Biomanufacturing Market Insights & Talent Trends

Q2 2023

The biotech & biomanufacturing sector is booming as use cases increase across multiple industries

Emerging Applications for Biomanufacturing Across Industries

Human health & performance

- Nucleic acid vaccine technology enabling rapid pandemic response
- Stem-cell derived transplantable organs

Agriculture & food technology

- Large-scale production of low-cost cultured meat ingredients replacing animal-derived alternatives
- Optimization of crop microbiome to enhance growth metrics

Consumer products & services

- Utilizing biological data to offer consumers custom personal care & nutrition services derived via treatment of gut and skin microbiome

Chemicals & materials

- Performance biopolymers offering innovative sustainable alternatives to plastics and animal-derived materials

Sustainability

- Biosequestration of CO2 from atmosphere
- Bioremediation of polluted wastewater

Source: World Economic Forum; McKinsey

Tech advances are ushering in a new era for biomanufacturing by improving quality, speed, agility & resilience

- Digital advancements are reshaping the way the biomanufacturing industry operates by optimizing asset utilization, labor productivity & production lead times

No-touch planning	Paperless factory	Proactive risk management	Reimagined processes	Remote performance monitoring	Zero deviations
The adoption of digital twins—virtual versions of physical objects & processes—helps balance demand with the supply of raw materials, equipment capacity, & talent/staffing while allowing scheduling overhaul of production & lab activities	Electronic documentation allows seamless information flow from raw-material supply to planning to production to quality to warehouse, spanning internal & third-party manufacturing networks	Works by identifying & preventing problems before they occur by using predictive analytics to monitor in real-time & manage maintenance, environmental, quality, & other supply-chain risks to maximize throughput, cost, compliance, & sustainability	Automation & advanced production tech (e.g., line sensing, augmented & assisted-reality tools, & parametric product releases) is helping workers make remarkable gains in productivity	Interconnected systems allow real-time tracking of site performance, product status, & issue detection, resulting in more effective decision making by management	Advanced analytics models help plant leaders ensure that everything in the biomanufacturing process goes exactly as planned, mitigating quality risks, ensuring compliance, & maximizing product robustness
Receiving & Planning	**Receiving & Planning, Quality Control**	**Production & Packaging**	**Production & Quality Control**	**Production & Quality Assurance**	**Quality Control & Quality Assurance**

Steps in the manufacturing process

Source: McKinsey

Digital & analytics drive significant value for biomanufacturers by increasing key performance metrics

Key impact performance themes:

Quality: reduction in deviations due to improvements brought by digital & advanced analytics

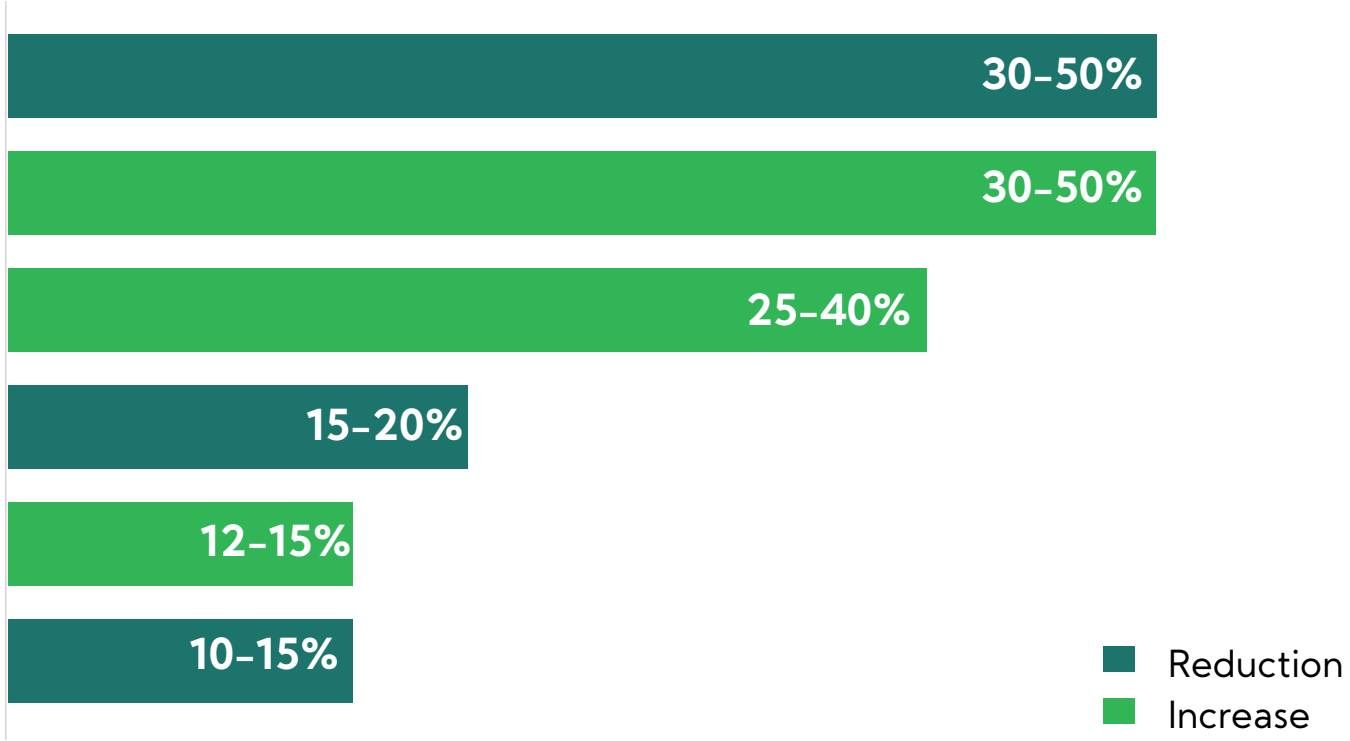
Productivity: increase in labor productivity by freeing up worker capacity to focus efforts elsewhere

Throughput: increase in plant capacity due to more optimized plant operations

Agility: reduction in lead times, more efficiency & less time spent on planning, QC & QA

Talent: increase in leadership capacity due to more decision-making done via the use of digital & advanced analytic tools

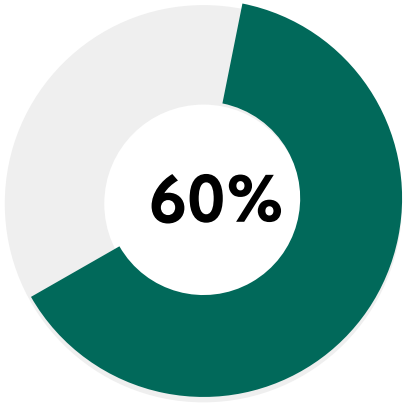
Cost: reduction in conversion cost via better efficiencies & greater productivity



Source: McKinsey

Strategic partnerships are accelerating the growth in biomanufacturing applications & advancements

Growing Potential Use Cases



It is estimated that as much as **60% of the physical inputs** *to the global economy could be* **derived from biomanufacturing** *in the coming decades*

Product Development Partnerships & Scaling Deployment of New Solutions

- Collaborative partnerships between biotech firms, CMDOs, & educational ecosystems are driving the development & adoption of biomanufacturing approaches, creating new opportunities for cross-industry co-development of applications
- Non-pharma biomanufacturing faces challenges, but strategic partnerships can reduce costs by combining synthetic biology breakthroughs with existing manufacturing processes.
- Forming "biomanufacturing cooperatives" through co-investment & co-design can accelerate prototyping & application testing, leading to greater success in commercial biomanufacturing.
- For example, Lululemon, a clothing brand famous for yoga pants, partnered with Genomatica, a biotech company, to produce sustainable bio-nylon derived from fermented plant sugars, eliminating 60 million tonnes of nitrous oxide & using significantly less water & energy to produce vs. traditional petroleum-based nylon.

Source: World Economic Forum; McKinsey

But to keep biomanufacturers on pace for continued growth, workforce transformations are imperative

Ways biomanufacturers cultivate a skilled workforce & achieve digital success

Start by **INSPIRING KEY STAKEHOLDERS** through digital orientation boot camps & go-and-see sessions

Estimate the value at stake & identify all priority use cases

Build & align on a digital road map, set up a team to oversee the firm's digital transformation

REORIENT THE ORGANIZATIONAL CULTURE around digital working & production systems

Create a communications campaign to kick-start the digital journey

Design & launch culture changing initiatives

RECRUIT CHANGE AGENTS & DIGITAL EXPERTS to build out digital capabilities & production systems

Identify core team members at selected sites for the first wave of design & implementation of new technology platforms & systems

Commit to major **UPSKILLING & RESKILLING** efforts for existing workforce

Build organizational wide capabilities via cohort-based learning journeys

Develop a plan for subsequent learning initiatives to ensure continuous digital innovation

Source: McKinsey

Biomanufacturers are investing in talent to close skill gaps & continue towards digital manufacturing innovation

10 Workforce Policies to Prepare & Advance Biomanufacturing Workforces

To power the future of biomanufacturing, action is necessary to grow & diversify the workforce & create synergies with recent developments in automation & digitalization. Firms can deploy the following tactics to prepare workforces:

1. Establish a skill anticipation system to enhance understanding of current & future skill needs
2. Increase investment in post-secondary education institutions & teaching staff
3. Encourage diversity in STEM education & careers
4. Address skills gaps between education & the skills demanded by the industry
5. Increase the focus of education & training on soft skills
6. Promote interdisciplinary approaches to skills development
7. Invest in effective lifelong learning systems & continuous training
8. Facilitate better recognition for relevant work experience & formal foreign qualifications
9. Provide support for workers by facilitating better working environments & work/life balances
10. Promote coordination among government organizations to strengthen social dialogue

CASE STUDY: How one biomanufacturer supports workplace transformation

To ensure their current workforce will have critical capabilities needed for the future, the company made it a priority to support lifelong workforce training & development in a fun & highly specialized way utilizing the following two-pronged approach:

Using a tailored approach to learning

via online training modules tailoring skills & skill level to target workforce segments along individual learning journeys

Gamification for increasing skills

by creating a game-like program designed to track accomplishment of individuals & leader-led challenges leveraging digital tools within the organization's ecosystem

Source: World Economic Forum

New initiatives are in place to grow the sector and address skill shortages impacting biomanufacturing

Biotech/biomanufacturing executive order

A US executive order on biotechnology & biomanufacturing, issued in September 2022, aims to spur investment & innovation across the sector. Its goals include:

- ✓ **Grow Domestic Biomanufacturing Capacity:** An initiative to build, revitalize, and secure national infrastructure for biomanufacturing across America, including through investments in regional innovation and enhanced bio-education, while strengthening the US supply chain that produces domestic fuels, chemicals, & materials.

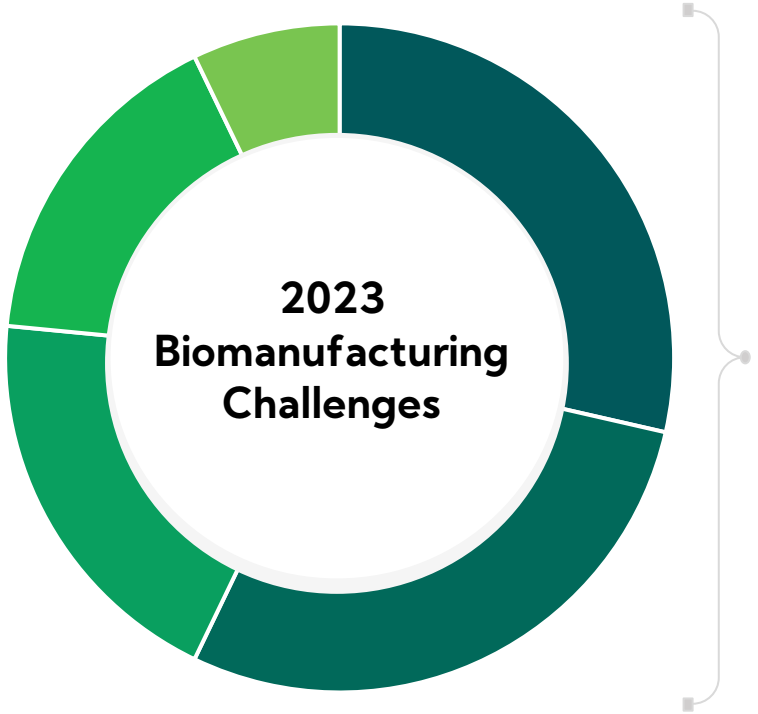
- ✓ **Train a Diverse Skilled Workforce:** An initiative to expand training & education opportunities for all Americans in biotechnology & biomanufacturing, with a focus on advancing racial & gender equity & support for talent development in underserved communities.

Source: Whitehouse.gov

The surge in demand is compelling more states to fund training programs & for biomanufacturers to rethink education requirements & production locations

- There has been a **surge in announcements for cell & gene therapy (CGT) biomanufacturing facilities**, with concentrations in both established & emerging centers, **fueling the need for talent & facilities**
- Although biomanufacturers tend to cluster on the East & West Coast, with California, Massachusetts, and North Carolina the leading destinations, as the competition for talent & facilities becomes more competitive, some **biomanufacturers are moving to interior states** such as Indiana, Ohio, & Texas
- Biomanufacturers are increasingly writing job descriptions that **do not require advanced degrees to address talent constraints**, and states and communities are responding with accelerated training initiatives
- States & communities are responding to biomanufacturing talent shortages with accelerated training initiatives. North Carolina, Massachusetts, & California are among the leaders in **offering biomanufacturing education and training programs**

But biomanufacturers face challenges inhibiting progress, including the ongoing inability to hire skilled talent



28%
Selecting a qualified CMO/CDMO

28%
Inadequate manufacturing capacity

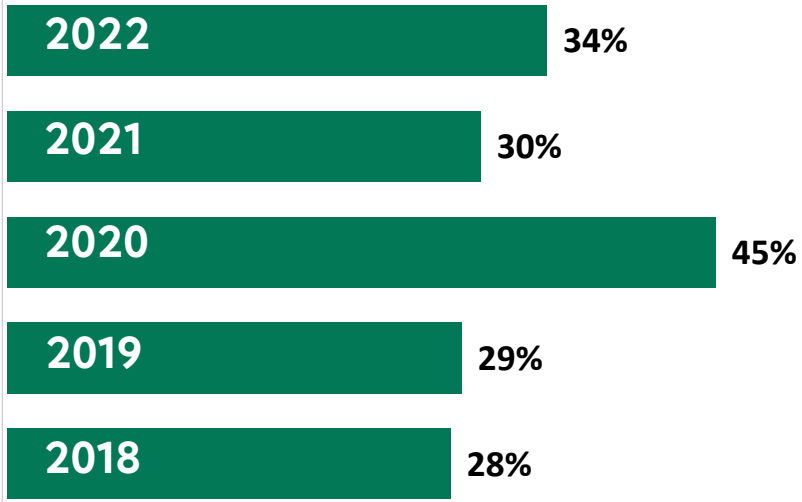
19%
Shortage of materials

16%
Supply chain issues

7%
High costs

1/3 of biomanufacturers say the inability to hire experienced technical & production talent is limiting growth

Major constraint limiting organizations' growth: The inability to hire new, experienced technical & production staff

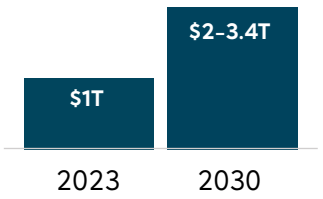


Source: 2023 BDO Life Sciences CFO Outlook Survey; BIO Process Online

And as the biomanufacturing market expands, so does the need for more highly skilled talent, fueling wage increases

Market Growing

Biomanufacturing CAGR forecast 10%–30% globally through 2030



Increase in Talent Demand

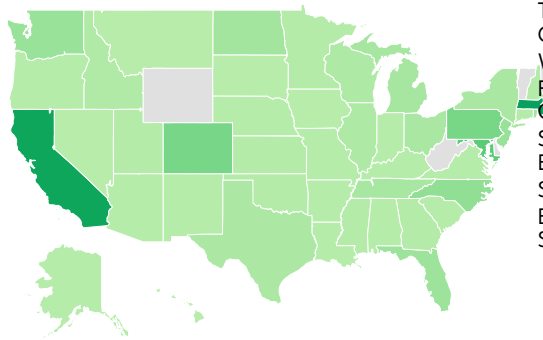
+39%

Increase in unique job postings for US biomanufacturing talent in the past two years

Top In-Demand Roles

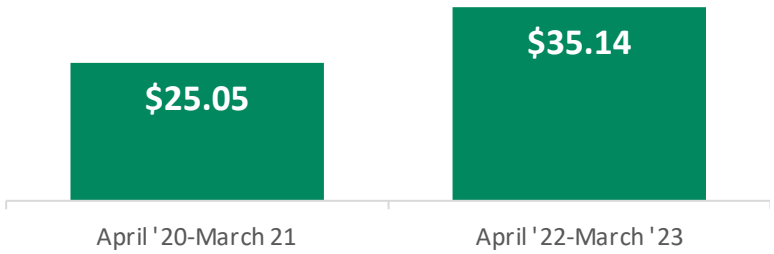
- Principal Scientists
- Manufacturing Associates
- Research Associates
- Process Development Scientist
- Medical Science Liaisons
- Quality Assurance Specialists
- Associate Scientists
- Manufacturing Technicians
- Analytical Development Scientists
- Manufacturing Specialists
- Quality Control Analysts
- Process Engineers

Top Geo Locations Seeking Talent



Top Cities:
Thousand Oaks, CA
Cambridge, MA
Waltham, MA
Framingham, MA
Gaithersburg, MD
Swiftwater, PA
Boulder, CO
San Diego, CA
Baltimore, MD
San Francisco, CA

US Median Advertised Wage Up +40% in Past Two Years



In-Demand Skills

- Manufacturing
- Biology
- Biochemistry
- Biopharmaceuticals
- Biotechnology
- Process development

Top Employers Posting

- Sanofi
- Amgen
- Emergent BioSolutions
- Kbi Biopharma
- Novavax
- Agc Biologics

Source: Lightcast, April 2023; Biomanufacturing GAGR based on aggregate of market forecast estimates from Data Bridge Research, Nova One Advisor, Grand Review Research, Biospace