BUILDING THE SUPPLY CHAIN FOR COVID-19 VACCINES

A GLOBAL EFFORT IN PANDEMIC RESPONSE

Group A

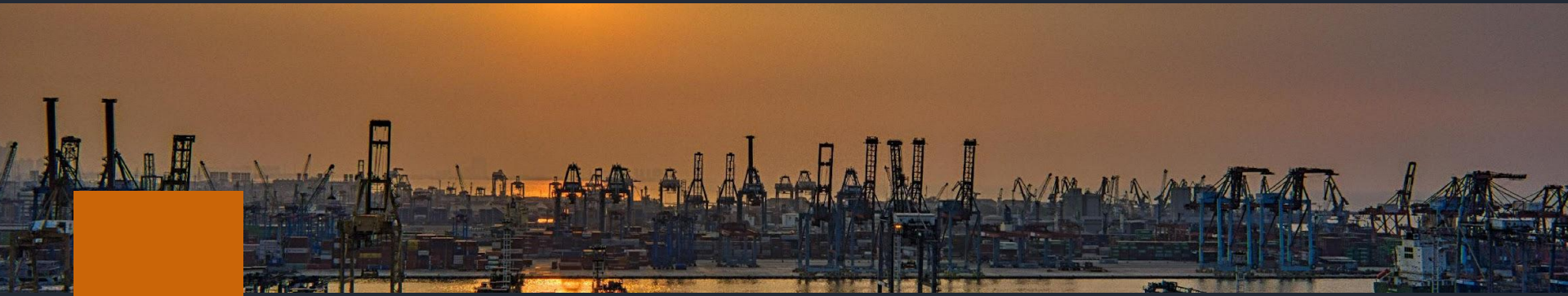
Global Disruption and the Vaccine Challenge

- Government lockdowns disrupted supply and demand in vital industries including retail, tourism, manufacturing, and services, crippling the global economy.
- Hospitals flooded with COVID-19 patients, causing major shortages of vital intensive-care materials.
- The organization of supply chains to manufacture, distribute, and administer a vaccine to a sufficient portion of the **7.6 billion** world population posed significant challenges.
- Approximately **5.6 billion** people needed to be inoculated to achieve that goal.

Accelerated Development under Pressure

- This process typically takes **9.4 years** but was projected to be completed in **eight months**.
- Several clinical trial steps typically conducted in sequence were combined or conducted in parallel.
- The global portfolio included some 321 vaccine candidates by early fall 2020.
- In early November, Pfizer-BioNTech's **Phase III trial** with approximately **44,000 subjects** revealed its vaccine candidate to be over **90% efficacious**.

Clinical and Statistical Trial Challenges



- COVID-19 only has a one percent attack rate… the results would only be loosely statistically significant.
- Public health measures like social distancing and the use of face masks complicated this process.
- The FDA’s threshold for approval was a 50% effective vaccine.
- Asymptomatic transmission and low event rates delayed statistical significance.

Manufacturing, Bottlenecks, and Investment

- Building manufacturing capacity for a safe and effective vaccine took nearly half a decade under normal conditions.
- Testing and quality assurance procedures accounted for approximately **70% of production time.**
- Bioreactors, due to cost and limited supply, constituted a bottleneck to large-scale production.
- Governments in the US, UK, and EU made advance purchase commitments to support speculative manufacturing.

Technology Platforms and Production Strategy

- The global portfolio of COVID-19 vaccine candidates involved a diversity of platforms, including novel technologies like mRNA and DNA.
- Candidates using new platforms required new facilities and complex logistics such as ultracold storage.
- Serum Institute of India committed to a 50-50 arrangement whereby half of the initial production would be distributed within India.
- Locating production in developed nations increased cost and delayed scalability.

Cold Chain Infrastructure and Logistics Innovation

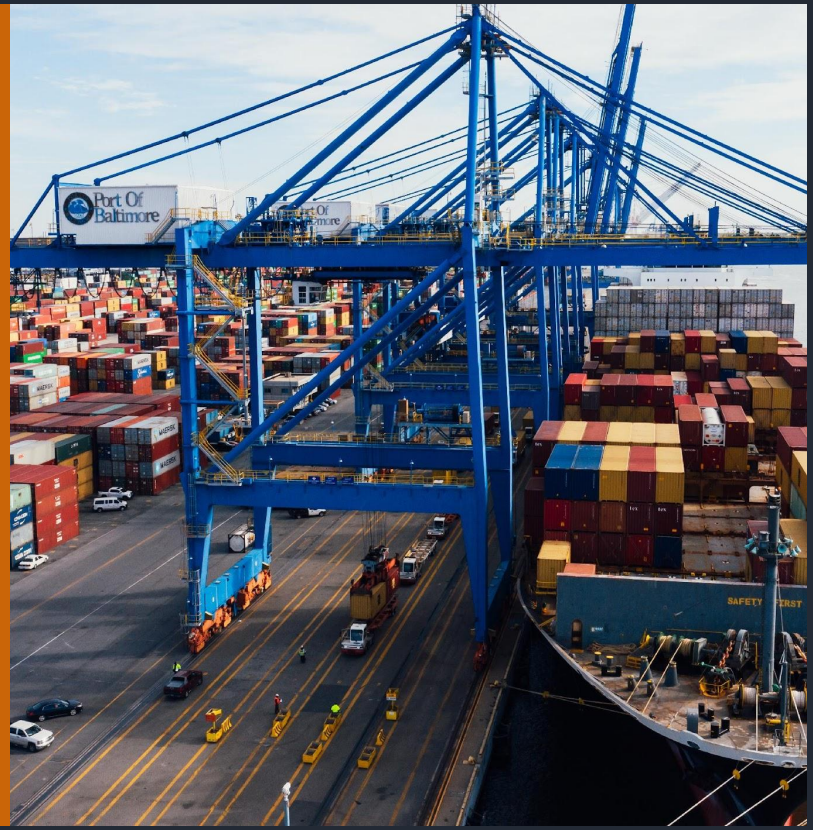
- The Pfizer-BioNTech vaccine candidate required ultracold storage and distribution, which was not supported by most existing cold chain infrastructure and would, therefore, require costly new freezer capacity for distribution.
- UPS announced construction near its air cargo hubs in the US and Germany of dedicated cold storage facilities, each with **600 freezers** able to accommodate **48,000 vials of vaccine.**
- To distribute **10 billion vaccine doses** would involve **~200,000 movements** by pallet shippers on **15,000 flights** carrying **~15 million cooling boxes**.
- Refrigerated warehouse capacity was in high demand by both food and pharmaceutical industries.

Political Tensions and Nationalism in Vaccine Supply

- Political tensions, such as the pre-pandemic trade war between the US and China, complicated location decisions for COVID-19 vaccine production.
- Conditioning investment on the commitment of large quantities of initial supplies to the US population discouraged some developers from engaging with Operation Warp Speed.
- Several developed nations, including Canada and countries in the EU, engaged in similar agreements to secure initial supplies of promising vaccine candidates.
- Nationalizing vaccine supplies within developed nations risked international resentment and political tensions with the developing world.

Long-Term Impacts and Future Preparedness

- The COVID-19 vaccine rollout was a success built on global cooperation, rapid innovation, and public-private funding. But it also exposed deep flaws in supply chains and global equity.
- Agile manufacturing systems are essential to switch between candidates when clinical trials fail.
- The experience underlined the need for better preparedness, smarter logistics, and above all, trust.
- These lessons will shape how we respond to future global health emergencies.



THANK YOU