

In collaboration with
McKinsey & Company



Pandemic, Parcels and Public Vaccination

Envisioning the Next Normal for the Last-Mile Ecosystem

INSIGHT REPORT

APRIL 2021



Contents

| | |
|----|--|
| 3 | Foreword |
| 4 | Executive Summary |
| 5 | Introduction |
| 8 | 1 Six Structural Changes Are Reshaping Last-Mile Ecosystems |
| 13 | 2 What's Next for Last-Mile Delivery? |
| 15 | 3 The Race to Patient: Challenges and Solutions for Urban Last-Mile Vaccine Deliveries |
| 20 | Conclusion |
| 21 | Contributors |
| 22 | Endnotes |

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Foreword

Growing demand for e-commerce delivery will result in 36% more delivery vehicles in inner cities by 2030.



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Order something online one day and you'll have it at your doorstep in no time. With social distancing as the new normal, consumers' reliance on e-commerce has permanently increased. However, this age of convenience began before the COVID-19 pandemic.

Growing demand for e-commerce delivery will result in 36% more delivery vehicles in inner cities by 2030, leading to a rise in both emissions and traffic congestion without effective intervention. And without effective intervention, the urban last-mile delivery emissions and traffic congestion are



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on track to increase by more than 30% in the top 100 cities globally.

Given the increase in urban deliveries and rising expectations on shorter delivery times, how can cities reduce the increase in carbon emissions and commute times by 2030? Recovering from the pandemic can be a catalyst for digitalization and decarbonization.

There has never been a time for greater global and local collaboration to build back better from the effects of the pandemic.

Executive Summary

The ongoing pandemic has spurred a radical change in the entire supply chain, especially forcing companies to rethink the strategies behind their last-mile deliveries. Companies are searching for ways to provide fast and timely deliveries (faster than ever before) while minimizing the contact between humans, both on the back end in distribution centres as well as between delivery people and consumers. Cities have had to redirect their funding towards health and safety protocols while maintaining their focus on congestion and carbon emissions. As such, consumers have become much more reliant on e-commerce-led, last-mile deliveries.

The development and clinical release of various vaccines was the remarkable success story of 2020. The last-mile distribution of these vaccines to a critical mass of people will be the unparalleled challenge of 2021.

As we begin to see the start of the end of the health crisis, we ask ourselves how persistent urban challenges like air pollution and congestion will be addressed in a post-pandemic world? One lynchpin for overcoming the pandemic is implementing the mass immunization with COVID-19 vaccines. What are the logistical challenges that need to be addressed vis-à-vis regulations and healthcare providers? What will the “next normal” look like?

The objective of the Future of Last-Mile Ecosystem project, a collaboration between the World Economic Forum and McKinsey & Co, is to provide advanced analytics-based congestion simulation and quantitative modelling to inform last-mile ecosystem players’ strategy discussions. Through a solid database, the project is designed to foster and encourage public-private partnerships that can accelerate the development and implementation of effective interventions that enhance last-mile ecosystem’s sustainability and resiliency.

This report follows an initial publication in 2020, which was launched at the World Economic Forum Annual Meeting in Davos before the pandemic struck. Since then, the working group of more than 30 leaders and experts in the private and public sectors have continued the discussion in the form of formal meetings, virtual roundtables and informal industry discussions.

Based on the new perspectives gathered, expert interviews and updated data, we adjusted overall baselines for interventions developed in 2020, such as e-commerce volumes and electric vehicle (EV) penetration rates in the automotive market. Addressing pandemic impact on last-mile delivery,

we further conducted interviews with non-logistics partners such as healthcare providers, governments, start-ups and technology pioneers to give an ecosystem view of the challenges ahead and solutions that can be implemented.

In the first chapter, authors describe selected interventions by companies and cities that are ramping up sustainability and resiliency of last-mile deliveries and its impact on cities. Then, in the next chapter, six structural changes which occurred over the last few months are presented:

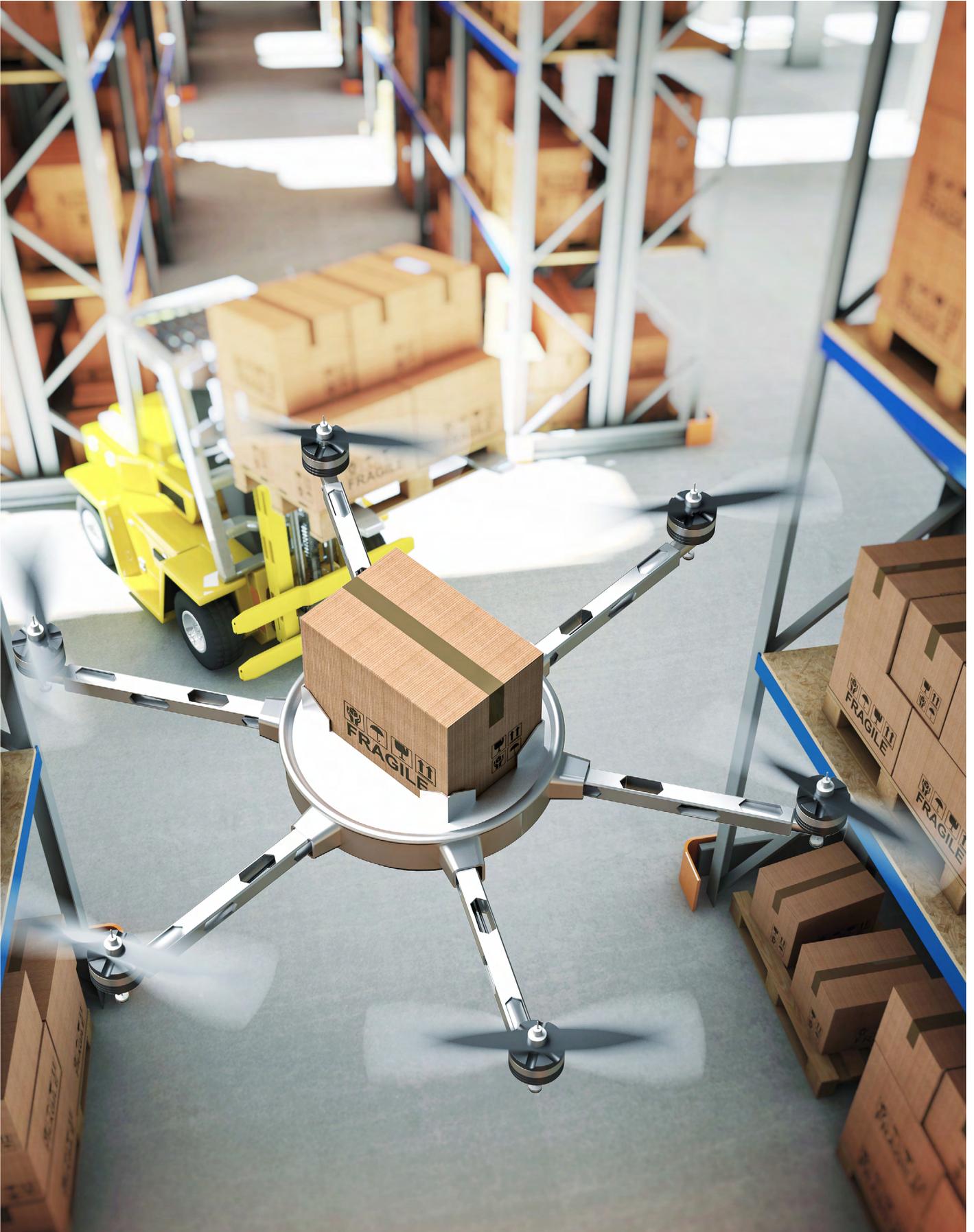
-  1. The pandemic has caused an increase in last-mile deliveries that will persist beyond the pandemic
-  2. Consumers increasingly buy new types of products online and consider environmental and health impact when buying
-  3. Decarbonization of last-mile deliveries has accelerated
-  4. Faced with budget challenges and increased transportation needs, cities steer last-mile transitions
-  5. Proven technologies are fuelling the last-mile ecosystem revolution
-  6. New business models emerge to meet an increased demand for sustainable delivery vehicles

In the next chapter, the authors offer a perspective on how the last-mile ecosystem will evolve. For example, we can expect EV penetration to increase dramatically. Autonomous driving will occur in the goods segment before it scales up into the people transport segment. Real-time data, re-routing and capacity sharing will ease congestion. Delivery options for consumers will diversify as commuter habits have changed. Urban commercial traffic rules may become stricter to manage congestion.

The last chapter is a deep-dive analysis of logistics challenges related to vaccine deliveries. We offer initial thoughts on both challenges and solutions, inviting all ecosystem stakeholders to join the discussion.

In conclusion, there has never been a time of greater change for the “last mile”. Technology solutions shared between governments, logistics providers and healthcare providers are needed to reach the end of this pandemic and move towards the “next normal” of the last mile.

Introduction



2020 has accelerated the last-mile revolution

Consumers, international companies, local businesses, and governments are fuelling unprecedented desire for faster and more reliable parcel shipping, at lower cost and with real-time tracking, less face-to-face interaction, less traffic congestion and fewer greenhouse gas emissions. Accelerated by the COVID-19 pandemic, this hunger for last-mile delivery innovation is likely to change the face of cities worldwide.

The necessary technologies are ready. Electric vehicles, real-time route optimization, parcel lockers and smart inventory management are already in commercial use, while droids, autonomous navigation and many more innovations are in tests around the world and counting:

- Amazon has already ordered 100,000 electric delivery vans from start-up Rivian to be delivered by 2030, and says it expects to have 10,000 vans on the road making deliveries “as early as 2021”.¹ UPS announced a minority stake in UK-based player Arrival, committing to order 10,000 purpose-built delivery vehicles.² Daimler, General Motors and Ford are close behind with their own models.³ New eTruck players like Sweden’s Volta Trucks are tailoring their product and solution offering to the growing urban delivery segment.⁴

- Tokyo is piloting an advanced drone programme. FedEx is partnering with Walmart, Pizza Hut, AutoZone and other retailers to test its autonomous “SameDay Bot”, which reportedly can navigate unpaved surfaces, kerbs and steps.⁵
- In India, where a large section of the population had not adapted to e-buying, the post COVID-19 period witnessed a rise in first-time e-commerce users. So overwhelming were the initial months of the 2020 lockdown that leading e-commerce platforms such as Big Basket, Amazon and Grofers had to prioritize orders and request customers to bear with delays. In India, logistics providers are harnessing existing delivery systems enhanced with internet of things (IoT) and autonomous technologies to provide hyperlocal delivery services, provided by small business enterprises, to millions of online shoppers.⁶ Restaurant aggregators looking to boost revenues have expanded into adjacent verticals such as groceries, pharmaceuticals, and alcohol. Innovation-focused start-ups like Pickup are increasingly filling a void by harnessing technological innovation to create algorithms and systems that optimize the use of resources while ensuring a high degree of customer satisfaction.

“ We expect that last-mile ecosystems will vary significantly – country by country and city by city.



- The Ola Mobility Institute has opened up its technology platform to governments to fight COVID-19 through “Ola CONNECTS” (Comprehensive Navigation, NETWORKing, Control and Tracking Solution). This is a platform that allows government agencies to manage Real-Time War Rooms for various operations

at scale amid the ongoing COVID crisis, with 100% data privacy and world-class security. In the state of Punjab, for instance, this free platform is used to provide e-passes to farmers to enable farm-to-market movement of fresh produce during the crisis.⁷

- Over the past few years, digital technologies have transformed restaurant delivery, and recent efforts by global tech giants in this space have forced new competition with local players. *Zomato* and *Swiggy*, both fast-growing hyperlocal food discovery and delivery start-ups, tied up with big grocery brands and gave customers the option to order groceries through an app. The Ola Mobility Institute has identified reskilling and reattribution of workers to unlock new earning opportunities as a theme in its report, [Leveraging and protecting the gig economy against Covid-19: Measures by gig economy and governments around the world](#).
- *LeasePlan* is working with several global online retailers to identify which of their delivery routes are most suited to make an immediate transition to electric delivery vehicles.
- The city of Santa Monica, together with *Los Angeles Cleantech Incubator*, recently launched the first zero-emission delivery zone.⁸ Kerb management company *Coord* is working with cities like Nashville, Aspen, West Palm Beach and Omaha on installing smart loading zones which drivers can reserve via an app and whose prices can be adjusted dynamically, depending on demand.⁹ Arguably, this pilot series is also a sign that the last-mile revolution has also reached tier-2 cities.

The last-mile revolution will be fuelled by a shared global desire to recover better than we were before the pandemic. We expect that last-mile ecosystems will vary significantly – country by country and city by city.

Last-mile has always been critical, but the issue is even more pressing as demand has risen. Growing

e-commerce demand could lead to 36% more delivery vehicles in inner cities by 2030 leading to rising emissions and a 21% increase in last-mile delivery-induced congestion (or 11 minutes of commute time daily)¹⁰.” Angela Hultberg, Head of Sustainability, IKEA Retail (Ingka Group), said that even in countries that had strict lockdowns, “We witnessed a record year for deliveries despite restrictions.”

Even the largest stakeholders, such as logistics and e-commerce players, cannot create complete ecosystems on their own – nor should they. In an “evolutionary revolution”, small businesses, from restaurants and pharmacies to florists and boutiques, will need access to last-mile services to keep serving customers and employing workers in the “next normal”. Even with the vaccine distribution under way, city governments and healthcare providers will need to connect vaccination demand and supply to reach millions of people at healthcare centres.

Ecosystems should also serve public interests. City governments will need to enable and support the new ecosystems to reduce traffic congestion, noise and air pollution. In New York City,¹¹ for example, more than 1.5 million packages were delivered every day *before* the pandemic. To meet this need, delivery companies racked up more than half a million parking violations rather than work around the city’s existing delivery ecosystem.¹² Commercial delivery entities incurred more than \$123 million in parking fines to ensure they could meet consumer needs.¹³

In this report, we outline structural changes impacting last-mile deliveries and put the spotlight on innovations and strategies to help create efficient, resilient and environmentally friendly supply chains that enable a thriving modern ecosystem for consumers’ delivery needs.



1

Six Structural Changes Are Reshaping Last-Mile Ecosystems



The World Economic Forum and McKinsey & Company launched [The Future of the Last-Mile Ecosystem](#) initiative to provide insight into the economic, social and environmental impacts of e-commerce growth on last-mile logistics. More than 50 cross-sector leaders from cities and

businesses meet regularly to discuss trends, interventions, and ecosystem pilots. In their discussions, workshops and roundtables since the beginning of the pandemic, these leaders have identified six structural changes that are reshaping last-mile ecosystems.



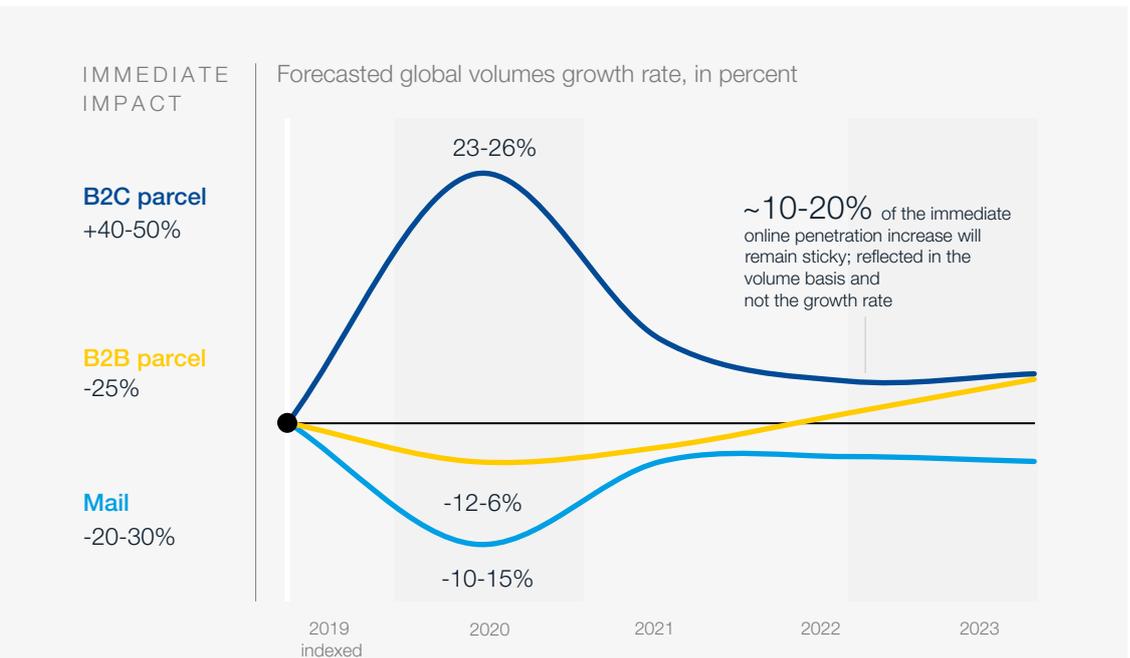
1. COVID-19 is accelerating the evolution of the last-mile ecosystem

Globally, e-commerce sales have tripled since 2014 to more than \$3.5 trillion¹⁴ thanks to rising urbanization and the ubiquity of smart devices, as well as new e-commerce business models. The pandemic has amplified and accelerated this trend. In 2020, business-to-consumer parcel deliveries have risen by about 25% and our analysis shows part of this increased demand will be durable (Figure 1).

The pandemic is also driving demand for autonomous, contactless delivery. As investments flow into the technology that makes it possible,

on-road urban testing is under way around the world. Start-up *Nuro*, for example, is partnering with CVS¹⁵ and other retailers to test autonomous local deliveries on city streets to scale up and accelerate droid adoption. So far, the company has raised \$1 billion.¹⁶ *Amazon* purchased *Zoox* in the midst of the pandemic.¹⁷ *Cruise*, the self-driving subsidiary of *General Motors*, redeploys some of its self-driving cars to make food deliveries in San Francisco.¹⁸ Other companies like *Waymo* have announced new initiatives to create hardware and software solutions for automated parcel deliveries.

FIGURE 1 Forecast global sales for mail and B2B and B2C parcels



Source: McKinsey & Company

^a UPS Q1 2020 Earnings Call, Apr 28, 2020

^b <https://blog.aboutamazon.com/company-news/amazon-hiring-for-additional-75-000-jobs>

^c Announcement already in 2019, proactive announcement in 2020: No change due to COVID-19

| | | |
|--|--|---|
| <p>15% increase in total average daily stops^a</p> | <p>100,000 employees hired by Amazon in March, with 75,000 more planned in April^b</p> | <p>100,000 EV orders from Rivian by Amazon – Electrification at the tipping point^c</p> |
|--|--|---|



2. Consumers increasingly buy online and consider environmental and health impact when buying

Hundreds of millions of people are now accustomed to ordering products of all kinds online for home delivery and they expect to order more across categories, including food, beverages, home improvement items, plants and beauty products (Figure 2). Consumers are also becoming more ecologically aware. For instance, 56% of millennials

cite environmental protection as the reason for choosing alternatives to home delivery, and more than half of consumers say they are conscious of environmental issues in e-commerce. More shoppers now feel the need to choose health safety along with sustainability – a preference that is likely to endure in the wake of the pandemic.

FIGURE 2 Consumers intend to purchase more goods online across categories

| Western European physical e-commerce market by product category ^d % | | Retailer example | Share of consumers expected to increase online sales in Next Normal ^e |
|--|-----|------------------|--|
| Apparel and footwear | 26 | ASOS | ~29% |
| Consumer electronics | 19 | NBB | ~16% |
| Food and drink | 12 | VIVINO | ~70% |
| Homeware and home furnishings | 10 | IKEA | ~8% |
| Media products | 9 | jpc | ~31% |
| Home care, improvement, gardening | 3 | OBI | ~72% |
| Traditional toys and games | 3 | LEGO | ~15% |
| Sports equipment | 2 | BIKE24 | ~9% |
| Beauty and personal care | 1 | DOUGLAS | ~69% |
| Consumer health | 1 | SHOP APOTHEKE | ~59% |
| Other | 14 | | |
| Total / weighted average | 100 | | |

+50%
Daily parcel volume in April (8.0 mn; compared to a yearly average of 5.2mn pre-Covid-19) in Germany

66%
Stock price increase since March 12^f

Source: McKinsey & Company

^d Original breakdown by Forrester includes digital media – weights thus adjusted to exclude digital media

^e Coresight research, sample size of ~1,150 US internet users aged 18 and above

^f From March 12 (EUR 19.11) to June 29 (EUR 31.76)



3. Decarbonization is accelerating

Some companies and cities have already made commitments to make emission-free deliveries. *IKEA Retail (Ingka Group)*, for example, aims to make all deliveries emission-free by 2025. Some 90% of deliveries made in China by *IKEA Retail* are already electric. Pandemic-related economic stimulus packages, especially in the European Union and China, contain provisions to support green mobility and goods transport. For instance, Germany is raising subsidies for new EV vehicles from €6,000 to up to €9,000,²⁰ pushing entry-level

EV models such as the *Tesla Model 3* and *VW ID.3*. China is extending its consumer subsidies and tax breaks for EVs until 2022 as retailers and shipping companies drive demand for electric delivery vehicles. *Micelio*,²¹ an EV start-up in India, is investing in R&D to build a new EV vehicle that is suited to the hyperlocal delivery needs of a city like Bangalore, keeping in mind delivery executive safety and with the broader goal of building a more efficient delivery system.



4. Faced with budget challenges and growing transport needs, cities steer last-mile transitions

City budgets are facing unprecedented pressure. Worldwide, residents report fear of catching COVID-19 from public transport, which is fuelling a rise in automobile traffic. Cities must now cope with the proliferation of more personal vehicles on the road and record levels of demand for optimized goods transport. C40 cities and many others use this momentum to make serious commitments to

accelerating decarbonization. The Paris “15-minute city” announcement and pledge to ban diesel vehicles in 2024 might be the most prominent example. Cities like Seattle and Boston repurpose kerb space to designated delivery pick-up.²² Also, Santa Monica and Amsterdam are taking bold actions to get into the fast lane for zero-emission (see text boxes below.)

BOX 1

How Santa Monica is creating a zero-emission delivery zone

The Los Angeles Cleantech Incubator (LACI) has partnered with the City of Santa Monica to create a voluntary “zero-emission delivery zone” (ZEDZ) in a one-square-mile area encompassing the commercial cores of Santa Monica’s Downtown and Main Street as well as the Ocean Park neighbourhood. The beachfront community zone, where about 16,000 people live and 29,000 work, is incentivizing voluntary participation through priority kerb access for zero-emission delivery at 20 loading zones in the ZEDZ. Additionally, the ZEDZ is enabling deployments of last-mile delivery of food and parcels with technology companies, delivery partners and local businesses that include sidewalk robots and other micro-mobility,

commercial electric truck rentals, mobile charging applications, and more.

The core goals of this effort are to provide a blueprint for other cities to create zero-emission zones, provide benefits to the local community in the reduction of emissions, noise, congestion and road accidents, and offer economic benefit to small businesses and individuals in the zone.

The ZEDZ was formally launched in February 2021 with partners including IKEA US, Axlehire, Foodcycle LA, Shopify, Guayaki, AlSCO Uniforms and REEF Technology. The ZEDZ will be evaluated for continuation and expansion at the end of 2021.

BOX 2

How Amsterdam can deploy charging infrastructure for electrified logistics

A study was conducted within zero-emission zones in Amsterdam to analyse how, where and when vehicle-charging infrastructure needs to be put in place. Using available statistics and cost-optimization model, estimates were also made of projected impact on the power grid, required number of charging points and spatial impacts. The cost optimization model considers the vehicular, battery and charging station characteristics and the journey profiles. The model spews out charging, battery actions and charging station capacity and charging scenarios.

Based on these results, and the choices made, a vision emerges of where, when and how fast

vehicle charging might take place, allowing grid operators and municipal authorities to develop plans in terms of both charging infrastructure and spatial planning.

The results showed that for all sectors of city logistics – from waste collection, to construction, to retail, to hospitality – the best placed charging happened at a distribution centre or depot at night using 150kW. Therefore, there was no need for local governments to provide charging infrastructure in city centres. A zero-emission zone in Amsterdam will cause a total energy demand 1%-2% of total energy demand in the greater Amsterdam region.



During national lockdown, the Government of Karnataka collaborated with *ANI Technologies* (Ola Cabs) and *Uber*, both application-based online cab aggregators, to allow “COVID Warriors” and those seeking medical help to commute intra-city. Special travel passes were offered to these cabs operating during the lockdown. The government has fast-tracked the long pending suburban train project, connecting the Bangalore with its surrounding fast-growing suburban cities. This a big requirement for a city like Bangalore

and serves the need for a traffic-free commute for residents who want to relocate to new towns and cities around Bangalore and commute to the city for work. The Government of Karnataka is expanding the current metro network in Bangalore and assisting last-mile logistics companies in their operations as they look at equipping more metro stations with rentable cycles and bikes and offer easy availability of shared two-, three- and four-wheeler ride options for commuters.



5. Proven technologies are fuelling the last-mile ecosystem revolution

While disruptive new technologies will continue to emerge, the last-mile revolution is happening now as proven technologies scale up and the costs of ownership fall. The purchase prices of EVs in Europe, for example, are, according to Jack Ewing of the *New York Times*, “tantalizingly close to the prices for cars with gasoline or diesel engines”.

Parcel lockers are being adopted around the world, and companies of all sizes can now share and gather data to improve load pooling and real-time route optimization at a lower cost than ever. Drones can help the ecosystem but scaling the use of existing technologies – from EVs to route optimization – will fuel the last-mile ecosystem.



6. New business models emerge to meet an increased demand for sustainable delivery vehicles

Fleet owners, from two-wheelers to four-wheelers, expanded their offering for delivery purposes. *Gotcha Mobility*²³ began offering its e-bicycles or seated scooters to local restaurants and merchants to meet demand for delivered products such as take-out meals and groceries at a starting discounted rate of \$15 a day for each vehicle (further discounts offered for more than five vehicles). In India, *Bounce*, a scooter-rental and bike service start-up, currently has over 13,000 two-wheelers in Bangalore alone.²⁴ Unused inventory numbers are large. With the intention to boost sharing economy, *Bounce* has launched the Scooter Hero platform where anyone can pledge their idle two-wheeler to be used by frontline workers, battling the crisis every day. They have also dispatched about 1,000 *Bounce* scooters to various government authorities across the country. In Malta, *Cool* on-demand, micro-transit extended its service allowing grocery stores and small businesses to dispatch essential goods using the local service app. The app further allows deliveries to be shared, with an adjusted algorithm enabling an increase of volume of packages that can be picked up by the same vehicle. *Ola* launched a contactless parcel delivery service in Australia and New Zealand, and *Voi*

expanded its offering of e-scooters to restaurants under special subscription models in Nordic cities in response to increased home delivery demand.²⁵ Business models of urban delivery-focused modes rental like *Emco*²⁶ and *Urban E-Bikes*²⁷ are projected to be joined by other mobility service providers. Finally, *Uber* revealed in its Q4/2020 earnings’ call that the company is now earning more revenues from delivering goods than from moving people.²⁸

Despite the various innovations, there are not enough financial models today to make the transformation to a more sustainable fleet happen fast enough. That is why companies like *Ingka Group* have found it necessary to really step out of the traditional role as a transport service buyer by financing platforms such as *Fluid* and working directly with leasing companies and original equipment manufacturers (OEMs).

Institutional investors that have long-term and large-scale financing mechanisms can unlock main barriers to entry – upfront cost – off the balance sheet, turning capital expenditure (CAPEX) oriented business models to operating expenditure (OPEX) oriented, which is naturally more profitable for fleet operators.

2

What's Next for Last-Mile Delivery?



With the necessary technologies and systems in hand, stakeholders can now take concrete action to transform last-mile deliveries. In our previous paper on this topic, [The Future of the Last-Mile Ecosystem](#), we outlined 24 interventions to reduce emissions, delivery costs and urban congestion. We encourage stakeholders to consider the following significant trends reshaping last-mile delivery.

EV penetration is likely to increase dramatically.

As logistics players and e-retailers double down on sustainability commitments, and vehicle manufacturers improve the range and lower the costs of owning electric vehicles, businesses will likely buy more of them. In September 2020, the EU, US and China all made announcements to quicken progress towards zero emissions. The EU will vote in June 2021 on whether to increase 2030 CO₂ reduction targets from 40% to 55%, for instance. California has announced plans to phase out sales of new gas-powered cars and trucks by 2035, and China has committed to drastically reduce emissions and become carbon-free by 2060. State governments, especially in the US, will set stricter emission limits to put the states on a path to net-zero carbon emission by 2050.

Autonomous goods transport may increase and add to congestion in the short term.

While some major auto manufacturers are shifting investments away from autonomous passenger cars, the pandemic seems to be spurring more interest in autonomous goods transport.²⁹ That said, relatively slow-moving autonomous vehicles, operating alongside non-connected vehicles, might increase congestion and road accidents. However, this negative impact on congestion might be contained if more cities – like Brussels³⁰ – move ahead on the introduction on low-speed zones which, arguably, will not only increase road safety but also allow for faster roll-out of autonomous vehicles and droids.

Real-time, dynamic rerouting and capacity-sharing may ease commercial traffic in the medium term.

As parcel volumes rise, logistics players are using increasingly connected fleets to consolidate loads and speed deliveries at lower cost. We expect that the penetration of such

solutions will be 50% higher by 2030 compared to pre-COVID assumptions. The traditional hub-and-spoke model supply chain doesn't account for the dynamically changing demand and supply of things. Information siloes make it difficult to locate individualized things at any time, thereby relying on archaic inventory systems. Only an *Amazon*, an online supermarket of things, can have real-time dynamic data and algorithms to predict consumer behaviours. Ubiquitous smart phones in consumers' hands make it easy to give digital identity of things. The tracking information can be shared both ways – from business to consumer and vice versa. *EVERYTHING Product Cloud™* gives an intelligent digital identity to everything that is made and leverages real-time intelligence, machine learning and analytics to give end-to-end, item-level visibility from factory to consumer. This type of dynamic and networked, peer-to-peer information sharing helps optimize travel routes and thus reduce carbon footprint from transport.

Travel habits may become more diverse, creating a wider range of delivery options. As more people work from home, office deliveries may decline. Delivery locations, however, will expand far beyond the doorstep to include trunks, offices, “dark stores” that cater to online shoppers, parcel shops and especially parcel lockers, which allow on-demand, contactless deliveries. At the same time, we expect delivery fleets to transition to electric and become more diverse, as many players experiment with adding cargo-bikes and electric two-wheelers to their mode of transport.

Urban commercial traffic and carbon emission rules may get stricter, reducing congestion induced by last-mile deliveries. While cities may be reluctant to impose new parking rules and road-use fees on commuters and delivery vehicles, many may start to use technologies for stricter yet flexible regulation. In that regard, we believe data-driven solutions for dynamic kerb and road pricing will be a major solution for cities to manage demand and supply of transport, while at the same time securing and improving the availability and quality of transport for all macro-economic groups of road users.

3

The Race to Patient: Challenges and Solutions for Last-Mile Vaccine Delivery



Vaccine distribution epitomizes the importance of a last-mile ecosystem. The development and clinical release of various vaccines was the remarkable success story of 2020. The last-mile distribution of these vaccines to a critical mass of people will be the unparalleled challenge of 2021. This applies to both rural and urban areas of the world – the latter being the focus of the following paragraphs.

Interestingly, there are tremendous differences between countries regarding their respective speed and efficiency for last-mile vaccine deliveries. Broadly speaking, countries with high levels of integration of healthcare and logistics stakeholders saw the highest national vaccination rates being achieved soonest in the 2021 race to vaccinate. For example, Israel has universal insurance coverage and a central, fully integrated, digital public health system, allowing for data-based patient prioritization and timely communication.³¹ Nearly every Israeli citizen and resident belongs to one of four [public HMOs, a healthcare system rooted in the national trade union of Israel's early years](#). Every Israeli's full medical history – from physician visits to hospitalizations – is accessible to any health provider at the click of a mouse, a repository of digital records going back 30 years. [An efficient digitalized system alerted priority groups when and where to go for their vaccines](#).

Likewise, the UK's National Health Service (NHS) has one of the most centralized, streamlined vaccine distribution efforts worldwide.³²

Another surprising leader in vaccine distribution is Chile. In the first three days of the mass vaccination campaign, [556,000 people were vaccinated against COVID-19](#), quickly making it a leader in the region and beating the US in average daily vaccinations. The Chilean government was smart in hedging its bets by ordering all types of vaccines from *AstraZeneca* and *Pfizer* including the *Sinovac* from China that has simpler cold-chain requirements. This allowed it to not only have bigger supply right at the outset but also the ability to use different cold-chain requirements for the various vaccines for different purposes, locations and demographics.

The Singapore government managed the COVID-19 spread in an efficient and controlled manner. Vaccination is voluntary and free. One exemplary Singaporean method that is applicable for all logistical pilots is: Thing Big, Start Small. That is to say, for all COVID-19 protection protocols – from establishing isolation centres to setting up a system for inoculation – the multi-ministries task-force tested vaccination in one or two precincts first, fixed the kinks and then rolled them out to more precincts. Such cross-sectoral task forces and collaborations with private sectors has been critical for their planning. Lastly, of course, Singapore's small size, relative wealth and centralized system makes operations and planning more streamlined.

In contrast, countries like Germany and the US with decentralized, federalist approaches and a patchwork of disintegrated IT systems, seem to have struggled.

While some might say we will see efficiency gains in the second and third quarter of 2021, there is reason to believe that more “capillary” delivery chains will make delivery even more challenging for the last-mile ecosystem and will lead to an increased risk of unused doses as well as even higher need for data-driven orchestration.

Key challenges include:

“Tie your shoes while running” problem: The problem is rampant and urgent so there isn't much time for trial and error in the operational planning. Secondly, the ultra-cold temperature requirements make vaccine storage and distribution reliant on existing public health infrastructure that is underfunded and crumbling.

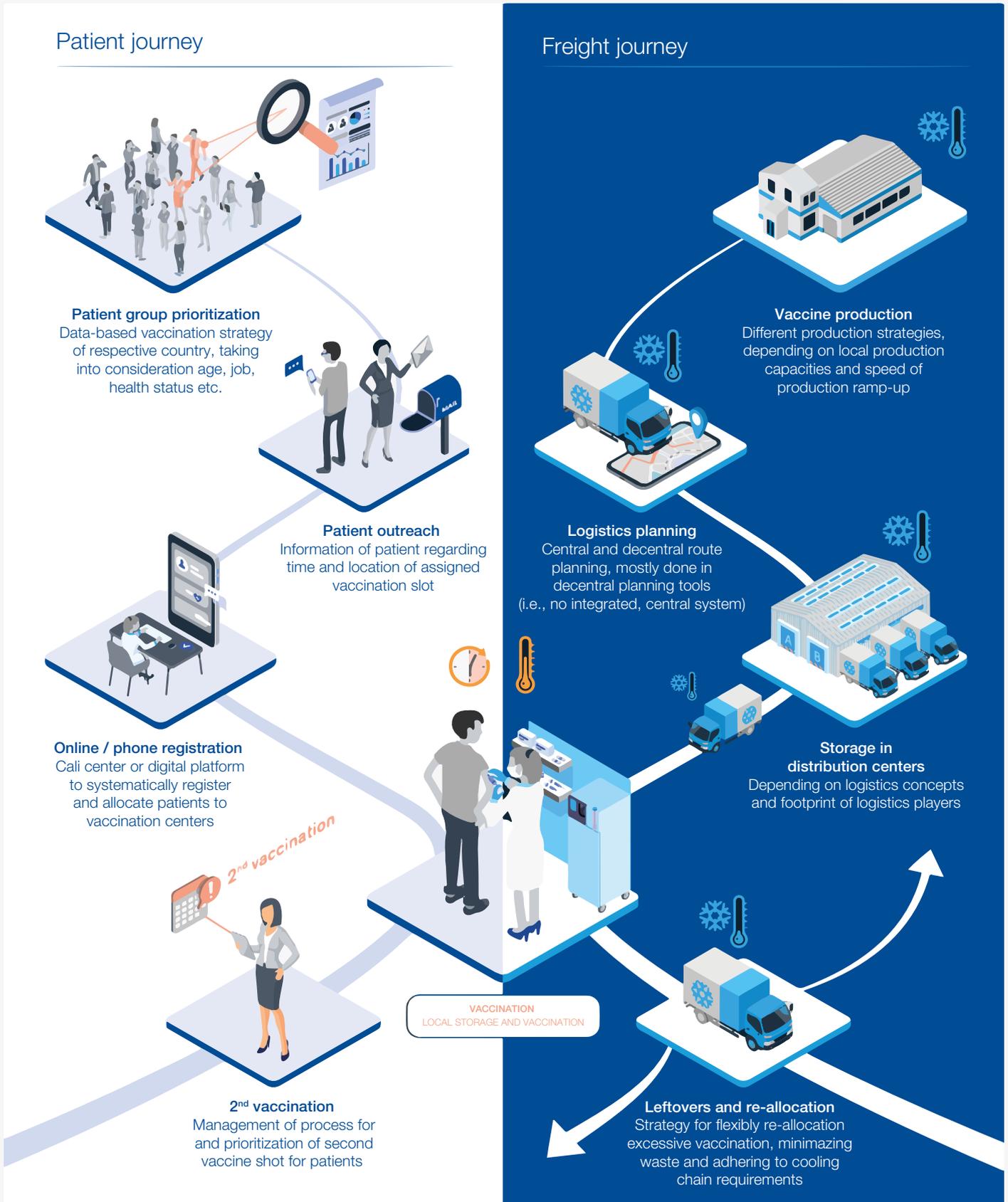
Perishability of vaccine doses and availability of accessories: Vaccinations do not hold their potency for long. Ultra-cold freezers or dry-ice delivery containers require specialized equipment that is not in huge supply. These “thermal shippers” are packed with dry ice and monitored using a remote thermometer and location trackers. Logistics players need to guarantee an end-to-end cooling chain with temperatures as low as minus 70 degrees Celsius (as in the case of Biontech). Additionally, some countries like Germany have had challenges with supply of dry ice for the cooling systems and enough vaccination equipment including alcohol wipes, syringes, needles, masks and gloves. Special cooling and vehicle/freight security concepts are not new for logistics players but have never been needed at such scale. Cold transport, although not new, is also necessary to move meats as well as many other foods and medicines.

Two-dose requirement for most COVID-19 vaccines add complexity to creating a predictable supply chain: Unless doctors, pharmacies and other providers have a steady supply of vaccines, which hasn't been the case so far, they will need to save half of a shipment to give people booster shots in about a month within a timeframe of two to three days. Only time will tell how long the vaccine immunity will last. Even with the *Johnson & Johnson* one-shot, we will still need a few years of learning to fully design a predictable logistics system for mass vaccination. Then, along with vaccines, glass vials, alcohol wipes, syringes, needles, masks and gloves are all in short supply.

More capillary demands in the second and third quarter of 2021: Many countries prioritized the vaccination of their elderly population, often carried out in hospitals and senior-citizen homes. In 2021, supply chains will need to extend to healthcare centres, local medical practices, and even schools or business campuses.

NATIONAL VACCINATION AND PATIENT STRATEGY

Disconnect between patient and freight journey



Disconnect between patient journey and vaccination supply journey (see chart above):

While many countries managed to digitize and professionalize the patient journey to a respectable degree – leveraging professional call centres, online registration and digital demand management – many logistics companies complain that the same rigorous approach to central, digital logistics management has not been effectively implemented. In many cases, logistics planning happens with the aid of manual Excel files, outdated by the time the data is handed over to route planners and drivers.³³ Much tighter integration of data flow and physical goods flow is needed in the coming weeks and months.

Data-based prioritization of population groups:

Although some countries began the dissemination of vaccines with a prioritization approach instead of a “first come, first served” basis, many have since adopted a blended approach. Prioritization has been heterogeneous and complex as groups of mixed age, profession and health status are considered

vulnerable. This may increase the need for a central, data-based prioritization strategy and will almost inevitably result in more complexity for logistics players who will face last-minute changes on demand and routing, and potentially need to factor in returns and re-routing of leftover doses from one place to the other.

As digitization of delivery processes increases, so does cybercrime:

While an integrated demand/supply system for patient prioritization and vaccination deliveries could increase system efficiency, new and unprecedented risks of cyberattacks and data misuse occur.

Increased inequitable results for the underserved:

The vaccine journey from a centralized distribution centre to clinics to patients isn’t even an issue of distance, but rather perusing a fragmented maze of local regulations, communication breakdowns and an unravelling of the systematic failures of our inequitable society.



There is no one-size-fits-all approach when it comes to solutions to the above problems. Initial hypotheses for **solutions** include:

Central, top-down leadership from national governments is key: Governments need to embrace their responsibility to not only manage demand and prioritize supply but also to invest in and manage supply chains for deliveries more closely.

Partners for data integration and digital supply chain management need to be identified:

Arguably, developing a central platform at national

level will be too complex, too expensive, too slow in implementation. Therefore, governments and logistics companies could think about teaming up with players who are experienced in managing very local, capillary demand and with integrating a large number of local retail outlets. Examples include large online retailers, e-grocery giants and technology/platform players. This could also enable more effective communication between driver/logistics players and local health centres, including real-time estimated time of arrival (ETA), automated push notifications, as well as dynamic navigation and reallocation of vaccination supply.

The importance of scaling data-sharing across supply chains goes beyond vaccine distribution. There are issues today of challenges in hand-off between different logistics providers in the chain due to lack of standardization of interfaces and data models. This means there is less flexibility for dynamic transport and logistics networks than there could be if item and tracking information could be shared more readily across transport networks and providers. There are competitive reasons to maintain a “walled garden” for tracking networks, but this is limiting the rate of adaptation. The needs introduced by reverse logistics – i.e., the ability to support pick-ups for re-commerce – are driven by sustainability demands.

The time for professionalization and digitalization of real-time route planning is now:

Logistics players need and have the chance to fast-forward real-time demand and route planning, reallocating RD/investment budgets and massively cutting down future delivery costs.

Scenario planning can help to minimize vaccine spoilage:

Cold-chain storage is complicated. All ecosystem stakeholders should move from reactionary logistics approaches to more proactive planning strategies and use of scenarios, factoring certain back-up contingencies into their supply chain strategies.

Traceability and authenticity of medical supplies and vaccines will make or break widespread acceptance:

Real-time intelligence about every COVID-19 vaccine vial could ensure knowing the provenance of the vaccine, the route it has travelled and, thus, its authenticity. It would also allow each healthcare centre to predict the number of vials a day needed at each individual centre. By giving a “helicopter view” of every vial of vaccine, real-time intelligence can create a dynamic inoculation system that can not only solve the demand and supply mismatch but also secure the trust in the authenticity of the vaccine.

Henry Schein, a notable medical supplies company, said global healthcare supply chains are built for maximum efficiency, not to deal with crises, such as the one that unfolded in 2020. To strengthen the resilience of supply chains, Henry Schein expressed the importance of sustained governmental and international investment to address these risks in the long term. From shortages in gowns manufactured in Wuhan prior to the outbreak to hoarding of medical supplies, had there been a real-time digital accounting of the PPE, companies could have managed the supply of masks better and curtailed the spread faster. Cloud technology companies such as EVERYTHING can give real-time intelligence for better scenario.

All intervention will be in vain without trust and inclusivity at a community level:

For countries such as the US and Germany where citizens and stakeholders have to navigate a fragmented and localized maze of regulations, it's essential that all of these interventions work in tandem with the existing infrastructure and community nodes set up by healthcare service providers at the local level. Some reflections were provided by the following US healthcare providers:

Jefferson Health is a network of 14 hospitals on the north-east coast of the US. It recognizes that marginalized populations face health disparities and their mistrust of the health system are common in many communities and can hinder public health initiatives. With programmes such as the Real Talk, Jefferson Health is encouraging conversations about the vaccine to overcome hesitancy. One of the biggest concerns is to inoculate the largely undocumented gig economy workers that work in the travel, tourism and restaurant businesses. Community leaders, such as *Black Doctors COVID-19 Consortium*, are setting up vaccination centres in the communities that are highest at risk and most reluctant to take the vaccine. The Y-USA, widely known as YMCA globally, established 175 years ago, are community centres where demographics – young and old, rich and poor – access community provision from health, libraries to cultural activities, forming deeply rooted trust-based presence in the communities.

The Y-global has a robust footprint in parts of the country where medical centres and pharmacies are not available. As such, for years it has been the lynchpin that connects community health need with its regional healthcare system. As a result, it is well-suited for conducting community-based inoculation sites for a new vaccine that requires education, trust-building and urgent implementation.

Home Instead is a US-based company providing care to the elderly population. Operating on a franchise model, it has 1,200 locations in the US in 14 states. Given the rampant and dangerous spread in nursing homes, Home Instead was critical in bringing health to home in safe ways. Its experience highlighted two important elements from a logistics planning perspective – dynamic data collection and trust-based reach. By collecting data on infection rates vis-à-vis human behaviours, it helped governments and companies dynamically adjust the need for COVID supplies and safety protocols on PPEs and distancing.

Governments and health companies can leverage community-based organizations' local presence to reach underserved, hesitant, elderly, undocumented, or disabled populations for scaling their operations. This will also help logistics providers with more reliable human behaviours.

Conclusion

The moment is creating urgency around implementation

The last-mile presents complex, interwoven challenges and opportunities for every stakeholder. While there is no silver bullet or breakthrough intervention, we encourage last-mile stakeholders to work with both urgency and a collaborative mindset to improve the lives of hundreds of millions of city dwellers around the world and support the businesses that serve them.

The vaccine delivery challenge shows us the twin realities of the last-mile ecosystem – the tremendous innovations that allow consumers to get same-day goods that were manufactured three seas away juxtaposed against persistent inefficiencies in the vaccination roll out. It's a testament to the point that public-private cooperation plays a central role in the evolution of the last-mile ecosystem.

Cities are already looking for ways to reduce traffic congestion, carbon emissions and delivery costs. As millions of people rely more on e-commerce, last-mile ecosystem players will need to implement the interventions that are most beneficial in the context of each city they serve.

While every ecosystem player faces tremendous pressure to act, they can make dramatic progress quickly by aligning on shared goals and acting in partnership.

Finally, the pandemic has taught us that all interventions will go to waste without a core trust-based system that allows consumers, governments and companies to achieve a more equitable, climate-friendly future.



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