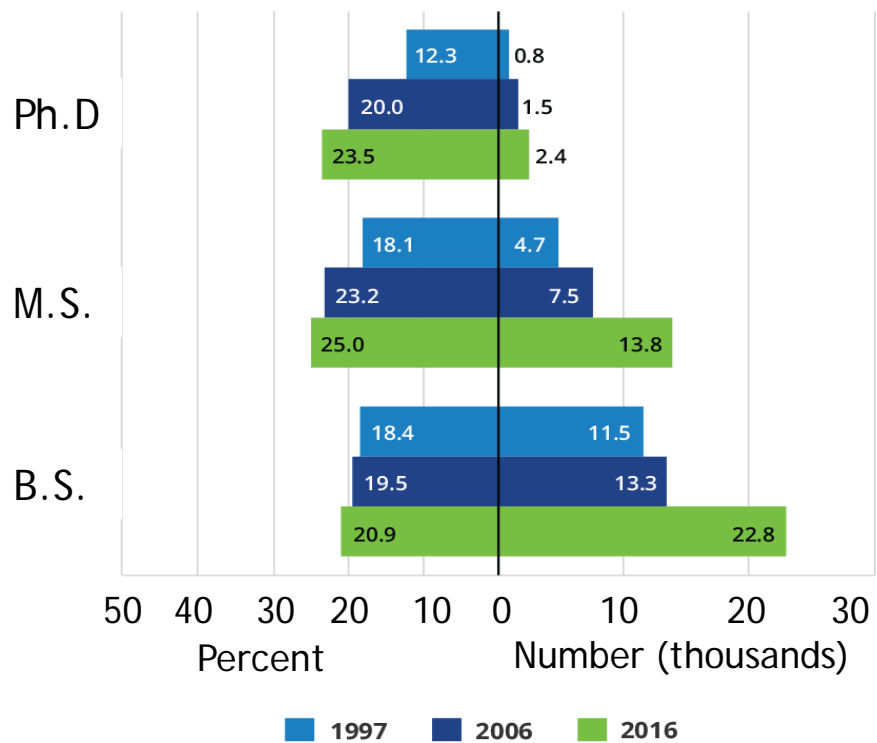
Blue Sky Competition

June 12, 2019

Industry	2018					
	Total employed (thousands)	Percent of total employed				
		Women	White	Black or African American	Asian	Hispanic or Latino
Total U.S. workforce	155,761	46.9	78.0	12.3	6.3	17.3
Manufacturing workers	15,560	29.2	79.5	10.4	6.9	16.7

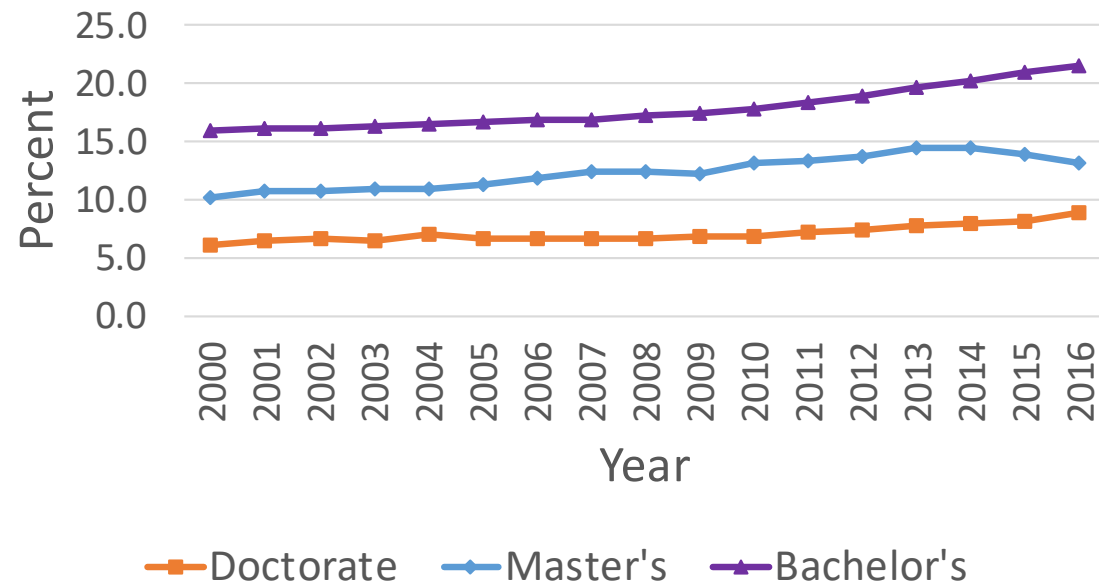
Source: BLS

Engineering Degrees Awarded to Women



Source: NSF

Science and engineering degrees earned by underrepresented minorities, as a percentage of degree type: 2000–2016



Thanks!

- ▶ Joannie Chin, NIST
- ▶ Maria Dillard, NIST
- ▶ Alkan Donmez, NIST
- ▶ KC Morris, Office of Congressman Tom Reed
- ▶ Ben Isaacoff, Office of Senator Gary Peters
- ▶ Brigid Mullany, NSF
- ▶ Debbie Tekavec, Carnegie Mellon University

Good morning. Thanks, ZJ, for the introduction. For those of you who don't know me, I'm Shawn Moylan. I'm a mechanical engineering at NIST where I research additive manufacturing, and I'm a former Chair of ASME's Manufacturing Engineering Division.

My talk today is going to be a little different than what we've seen from previous Blue Sky Competitions, and I'm doing that for a few reasons. One, this is a bit of a different topic in that it's not really about manufacturing technology, and it's not – strictly speaking – about what's next for advanced manufacturing research. Two, I don't want to patronize folks with buzzwordy or cliché-picture slides with minimal actual content. And three, I want you to really think about this.

I have only one slide – here it is. I'm just going to leave this up while I talk and really let this sink in.

I know that part of the agreement for finalists in this competition is provide slides to the organizers, so as an alternative, I've essentially written down what I'm going to say and I've sent that text to ZJ and he can post that online for people to read. I'm not going to read verbatim from what I've written, but it should be pretty close.

Before we get to this slide, let's take a step back and think a little about one of the motivations for my proposal. Manufacturers, especially those dealing in advanced manufacturing and manufacturing research, are being held back by a skills gap. Manufacturers in the U.S. have something on the order of 400,000 job openings right now. 89% of global manufacturers agree that there is a talent shortage and this is holding back growth in this sector. The problem may only get worse in the near future. Automation continues to change the skills needed for manufacturing jobs and more and more baby boomers are starting to retire. In short, the manufacturing workforce is at a crossroads.

That leads to my one slide. Of the 15.5 million people working in manufacturing, 29% are women. The percentages of Black or African American, and Hispanic or Latino manufacturing workers also lag broader employment averages. A little closer to home for the manufacturing research community, about 25% of engineering graduate degrees in 2017 went to women, and about 10% of graduate degrees went to underrepresented minorities.

My first thought is that in 2019 this is embarrassing. And things are actually worse at NIST. We have 80% of our technical staff as male, and 80% white. In my group, all of our technical staff are men, 9 white guys and 4 Asian guys. That's it. I also learned recently that among the membership of MED, only 6% are women. Depressingly, that's above average for ASME.

I bring up NIST and MED for two reasons. One, this is not me on my high horse saying you should be more like us. This is me being concerned about the future of manufacturing in the U.S. and about the future of manufacturing research at NIST. Two, I don't have any silver bullets. I can't really say, look this is what's working for us.

But I can say that this needs to change. And I think that's the flip side of this chart. There's a lot of room for improvement. This is an opportunity.

This competition is about posing a grand challenge, so here's my grand challenge: how can we engage **ALL** members of our society to help bridge the skills gap in manufacturing? Women and underrepresented minorities represent the largest untapped source of talent for U.S. manufacturing ... how do we get them more involved?

Some folks will point to programs like First Robotics that promise to engage a new generation of kids in manufacturing. To which I say, "that's great, keep those coming." But I'm still concerned.

First, this is going to take a generation to unfold. Manufacturers need help now. Second, what happens if this new generation who had great school-age experiences with manufacturing reach the workforce only to find that we have hostile or toxic environments, or that pay is unequal, or their promotion rates are low, or that none of the leaders in their lab or office or plant or corporate HQ look like them? We need to change our culture **now** to help our manufacturers now and to be ready for that next generation who are getting excited about manufacturing.

That's why I think this is the right venue to talk about this, because this forum is for big ideas, and culture change is big. I was excited to see the Women in Manufacturing sessions yesterday. Starting this up was a great idea by Kevin and Gloria, Barbara, and Maureen did a great job organizing. I hope this continues in the years to come. But we need something orders of magnitude bigger.

I certainly don't know exactly what that is. But I think the manufacturing research community is the right place to start. We know the benefits of embracing new ideas and implementing new research. And I think we should do exactly that, just for a different research community.

There is some really great research going on right now in social and behavioral sciences on how to improve inclusiveness and equity, especially in STEM. Now, I'm not going to get into the weeds and talk about micro-messaging or changing job postings or hiring and promotion processes. But what I do propose is that the manufacturing research community engage with the social and behavioral scientists and start implementing their ideas. We should create a major program that encourages this, helping with organization and with funding. We should test a whole bunch of ideas on a grand scale, not just one idea in one laboratory here and there, but in a way that helps get the social and behavioral scientists some meaningful data on the effectiveness of their ideas.

I know Brian has talked about NSF workshops coming out of Blue Sky ideas. I think that would be a great starting point. I envision this workshop being a little different than most. I think it would be great to have an audience of leading manufacturing researchers, and have the

panelists be experts in social and behavioral sciences to talk about what types of problems they see in our culture and what are the best ideas we can implement to make improvements.

I'm not sure what exactly would come out of this workshop or what a program in this area would look like. We'll certainly need to address topics like we discussed at the women in manufacturing forum yesterday. Who are we recruiting for new positions and where or how do we find them? How we mentor those new people? Maybe more importantly, what do we expect of our current employees? What behaviors do we want to encourage, and when might we need to make interventions (and how do we do that effectively)?

But we'll also need to address how we start taking action, and that's where I think the program comes in. What does that program look like? Again, I'm not sure. Maybe it's something like funding for clinical trials that go on in FDA or NIH. Maybe it's akin to moving from TRL 3 to TRL 5, taking an idea for improving culture that's observed anecdotally or demonstrated on a small scale and testing it out on a larger scale. Maybe it's something like funding for clinical trials that go on in FDA or NIH. Maybe it's akin to moving from TRL 3 to TRL 5, taking an idea for improving culture that's observed anecdotally or demonstrated on a small scale and testing it out on a larger scale.

But let's not get hung up on making sure we know exactly how this will go from the start. Let's make the manufacturing research community the leaders in changing the culture of the manufacturing workforce. And again, a workshop is just about how we get started. There will be a big step when we start implementing, and an even bigger step when we transition the ideas that worked in a manufacturing research environment into manufacturing production.

Now, I want to take a bit of a step back and talk about why I'm up here talking about this, because I'm not exactly the poster child for diversity and inclusiveness. I'd heard people talk about how this is a problem for our community for a while, and I always thought, "well, I'm not really the cause of this problem. I mean, I've hired female interns, and I'm not discriminatory in my thinking." But then when I was Chair of MED, we held an MSEC/NAMRC where none of the panelists or invited speakers were women, and I didn't even notice this until someone pointed it out to me. I was embarrassed. I realized how blind I was to the problem. And I realized, most importantly, this isn't about "not being part of the problem." Changing the culture means that every single person needs to be actively involved in making things better. Because that's the mentality that's required, that's the amount of effort it's going to take.

So I'll close with this. I'm not going to pretend that I know all the answers here, and I'm not going to pretend that proposing to bring together various research communities is especially profound or unique. Selecting this proposal is not about endorsing it as a great idea. It's more about recognizing that it's time to move beyond discussion and lay out a bold plan to take immediate action.

I think this Blue Sky Competition idea is fantastic because we need big, new, bold ideas for manufacturing in the U.S. But if you keep asking the same people the same questions, you're

going to get the same answers. And I think that's exactly why we need a more inclusive culture. Because our best ideas tend to come from our most diverse teams. We need to make sure we're engaging **ALL** segments of our society in this discussion. That's when I think we'll really start to see some major transformations.

And I lied. I actually have two slides. Here are the people I'd like to thank for providing me some feedback on my proposal. I'll be happy to answer your questions, at least as best as I can.