"Vaccine Distribution into one country alone with 60 Million people would require 100 B777 freighters to deliver".

KEY TRANSPORT CHALLENGES IN COVID-19 VACCINE DISTRIBUTION

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Introduction

Researchers, companies and countries around the globe are working day and night to create a safe and efficient Coronavirus (COVID-19) vaccine. Whilst this is being worked on, vaccine manufacturers are also working with governments, logistics companies, airlines and supply chain experts to figure out the solutions to the massive challenge in how to distribute these vaccines to people all over the world.

In our series of articles on the COVID-19 vaccine supply chain challenges our latest article we explore the biggest challenges unfolding in the global distribution of vaccines and the dynamics playing out as vaccine launch dates move closer.

Vaccine Update

Name of Vaccine	Manufacturer	Country	Anticipated Date	Temperature Requirements	Manufacturing Partners
Sputnik V	Gamaleya Research Institute	Russia	Q4 2020	2-8° C	Parana Technology Institute - Brazil, Dr Reddy's - India
BNT162b1	BioNTech, Fosun, Pfizer	Germany, China, USA	Q4 2020	-80° C	None
New Crown	Sinopharm	China	Nov 2020	2-8° C	None
NVX-CoV2373	Novavax	USA	Dec 2020	2-8° C	None
mRNA-1273	Moderna, NIAID	USA	Q1 2021	-20° C	Lonza and ROVI – Europe, Catalent – Indiana
AZD-12222	Uni Oxford, Astra Zeneca	UK	Early 2021	2-8° C	Emergent BioSolutions - US, Serum Institute - India
CoronaVac	Sinovac	China	Early 2021	2-8° C	None
Ad5-nCoV	CanSino Biologics	China	Early 2021	2-8° C	None

The above vaccines are the leading contenders in the world for manufacturing the COVID-19 vaccine for global use. Some of these vaccines such as Pfizer's BNT162b1 and Moderna's mRNA-1273 will bring new transportation and warehousing challenges related to minus degrees Celsius storage and transportation requirements. As per the latest press release on 21st October 2020, Pfizer stated that its vaccine will need storage and transport temperature of its vaccine to be as low as minus 80° C. Moderna's vaccine will need a storage and transport temperature of minus 20° C. The industry was earlier getting ready to transport these vaccines at temperatures ranging from 2 to 8° C. Temperature needs such as minus 20° C and minus 80° C will further add to complexities since the logistics industry has never seen such kind of a challenge before!

Transport Capacity

The biggest challenge will be connecting manufacturer production sites to distribution markets. We spoke earlier about the development of vaccine "consortiums" with multiple global manufacturing sites. In some cases, manufacturers are developing multiple production locations to ramp up production close to key distribution markets. Just some examples as to what is going on as we speak. A number of manufacturers will ramp up with both a production site in the US and in Europe. Astra Zeneca will work with a production partner in Oswaldo Cruz Foundation (Fiocruz) in Brazil and with The Serum Institute in India. The Russians are looking to partner with Dr Reddy for production in India.

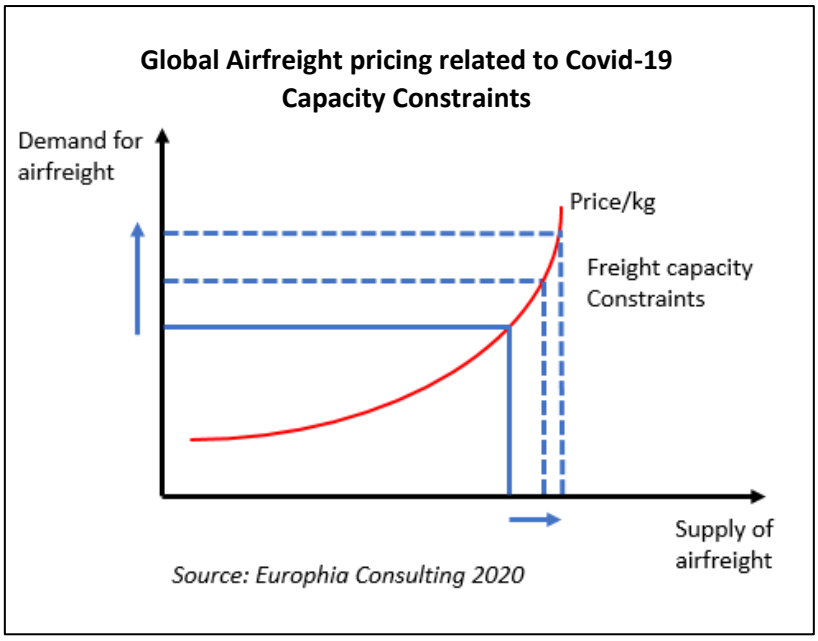
For large distribution markets such as the US, Europe, Russia, India, China and Brazil, most vaccines will probably be distributed from "local" production sites using road transport. The capacity requirements of temperature-controlled trucks will be substantial.

On the other hand, there will be many other countries across all continents that will require air freight solutions to get access to vaccines. Each will face their own set of challenges including capacity constraints.

Airfreight Capacity

In a recent interview, IATA, the International Airline Federation, said that transportation of COVID-19 Vaccine would require more than 8,000 747 Jumbo Freighters. This might be an underestimated number. This requirement, in the months ahead, will present a major challenge in the global airfreight capacity of all the aviation companies combined.

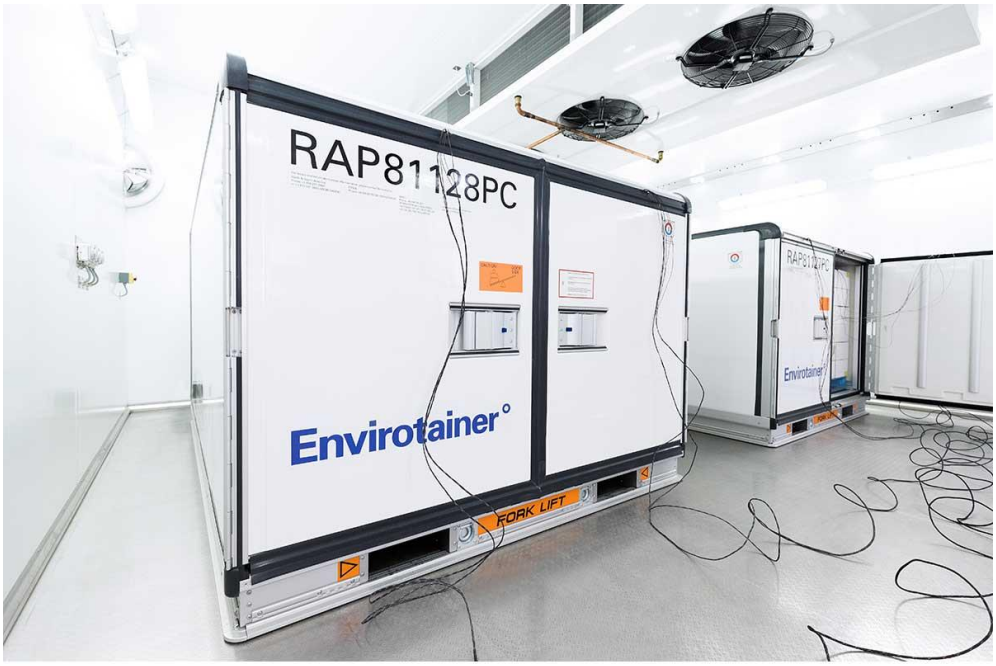
For example, to illustrate the massive scale of capacity required, the current population of the United Kingdom is 62 million people. Around 100 B777 freighters would be needed to transport a vaccine (double doses per capita) to immunise the UK's entire population from a faraway manufacturer. That's just to serve the needs of one country! Imagine now the distribution needs around the world using the limited air freight capacity available globally. The graph below illustrates the massive price impact capacity airfreight constraints might have in the months ahead. We saw this also during the first wave during Covid-19 in March through to June in which airfreight capacity went down as airlines retired passenger jets yet PPE capacity requirements went through the roof. The same scenario could happen here also and will likely drive up the costs of airfreight as well as create capacity constraints.



Final Mile Distribution and Product Security

Not only distribution but also the arrival of vaccines at many destination airports, especially in emerging countries will be a potential cause of concern.

Typically, ground handling at airports of pharmaceutical products are high risk points. Lack of professional cargo handling and temperature-controlled storage facilities, especially in the emerging countries, is a clear risk which needs to be mitigated somehow. Many airports do not have such facilities to store large volumes of pharmaceutical products at 2-8° C. Using actively cooled containers such as Envirotainers, Skycells and C-Safes could help mitigate some of the risks however the next challenge would be to get these vaccines safely transported to a safe cold chain storage facility in some of these emerging countries.



Transiting the goods in emerging countries through airports and into trucks will likely form a major challenge.

Moreover, if frozen storage is required, there are limited airports worldwide that have sufficient deep-freeze warehouse capacity available. For example, there are only four airports in the entire African continent that have this option.

Most airports that do have such facilities are not set up to handle large quantities of temperature-controlled product. Another huge risk is product security. Since these vaccines will be highly valuable commodities, the risk of theft or loss is substantial at many airports and in final mile distribution. Therefore, it will make sense for governments to start planning and to conduct risk assessments and final mile planning critical once product arrives in their countries. For instance, fast track processing time through arrival airports, giving temporary air traffic rights and the training of staff to be able to safely and quickly handle containers carrying the vaccine. All these practical measures can really help to ensure product quality, integrity and security.

If there are no 2-8° C or even lower cold chain facility at destination airports, there will be a need for Envirotainers or other T° active shipping containers to provide additional 2-8° C cold chain protection to make sure that the product is not stuck for a longer period of time at the airport or in transfer to final destinations. Active packaging containers are probably best applied on outbound shipments at origin to ensure product doesn't need to be handled more than needed at destination in non-temperature controlled environments.

Once the vaccine goes out from the destination airport, it would need temperature-controlled trucks to transport the vaccines to cold chain storage units and finally to hospitals, pharmacies or doctors. These cold chain trucks would need to be temperature controlled and would need constant monitoring. This could be another challenge in developing nations.

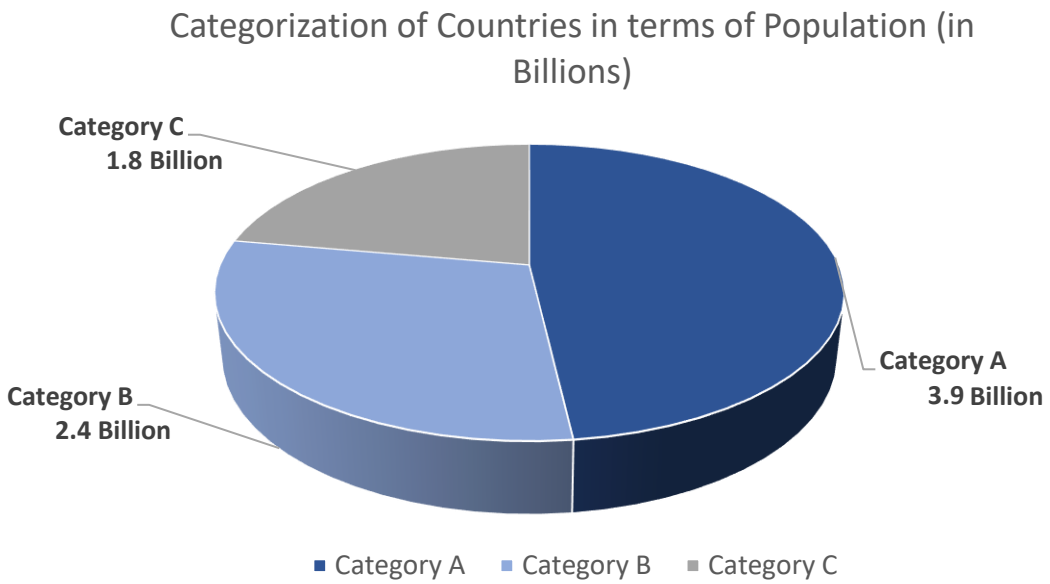
Moreover, in many countries such reefer trucks are potentially not available in sufficient numbers. Similarly, storage and warehousing of these vaccines will require adequate space too. Whilst a lot of countries and logistics companies have already started to build additional temperature-controlled storage facilities, there is still a long way to go. Several logistics companies such as UPS and DHL have started investing heavily in new temperature-controlled capacity. UPS recently added 600 freezers that are capable of handling temperatures as low as minus 80 degrees Celsius near UPS air hubs in Louisville, Kentucky, and in the Netherlands. Each of these freezers has the capacity to hold 48,000 vials of vaccine. However, electricity and consistent temperature control would be a concern in developing nations and regions prone to limited electricity reliability.

It is extremely crucial to monitor the vaccines right from the place of origin to the place of distribution and make sure that the quality and integrity of vaccines is well maintained. As per the latest publication by The Economist dated 23rd October 2020, there are a lot of organized crime networks and international terrorist organizations that have started supplying counterfeit PPE products to countries with short supply. Similar malicious activities can take place once a successful vaccine is ready for use and therefore, proper security monitoring and clear visibility would be required to maintain product integrity and safety.

Population Impact on Vaccine Distribution

The below chart clearly illustrates that most countries around the world fall into Category B and C when it comes to population size.

The countries that come under Categories B and C would require more attention in terms of air freight capacity and security because there is a high probability of vaccines being shipped by airfreight from other parts of the world rather than being able to rely on local production. Whereas, on the contrary, countries in Category A would need to concentrate more on road transport distribution planning since all these countries are currently manufacturing vaccines locally.



Category A are the countries that are likely to manufacture vaccines locally, whereas Category B and Category C are countries that are likely to get the vaccines shipped from other parts of the world.

Source: Europhia Consulting 2020

Category	Countries
Category A	United States, China, India, Russia, Brazil, EU27
Category B	Mid-size countries such as Indonesia, Japan, LATAM ex Brazil, Nigeria, Saudi Arabia, Iran, Turkey, Egypt and others
Category C	Smaller countries with a pop up to 50 Million per country

Regional Distribution Hubs

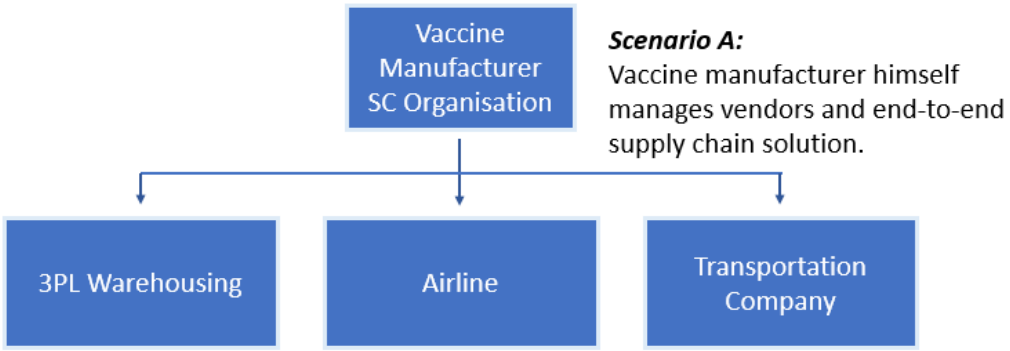
The main vaccine manufacturers have already started to produce at risk. Typically these manufacturers or their CMO's have limited storage capacities at their factories and need to move produced vaccines to external warehouse locations. One solution to overcoming capacity concerns at both origin and destination is to develop cross-dock hubs and replenishment models to "drip feed" vaccine supply into countries rather than in huge batches. This might take some of the pressure off airport processing, transport and storage capacity concerns. Drip feeding vaccines into markets by using a regional distribution hub for temporary storage of produced vaccines might help to mitigate some of the destination country distribution risks as well. For example, Emirates SkyCargo has just launched a dedicated airside hub at Dubai World Central (DWC) in Dubai as its regional hub for temporary storage of incoming vaccines for onwards distribution to countries.

Emirate SkyCargo DWC dedicated pharma hub for vaccines, Dubai

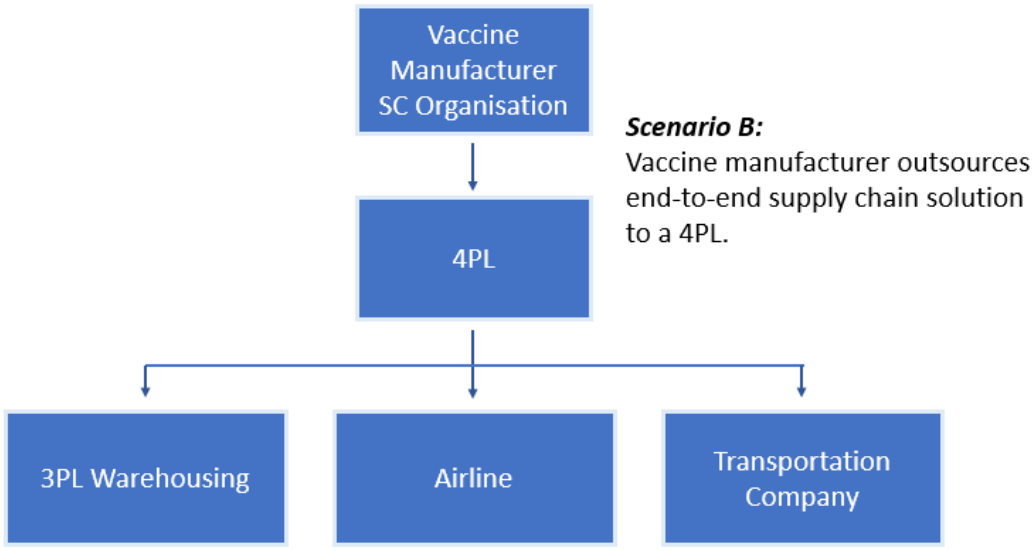
Conclusion

It is crucial for manufacturers of vaccines and/or governments to realize that they need a strong supply chain team to work together and design and manage their GDP compliant end-to-end requirements with the various logistics service providers and airlines providing solutions. Many of these parties are traditionally considered as 'competitors' however, given this very sensitive situation to be successful it is vital for companies to step over these 'traditional commercial considerations' to work together to bundle expertise and capacity across the end-to-end supply chain.

We see two key scenarios in how best to organize and manage the supply chain requirements effectively and quickly. In scenario A, the vaccine manufacturer needs to create an effective supply chain organization with professional supply chain expertise to help manage all the end-to-end supply chain challenges. This will help save time to design and execute the required distribution solutions and to manage the logistics partners in the supply chain. Critical elements to integrate into such an organization include forecasting and planning related to managing available capacities and bottlenecks, managing the logistics providers, contracts and so on.



In scenario B, a lead logistics company, typically a 4pl manages on behalf of the vaccine manufacturer the end-to-end supply chain requirements, logistics partners and provide visibility is one fast and effective way to navigate all the supply chain requirements through one logistics partner. Using a 4PL will help bundle logistics expertise, management, contracts, compliance to regional and local regulations, product visibility and reporting through one partner.



Scenario B:
Vaccine manufacturer outsources end-to-end supply chain solution to a 4PL.

Although a vaccine will probably be available in the first quarter of 2021 the production at risk and distribution of these vaccines has already started and will be an unprecedented global supply chain event. A large amount of vaccines will be required to be shipped and delivered to different parts of the world within a very short time period and hence multiple warehouse partners, final mile transportations partners in different countries, container providers and airlines should start working together to build an effective strategy on what is referred to as the 'biggest logistics challenge since the second world war'.

Europhia Consulting is an international management consulting company specialized in the logistics and supply chain industry in the life sciences sector. We operate global assignments for our clients. The opinions are based on the author's own experience and understanding of the dynamics within the sector.

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Supply Chain Operations SA, based in Switzerland, is a specialized healthcare supply chain consultancy firm created in 2011 to serve the bio-pharmaceutical and medtech industry. We bring more than 120 years of end-to-end supply chain expertise to our valued customers.

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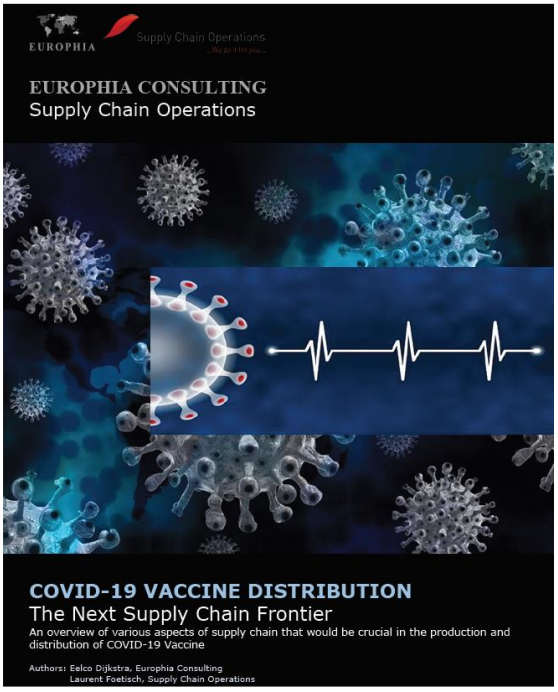
Both companies work together on strategic management assignments for clients globally. We do not pretend to have been able to capture all challenges in this whitepaper and all insights have deliberately focused within this strategy paper on some of the key challenges we see based on our work with clients within the industry. For any questions or comments about this strategy paper, please do not hesitate to reach out to us.

Previous COVID-19 Whitepapers

Europhia Consulting and SC Operations have been at the front end of global supply chain research related to COVID-19 developments since the start and have written multiple white papers and surveys around the concept.



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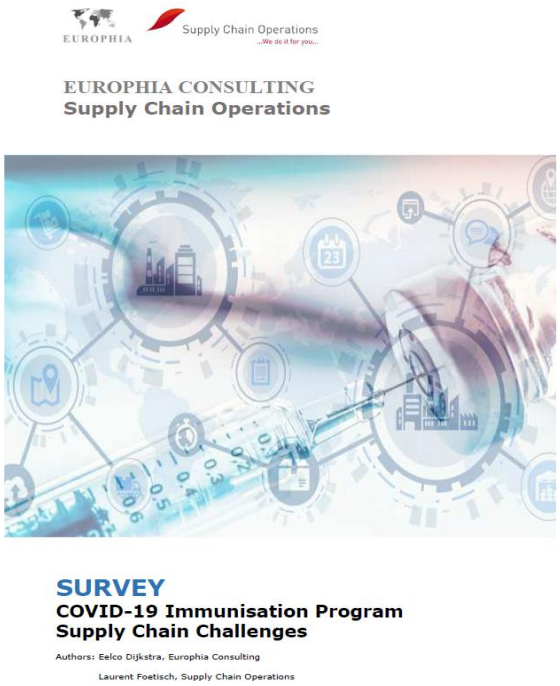

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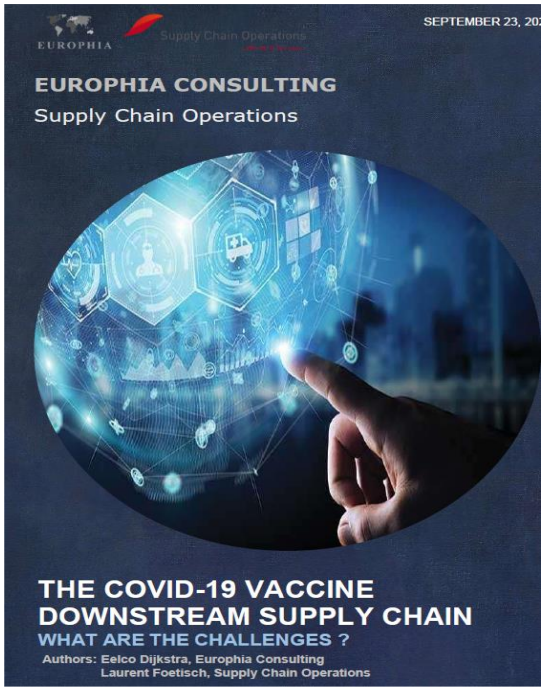

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