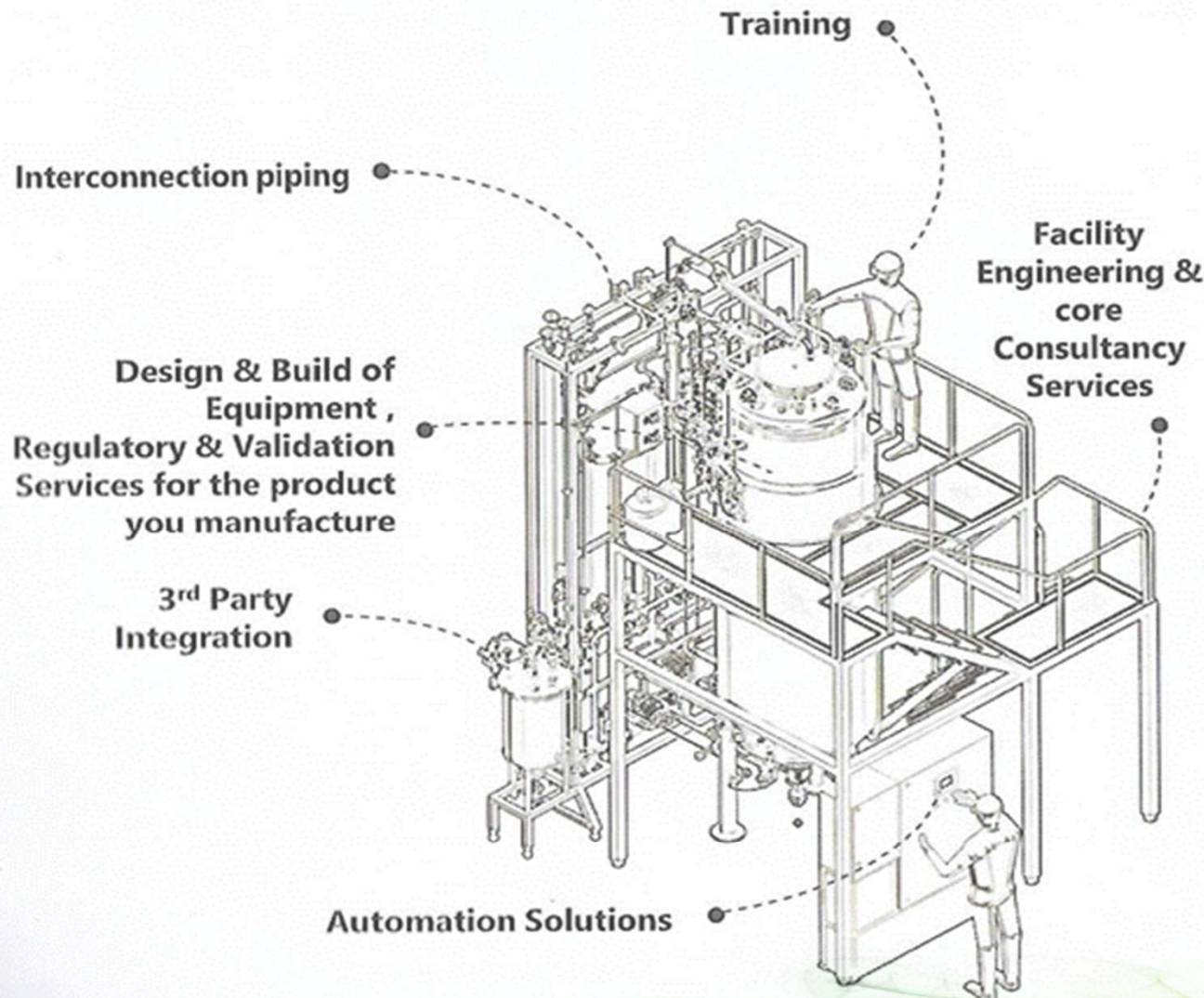


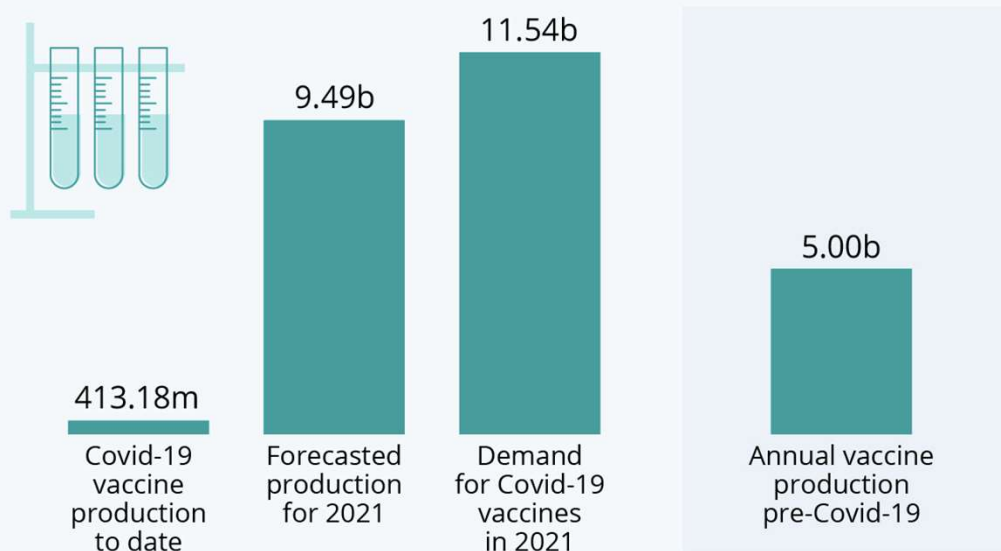
Approach to enabling vaccine manufacturing ramp-up



Vibin Joseph, BEng, MSc, Ph.D

21st Oct, 2021

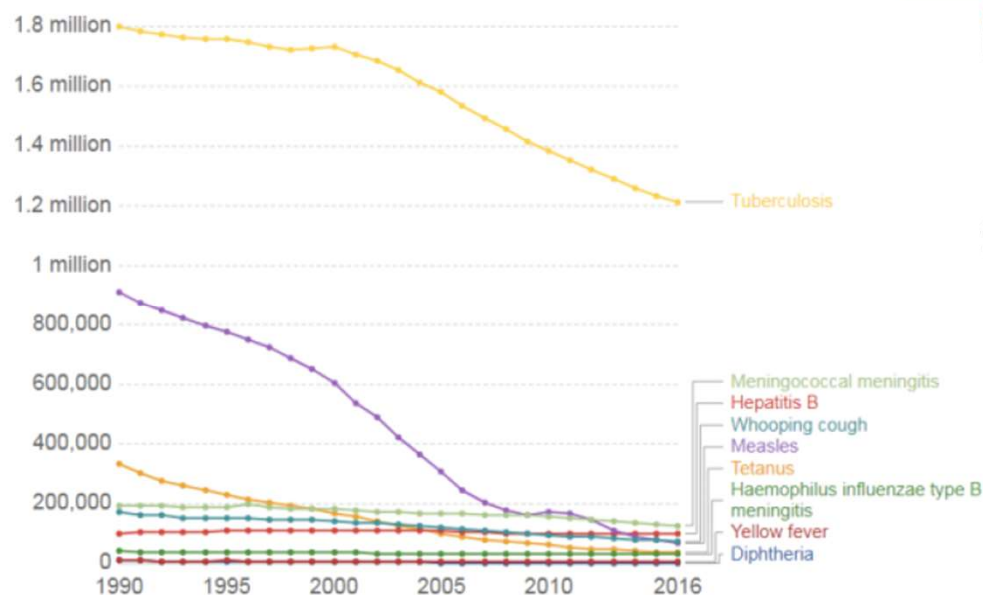
Importance of Ramping-Up vaccine manufacturing



* Production up to March 05, 2021.

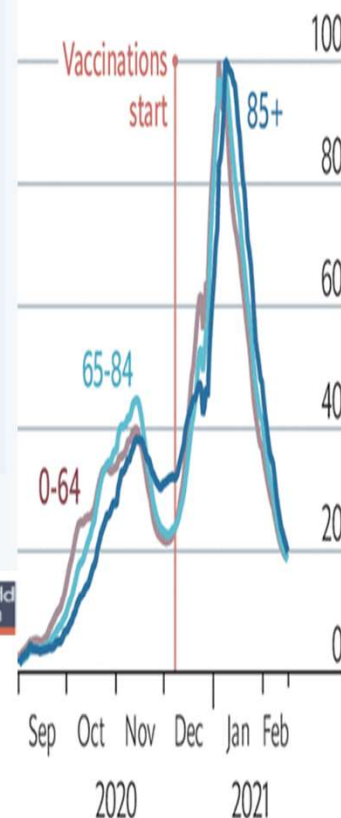
Source: Airfinity

Deaths caused by vaccine-preventable diseases, World

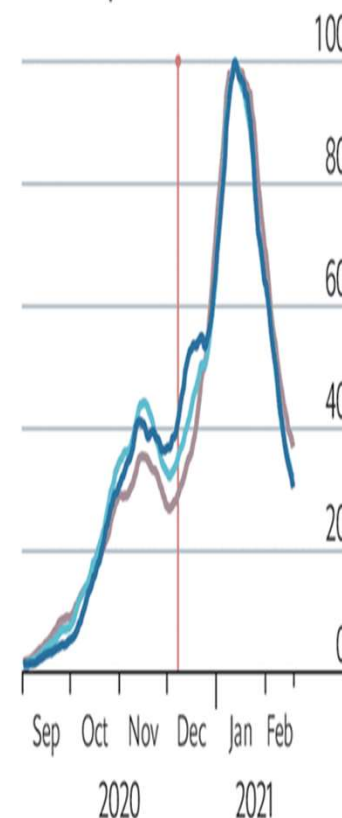


Source: Diphtheria, Tetanus, H influenzae type B meningitis, Hepatitis B, Measles, Meningococcal meningitis, Tuberculosis, Yellow fever, Whooping cough

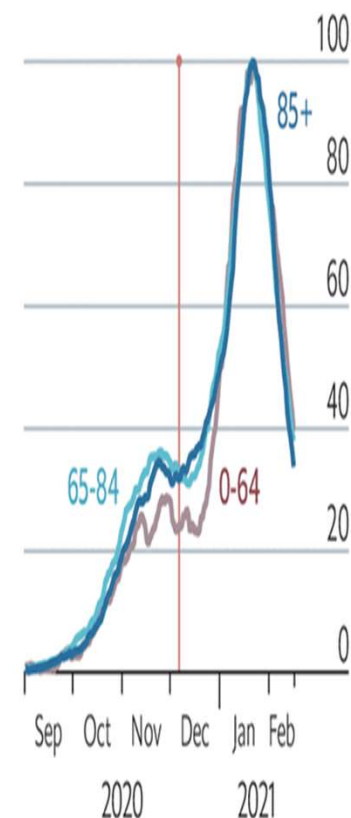
New cases



New hospital admissions



New deaths



Sources: Public Health England; The Economist

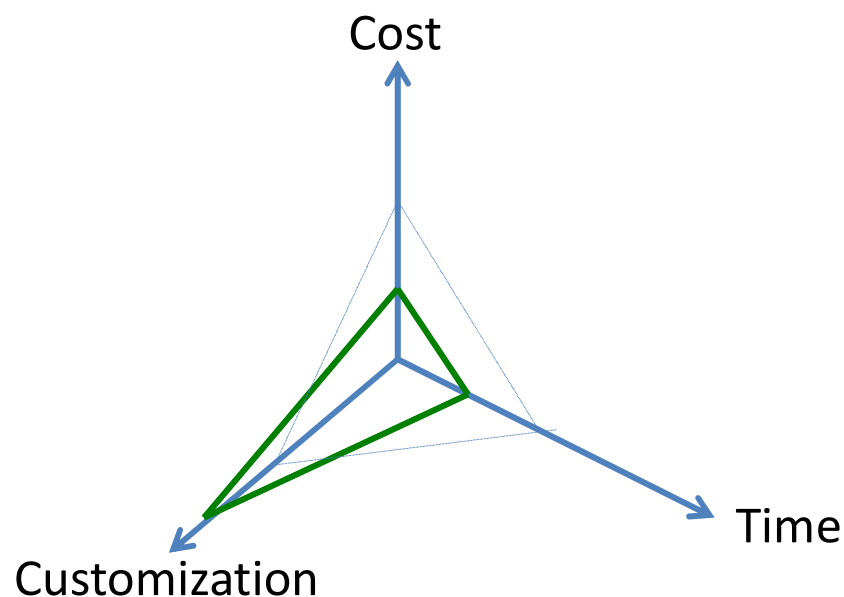
Un-vaccinated people

- 7 times more likely to test positive
- 49 times more likely to be hospitalized
- 32 times more likely to die

Challenges with Ramping-Up vaccine manufacturing

Inherent Variances and Complexities that limit a quicker one size that fits all approach:

- Vaccine types: Live attenuated, Replicating vectors, Non-replicating viral vectors, Inactivated virus, Virus like particles, Subunit, Nucleic acid vaccines
- Cell line: CHO, VERO, Sf9 insect cells
- Strategic considerations: largely based on engineering triad limitations



Need based tailored customization: Speed, Cost and Flexibility

Facility enhancement > Full customization except centrifugation and chromatography columns

Repurposing existing facilities > retrofitting existing hardware/software with PAT, process sequence changes

BZTRACKS – Speed & Cost

Green field facility > design and build in modular, semi-knocked-down architecture

Smaller, more production plants

BOT with collaborative approach

Facility Integration Services



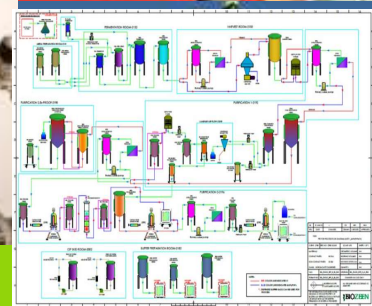
Automation



Training



Design & Build



Bioprocess Engineering



COMPLETE
BIOPROCESS
ENGINEERING
SOLUTIONS

Regulatory & Validation Services



BiOZEEN
CONSULTING • TRAINING • DESIGN BUILD
Solutions For The Biotech World

Product

Process

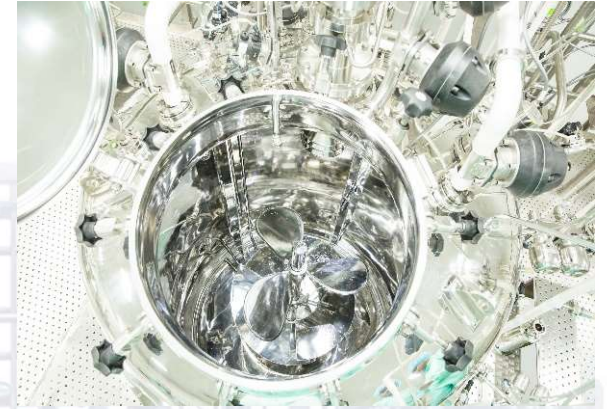
Production Support



Automated Bioprocess Plants & Technologies



Automated Bioprocess Plants & Technologies



- 
- A light gray world map serves as a background for the list of achievements. The map shows the outlines of continents and countries, with a slightly darker shade for the landmasses.
- 24/7, 365 days
 - 7 COVID vaccine manufacturers in 6 countries
 - Supplied 179 equipment to Brazil, China, India, Middle East, South Korea, Switzerland and Thailand.
 - Conducted physical Factory acceptance tests with 26 customer groups after implementing sanitized bubbles and daily RTPCR covid testing.
 - Leveraged 360 degrees pan audio-visual technologies with 4k support to conduct 20 online tests
 - Installed and commissioned 23 projects
 - Executed every project on time and to quality

We are into the business of Saving Lives™

Thank you



Diphtheria Pertussis Tetanus (DPT) Vaccine

Measles Mumps Rubella (MMR) Vaccine

Cholera Vaccine

Typhoid Vaccine

Rotavirus Vaccine

HiB Vaccine

Influenza Vaccine

We are into the business of Saving Lives™