NIIMBL® The National Institute for Innovation in Manufacturing Biopharmaceuticals

INNOVATION OF THE BIOPHARMACEUTICAL MANUFACTURING TALENT PIPELINE

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INTRODUCTION

The launch of NIIMBL in 2017 coincided with a time of increasing concern among leading biopharmaceutical manufacturers about a looming talent crisis. While most employers felt they had an ample supply of talent, they also expected that advances in new therapeutic modalities such as cell- and gene-based therapies would catalyze additional industry growth and create a talent deficit in the near future. Little did they know how right they were—not only was the anticipated talent crisis realized, it also overlapped with the additional strain on the existing manufacturing workforce imposed by the coronavirus pandemic.

Fast forward to the present day, and the industry has arrived at an inflection point. In talking to biopharmaceutical manufacturers across the U.S., the message is ubiquitous and resoundingly clear: candidate pools are shrinking and the biopharmaceutical ecosystem cannot find the desired talent to fill critical biopharmaceutical manufacturing roles.

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This reality reinforces the urgent national need for new approaches to attract and inspire, increase the diversity of, and train tomorrow's biopharmaceutical manufacturing workforce. It also exposes new opportunities for continuous improvement and innovation in the workforce and talent development pipeline, as our industry, academic, and workforce development infrastructure are currently hamstrung by tradition. Traditional degree programs. Traditional hiring practices. Traditional ways of demonstrating "experience." The biopharmaceutical manufacturing ecosystem needs to think differently to address this talent crisis.

The purpose of this "living" whitepaper is to catalyze dialogue and action by 1) shedding light on the current situation, 2) exposing some of the workforce development traditions that collectively hold us back as an ecosystem, and 3) introducing examples of non-traditional approaches that are being explored across the U.S. to innovate the biopharmaceutical workforce and talent development pipeline. New community college degree programs, badging and micro-credentialing initiatives, certification programs, apprenticeships, bootcamp-style professional development programs, and the employment of disabled and neurodivergent populations offer a wealth of opportunities to improve the U.S. biopharmaceutical manufacturing workforce. Most importantly, as we will explore, the success of these initiatives regionally and nationally hinges upon internal champions, systems change, and increased buy-in from educators, program administrators, talent acquisition professionals, and technical hiring managers.

In the months to come, NIIMBL will build upon this foundational narrative by highlighting and featuring novel, innovative, and non-traditional approaches to address and resolve the talent crisis in biopharmaceutical manufacturing.

THE BIOPHARMA TALENT CRUNCH IS UPON US

There's a clear need for talent in biopharmaceutical manufacturing, with the deficit fueled by a perfect storm of an industry-wide race into new therapeutic modalities, technological innovation, competition with other industries for brainpower, a renewed focus on reshoring, and of course, the coronavirus pandemic.

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Despite the pandemic's disruption across many industries, the life sciences sector fared relatively well. The CBSI-TEConomy 2021 Life Sciences Workforce Trends report noted "a majority of U.S. life science companies surveyed by CSBI and TEConomy report adding hires." According to data from leading labor market analytics firm Emsi Burning Glass, the biopharmaceutical manufacturing sector has experienced strong growth during the past five years, with a 25% growth rate in employment. This growth is expected to continue at a rate of 13% over the next five years. An influx of private investment into new modalities such as cell- and gene-based therapies has fueled rapid company growth. A recent report by GlobalData Healthcare anticipates that biologics will overtake small molecule drugs in the next five years, with Real Economy noting that much of the growth in biologics is specifically in cell and gene-based therapies, which are expected to see a 63% growth in sales between now and 2026.

Complicating all of this industry growth is the reality that candidate pools are actually shrinking nationwide. One talent acquisition leader in the southeastern U.S. noted that they are "sitting on hundreds of unfilled requisitions. There simply aren't enough people applying for the jobs." A human resources representative from a manufacturer in the mid-Atlantic region blamed greater competition for jobs, both from within the industry as well as from seemingly more accessible jobs in big box retail stores such as Walmart and Target that have begun paying competitive entry-level wages. As a result, the need to promote careers in biopharmaceutical manufacturing to a diverse audience remains front and center in the eyes of many in our ecosystem.

INDUSTRY, ACADEMIC, AND WORKFORCE DEVELOPMENT TRADITIONS HINDER INNOVATION

The U.S. biopharmaceutical manufacturing ecosystem has come a long way in the past 20 years. Regional training infrastructure and specialized degree programs have catalyzed interest in biopharma careers. Diversity, equity, and inclusion initiatives have moved from being "the right thing to do" to being seen as mission-critical for industry growth and innovation. Yet, the collective system of educators, employers, workforce development organizations, and intermediaries in the U.S. are deeply rooted in traditions that may be holding

back growth. Workforce and talent development innovation hinges on our collective ability to pay conscious attention to, adapt, adjust, and in some cases, pivot away from, traditions and hiring approaches that are no longer serving the needs of the biopharmaceutical manufacturing ecosystem.

Higher education must better prepare graduates for applied technology jobs. The U.S. is a recognized leader in biopharmaceutical manufacturing training and education, and is home to specialized biopharmaceutical manufacturing training centers and many biopharma-oriented degree programs. While these programs successfully train thousands of students per year, many more students in the U.S. graduate without an awareness of the biopharmaceutical manufacturing industry or how their knowledge and skills might apply to a biopharma career.

Awareness, of course, is a multi-faceted problem that goes beyond the students themselves. On one hand, many faculty in relevant academic disciplines such as chemical engineering or biochemistry do not place a strong emphasis on careers in the biopharmaceutical industry. Many traditional education pathways excel in teaching a standard biology curriculum (e.g., cell structure, metabolism, classical and molecular genetics); however, far less time is spent on industry applications of this foundational knowledge and career opportunities beyond research.

On the other hand, our industry's talent needs are increasingly multidisciplinary thanks to recent advancements and movement toward digitization, automation, artificial intelligence, and machine learning. Unfortunately, academic departments such as computer science, data science, and statistics simply don't recognize the value their students can bring to the biopharmaceutical manufacturing industry.

Traditional hiring practices, including a longstanding preference for bachelor's degrees for manufacturing and technician roles, hinder the biopharmaceutical manufacturing sector's ability to increase the intellectual diversity that's critical for success and innovation.

Ultimately, awareness is the very fuel that keeps successful programs growing—without ample enrollment, even the most well-developed training programs won't succeed. Even in regions of the U.S. with thriving life science industries, far too many students, parents, and educators aren't aware of the myriad career possibilities in biopharmaceutical manufacturing. Much of the focus in life science education and training remains on careers in research laboratories. The result is that many graduates seek jobs outside of biopharmaceutical manufacturing, further complicating the overall pipeline challenge.

Industry hiring traditions favor bachelor-degreed graduates. Traditional hiring practices, including a longstanding preference for bachelor's degrees for manufacturing and technician roles, hinder the biopharmaceutical manufacturing sector's ability to increase the intellectual diversity that's critical for success and innovation. According to the

2021 CSBI-TEConomy report, 75% of job postings reflect "a preference for hires with a bachelor's or higher degree." Narrowing in on biopharmaceutical manufacturing job postings specifically, data compiled by Emsi Burning Glass for NIIMBL in 2022 confirm the preference for bachelor's degrees, especially when compared to similar jobs in other manufacturing industries. For example, while only 25% of Manufacturing Associate job postings required a bachelor's degree in the broad manufacturing sector, that number increased to 42% when looking specifically at biopharmaceutical manufacturing. That jump is not surprising, considering the importance of applied biotechnology and bioprocessing skills including good manufacturing practices (cGMP), cell culture, and aseptic technique.

Signs of change are emerging in biopharmaceutical manufacturing as recruiters have begun to loosen educational attainment requirements, making good manufacturing jobs attainable by individuals without a four-year college degree. While the percentage of biopharmaceutical manufacturing roles requiring a bachelor's degree is comparatively high, it is noteworthy that more than half of Manufacturing Associate job postings require less than a bachelor's degree. This trend is reinforced in the CSBI-TEConomy report, which notes that one-third of employees in the biotech industry are working in roles "requiring training or education beyond a high school diploma but less than a bachelor's degree." This finding is important, as it demonstrates that there are existing pathways into manufacturing jobs that do not require a bachelor's degree.

Simply stated, not enough employers and/or hiring managers place significant value on non-traditional and innovative pathways into biopharma manufacturing careers.

In fact, in recent months, a number of large biopharmaceutical manufacturers have launched recruitment initiatives focused on attracting non-degreed individuals into manufacturing and related careers. One of the companies leading this charge is Merck & Co. Glancing at Merck's social media presence, radio advertisements, and career website reveals taglines such as "Diploma, degree, or somewhere in between?" A lengthier Twitter post by Merck Careers states "No degree? No problem. Leverage your skills to accelerate your career. Join our virtual event to learn more about our career opportunities that focus on skills first, not a four-year college degree. What are you waiting for? Jumpstart your career!"

However, while more than 50% of Manufacturing Associate job postings require less than a bachelor's degree, much of the biopharmaceutical industry continues to favor those with degrees in their manufacturing talent pool. Educational attainment data often shows more college graduates in manufacturing than one would predict through job postings, an indication that bachelor's degree-holding applicants are outcompeting job seekers from other pathways in terms of quantity, though not necessarily in terms of real or perceived differences in skills and abilities.

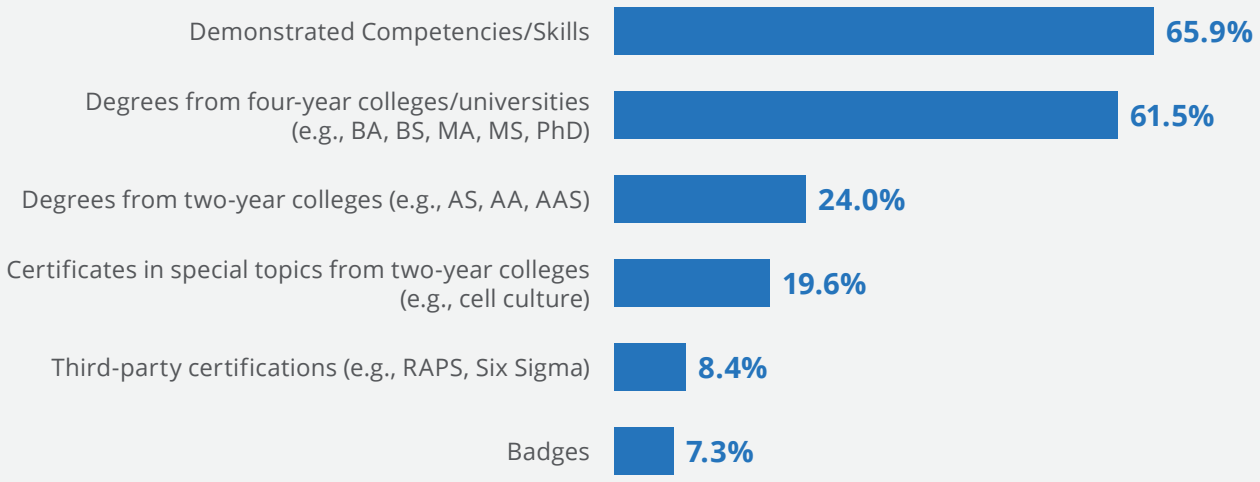
Previously unpublished survey data collected by CSBI and TEConomy Partners in 2021 drives this point home and reinforces the critical need for increased industry awareness and utilization of less

traditional and more innovative pathways into a career in biopharmaceutical manufacturing. They surveyed human resource departments at 194 drug and pharmaceutical manufacturing companies in the U.S. to understand the relative value of different education levels and training credentials. The data show that a majority of companies strongly valued demonstrated experience and a bachelor's degree. Far fewer manufacturers valued less-traditional ways of demonstrating competency and experience, such as associate degrees (24.0%), certificate programs (19.6%), certifications (8.4%), and badges (7.3%).

And therein lies the problem—as well as a tremendous opportunity. Simply stated, not enough employers and/or hiring managers place significant value on non-traditional and innovative pathways into biopharma manufacturing careers. While employers value demonstrated experience and many have implemented recruitment strategies focused on individuals without degrees, the biopharmaceutical manufacturing industry still has a long way to go before the broader swath of hiring managers, department heads, and technical leaders recognize the game-changing ways that candidates can demonstrate their experience and the value they bring.

A systems change is needed. Together, the challenges posed by low awareness and stubborn traditions are significant, but not insurmountable. It's clear that the industry must innovate the biopharmaceutical and workforce development pipeline to remain competitive and resilient and keep jobs in the U.S. As members of the larger biopharmaceutical manufacturing ecosystem, we must begin rethinking traditions, biases, and hiring practices and seek out new solutions that will drive systems-level change. Hiring managers, recruiters, and early talent professionals can greatly diversify their talent pools by recognizing and considering alternative and non-traditional pathways into manufacturing jobs.

Pathways Valued by Employers



Unpublished data, Coalition of State Bioscience Institutes & TEConomy Partners LLC (2021)

A CALL TO ACTION TO DRIVE SYSTEMS CHANGE

There's tremendous potential for systems change within the biopharmaceutical manufacturing ecosystem, and several innovative education, training, and workforce development initiatives are already underway. From new community college degree programs, outreach and awareness initiatives, badging and micro-credentialing initiatives, certification programs, apprenticeships, and bootcamp-style professional development programs, to the employment of disabled and neurodivergent populations, a wealth of opportunities are available to the U.S. biopharmaceutical manufacturing ecosystem to solve the talent crisis. National adoption of these non-traditional and innovative hiring approaches will require broad awareness as well as internal champions.

In fact, one of the common threads we've noted across successful pilot initiatives is the presence of dedicated internal champions—individuals who are often driven by sheer passion for change. However, it's also imperative to recognize how fragile some of these innovative initiatives are when limited to single points of contact, such as a recruiter or a hiring manager. Recruiting relationships in particular are often personal relationships between individual recruiters and academic institutions. Turnover among internal champions poses a real challenge to systems-level change. Moving forward, there's a need to identify and support internal champions who can enable passion projects to evolve into organizational change that will support the growth of the biopharmaceutical manufacturing talent pool.

NIIMBL aims to continue its work to 1) recognize innovative approaches to pipeline development, 2) scale up good ideas, and 3) support trials of new approaches in pilot programs. In the coming months, we will highlight some of the successful initiatives underway within NIIMBL's growing ecosystem of large companies, small companies, academic institutions, and non-profit groups. It's our hope that increased organizational awareness can help establish a business case for systems change, plant seeds for consideration, establish best practices for communicating effective strategies across organizations, and ultimately forge new partnerships—even within a single organization—to make disparate efforts better understood and aligned as we strive to innovate the biopharmaceutical manufacturing talent pipeline.

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