PEAKLOGIX

AN ALTA MATERIAL HANDLING COMPANY

WHITEPAPER

Micro-Distribution: Fulfillment's Next Revolution

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That e-tail giants like Amazon, Alibaba, eBay, and JD.com have changed – and continue to change – commerce is no secret. From same-day shipping to same-day delivery to, now, delivery in as little as an hour, the pressure has never been higher for companies to deliver the right product to the right person at the right time.

Not every company, however, has the resources or the need to invest in the kinds of fulfillment centers that have made Amazon so successful.

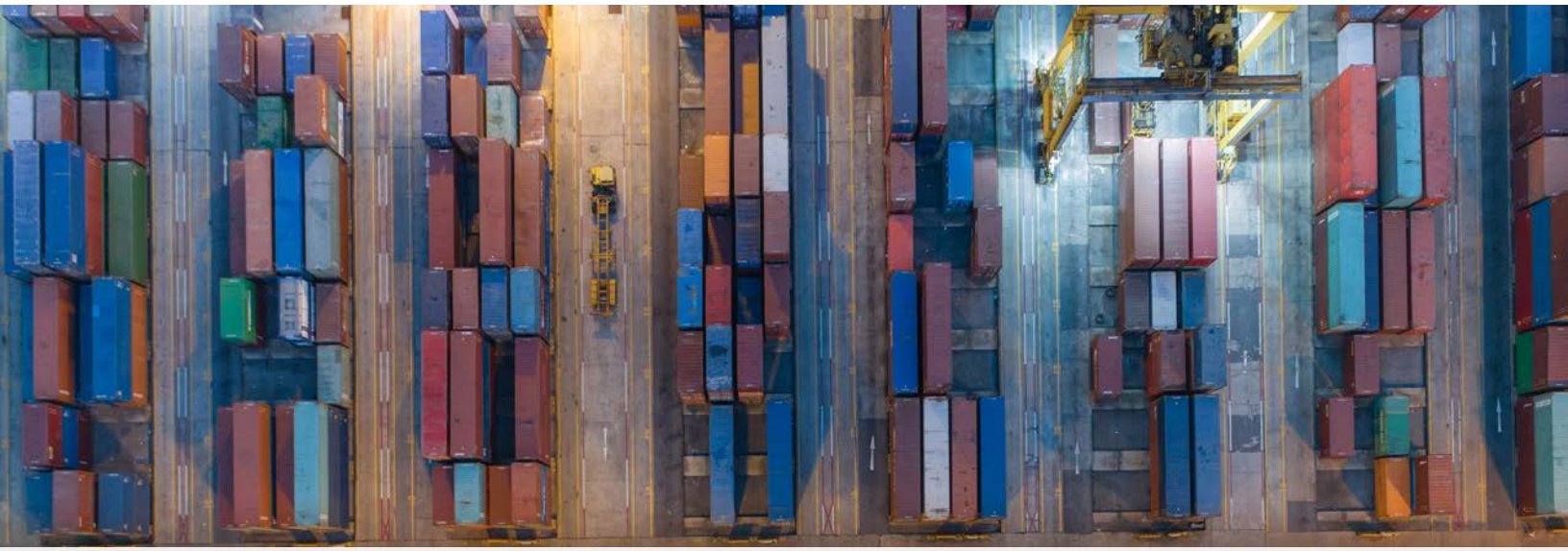
Newer, better ways of matching Amazon's throughput, consistency, and timing are being developed. They are an outgrowth of the technologies that have brought e-commerce to where it is today, but are scaled down and diversified to meet the needs of the consumer where the consumer is.

The current state of affairs

Big data analytics

Perhaps the single greatest driver of the e-commerce revolution has been big data and big data analytics. The ability to retain, combine, and analyze all of the bits of information throughout the supply chain network – from customer habits to all of the details of an item moving through a warehouse – is essential to modern fulfillment.

Big data gained a foothold on commerce in the mid-nineties, with two great revolutions.[1] First, computer processes and memory became advanced and inexpensive enough that warehouses could begin leveraging their power. Second, the Internet became useful as a tool that consumers could use to access the entire catalog of their favorite brands.



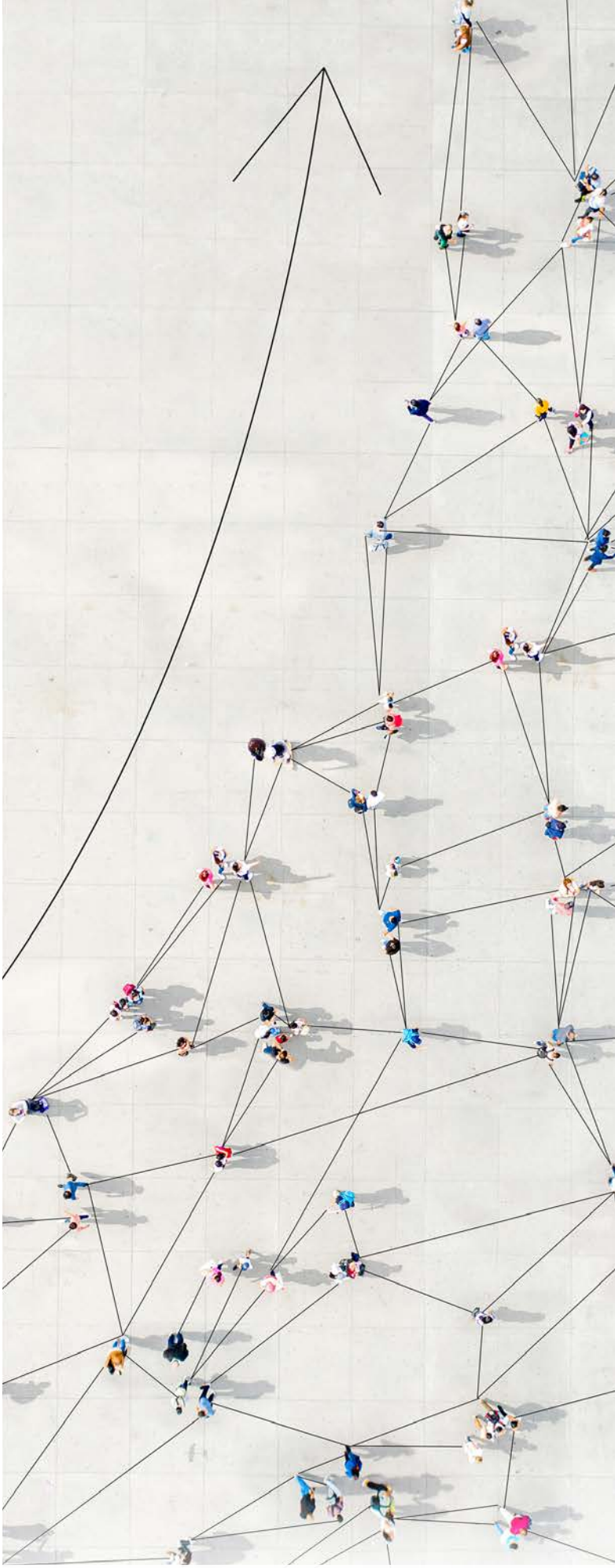
No longer could companies afford to focus solely on retailers and wholesalers that only ordered in pallets and cases. Instead, companies had to develop an omnichannel supply chain that could accept and deliver orders for wholesalers, retailers, and individual customers.

The only way to accomplish that has been to lean further and further into the big data revolution.[1]

There is no aspect of modern fulfillment not affected by big data analytics. In "Big data analytics in E-commerce," Akter and Wamba highlight: pricing strategies for both products and services; focused advertising; research and development; customer service; and multi-channel integration and coordination.[2]

We would add to their list scheduling and payroll, machining and tooling of equipment, shipping and freight, cycle times for warehouse equipment, and nearly every other aspect of modern warehousing.

Big data analytics has changed the way customers shop and how they expect their merchandise to be delivered. Its influence on society will only continue to grow.



No longer can companies afford to focus solely on retailers and wholesalers that only ordered in pallets and cases. Instead, companies have to develop an omnichannel supply chain that can accept and deliver orders for wholesalers, retailers, and individual customers. The only way to accomplish this is to lean further and further into the big data revolution.

The sharing economy

Perhaps one side effect of the prevalence of big data is the sharing economy. Platforms such as Uber, Lyft, Airbnb, and WeWork have accustomed consumers to shared public spaces, and the use of private resources in quasi-public ways.[2]

A personal vehicle can be turned into a taxi with little more effort than downloading an app. In a similar way, income can be generated by turning a spare room – or an entire house – into a part-time hotel.

In this way, Lyft, Uber, and Airbnb have made private spaces public. At the same time, the cubicle culture, open workspaces, and platforms such as WeWork have made it unavoidable that public spaces include moments of private life.

The upshot of all of this is that consumers have become accustomed to, and willing to work within and leverage, these shared spaces.

The door is open for companies and consumers to find new ways to invest their time and resources in a shared, mutually beneficial, way.[3] Companies that recognize this and act on it conscientiously will be part of the next wave of commercial industry.

The fragility of modern fulfillment

Over the past 25 years, consumers have grown to expect better and faster service. With the ability to order nearly any commercial item and track its progress from shipping to delivery – often in as little as a single day – it's forgivable that both producers and consumers have become blind to the fragility of modern fulfillment.

However, within these apparently seamless supply chains, cracks, and faults have emerged.

Last mile delivery has proven to be difficult and costly in both urban and rural areas. On the one hand, consumers increasingly demand faster delivery of single-piece orders. On the other, they also demand greener companies – but often not at the expense of their own convenience.[4]

Meeting these conflicting consumer demands is a challenge but, as discussed below, is not impossible. Another fault in modern fulfillment is its relatively slow response to sudden changes in the market. The effects of COVID-19 is one example. Big Box stores such as Walmart and Target were left with entire aisles bare, leaving some consumers desperate for basic needs such as bread, milk, or toilet paper.[5]

In some part, these problems didn't happen because those items weren't able to be produced. They happened because of the inability of modern fulfillment and logistics to meet that sudden increase in demand.

A review of problems in modern logistics

The greatest cost in modern logistics

In "Understanding the diversity of final delivery solutions for online retailing" (2016), Xiao, Wang, Lenzer, and Sun note that "final delivery [in ecommerce] is one of the most complicated, expensive, and inefficient segments along the whole logistics fulfillment chain".[6]

Final delivery – known as last mile delivery – accounts for more than 50% of the total cost of the entire logistics chain. Especially in industries with narrow profit margins such as grocery, home delivery is a major challenge. Small packages are being delivered at increasingly high frequencies in increasingly more urban areas.[7] The cost associated with home delivery increases by 42% when a time window has to be met. In scenarios where the time window is limited to an hour, the distance traveled by the carrier increases by 2.15 times, due to the frequency of missed delivery windows, the need to revisit the same address with the same package, and the need to plan sub-optimal routes to meet targeted windows.

In 2019 alone, UPS paid New York City $23M in parking fines. The same year, FedEx paid $9.8M. Ecommerce giants such as Amazon didn't report the amount they spent in fines, but it should be assumed to be at least as high.[8]

Home delivery and parking violations, of course, are only two parts of a much larger problem in last mile delivery.

Nevertheless, home delivery is so highly valued by consumers that it is "what the ongoing e-commerce battles are currently fighting for".[6] The needs of shoppers, who increasingly buy online from their smart devices, are increasing the demand for seamless omnichannel logistics.

COVID-19 has only increased these demands. It's acted as a catalyst for organizations not already considering their own future of fulfillment while industries and entire regions are being pushed towards social distancing, which inevitably also pushes them towards ecommerce, click-and-collect, and home delivery of basic goods.[9]

Some consumers new to this market will find it convenient enough to stay even after the pandemic passes. How many stay, as warned by eMarketer, will depend on how well their needs are met, and the trust companies manage to build with them.

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The discussion of micro- or nano-distribution, however, has become a more widespread, and pressing, conversation than ever before.

Urban density and rural sprawl

The research of Gevaers, et al., discuss six "fundamental aspects" that describe the nature of last mile delivery.[4] These include:

- the level of customer service
- the security and delivery type
- the geographical area
- the degree of market penetration and density
- the vehicle fleet and its technology
- the environmental impact

They found that, whether in rural or urban contexts, final delivery is equally a challenge, though for different reasons.

In rural settings, much of the difficulty lies simply in the distances involved. A "lack of critical mass" over a geographic area greatly increases costs and reduces efficiency.[4] Moving a large UPS truck across tens of miles of road to deliver a single t-shirt simply isn't an efficient use of fuel, vehicle, or man-hours.

In urban settings, the drive for efficiency is hampered by the simple crowding of a densely packed setting. Road congestion, pollution, and difficulties parking all create inefficiencies. Nevertheless, due to that high density reaching critical mass, costs are reduced by about one-third when compared to rural deliveries.

The growth of megacities and urban flight

By 2050, 70% of the world's population is expected to live in cities.[7] At the same time, many older cities – such as in America's rust belt – have struggled to keep up with changing times and are shrinking.[10]

The cautionary tale here is that what is needed is a system that can be reactive.

Over the next 30 years, as some areas become increasingly dense, the demand from both consumers and municipalities for ecologically responsible companies is also expected to increase.

While the opportunities posed by dense urban areas are clear, the most successful organizations will be those that are able to adjust their strategies as a city's landscape and consumer expectations change. The current set-up of logistical operations – in which a large, expensive distribution center (DC) is located just outside of dense urban areas, and freight is shipped in large trucks for last mile delivery – is insufficient.

As city landscapes and consumer expectations change, the ability to be flexible is paramount. Poor planning will mean underused real-estate investments, lost man-hours, increased pollution and, especially in dense urban areas, unnecessarily adding to the problem of road congestion.

Modern fulfillment is still best at delivering large quantities of goods to relatively small areas – truck loads to retail centers.

The costs of manual picking

In 2018 alone, same-day delivery increased by 500%. Click-and-collect – in-store or curbside pickup – is similarly on the rise. By 2023, the online grocery market will go from the 2% market share it held in 2019 to an estimated 20%.[11]

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This will place new demands on automating both the picking and delivery processes. Currently, grocery orders placed online and sent to a store to be manually picked result in a net loss of between $5 and $15 on every order.[11] That's not including any losses incurred if the order then has to be stored for any length of time, or delivered.

The logistical problems of meeting the demands of consumers will only increase in the coming decades, and will be compounded by unforeseeable problems of the global market.

New, flexible solutions are needed.

An elegant solution in micro-fulfillment

Stationing large fulfillment centers outside of urban hubs and in strategically located rural areas was never an option for most e-commerce businesses. Even for the most successful businesses in the industry, such as Amazon, it's a system that can't be sustained in the face of increasing consumer demands and logistical struggles.

To weather the coming changes, the future of ecommerce will move in several directions. Each direction, though, will serve to diffuse the now centralized system of vast DCs pushing goods out to consumers in broad markets.

The groundwork for these changes has been laid out by big data and the sharing economy. The need has

been exposed by our current system's fragility. And the benefits to both consumers and businesses are being shown in markets and companies that have already begun the transition.

Broad-scale data analytics

Over the past several decades, the real power that big data analytics has brought to the industry is in the way it allows for the targeted deployment of resources. In warehousing and manufacturing, the use of materials, man-hours, and equipment have all been streamlined by the ability to precisely target where and when resources are needed.

Already, big data analytics has moved outside the warehouse. The next wave in the fulfillment industry will see last mile logistics using big data analytics to precisely focus resources and cut waste.

Perhaps the biggest change will be in the ability to analyze and predict what goods consumers will want and when. More and more, last mile logistics will include micro-warehousing and micro-fulfillment options that work within micro-markets.[12] Stocking fewer, high-value items closer to where consumers live will allow for faster shipping, lower costs, and increased customer satisfaction with both selection and service.

For the cost of a single distribution center, many smaller micro-fulfillment centers can be built. Big-data analytics will target what goods are considered high-value in a particular market. This will allow a micro-warehouse, of perhaps 15,000 SKUs, to stock "about 80% of the items most often ordered by customers online".[13]

Established companies have, for years already, enhanced their product lines to enable better ecommerce to offer a variety of automation and fulfillment options that promise "scalability" and "modularity" with an eye on ecommerce and omnichannel markets. Some have gone so far as to look at last mile delivery and offer services such as "picked and packed" orders with a consistent chain directly to a customer's door.

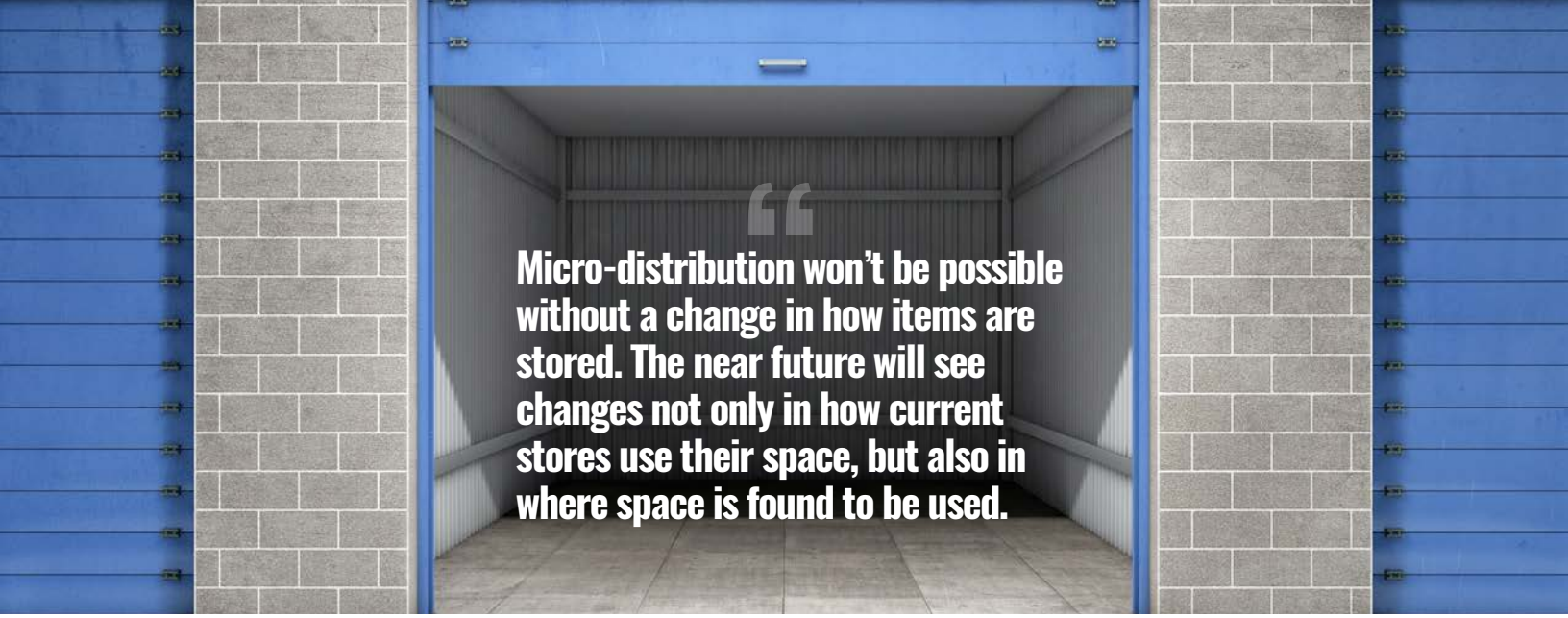
At the same time, newer players are working to ensure that the right fulfillment solutions are being made in an omnichannel environment, and that the capacity of robotics are optimized in last mile logistics.

The sharing economy and micro-warehousing

Micro-distribution won't be possible without a change in how items are stored. Our current system of large distribution centers located outside of urban hubs is already insufficient.

The near future will see changes not only in how current stores use their space, but also in where space is found to be used.

Some are approaching this by finding under-used space in an existing facility. This might be a corner of a stock room, a decommissioned department, or part of the sales floor. Once space is found, they



install an automated fulfillment solution – a micro-warehouse. The benefit here is that the real-estate is already owned by the company, and customers are already accustomed to coming to the location.

Meanwhile, others are placing micro-fulfillment centers in key locations in urban landscapes. With these kinds of technologies, micro-warehouses of as little as 200 SKUs are possible.

Such small warehousing opens up the ability to place micro-fulfillment solutions into dark stores, small real estate investments, or rentals.

This is where the sharing economy and the fulfillment industry are meeting.[14] In the same way that Airbnb allows the rental of living space, revolutionaries in the fulfillment industry are discussing the ability to rent areas within car parks, office building basements, or even private garages.

These will become micro-warehouses. They might have pre-filled, automated trailers dropped on their site. Or, they may be fitted with cutting-edge storage solutions and automated robots. In either case, orders of high-value items will be able to be delivered to a customer's doorstep within an hour. Already, these micro-fulfillment solutions on the order of 5-10,000sq ft are being tested in market.[15]

Corporate Social Responsibility (CSR) in last mile logistics

Academic literature is replete with case studies linking the positive effects of Corporate Social Responsibility (CSR) on a company's ability to "energize and motivate stakeholders... manage societal perceptions and expectations"[16] and weather economic meltdowns.[17] However, as we've mentioned, a portion of consumers are unwilling to sacrifice their own convenience in order to help corporations be socially responsible.[4]

Considering the proportion of expense of last mile delivery to the overall logistics chain (of more than 50%), the positive effects of CSR, and the demand for consumer convenience, companies are going to have to find a balance between these competing drivers. Social responsibility can't be

eschewed, expenses can't be added to an already costly process, and consumer convenience can't be sacrificed.

Big data analytics and micro-distribution are parts of how this balance will be found. They will allow e-commerce retailers to better get the right product to the right person at the right time with less expense and with greater social responsibility.

The first step will be in identifying high-value goods for precisely defined markets.

Big data analytics will allow relatively small areas to be precisely targeted to meet consumer demand quickly. Whether the product is going to a rural big-box retailer or an urban micro-warehouse, this targeting will be key to getting the right quantities of the right product to the right places.

The next step will be locating micro-warehouses in many, small, strategic locations. Especially in more urban settings, this might look like stand-alone micro-warehouses in formerly dark retail centers, office building basements, or even private garages.

In rural settings, it may make more economic sense for businesses to dedicate under-used space in an existing facility to an automated fulfillment solution.

At the same time, streamlining how these new, micro-facilities are resupplied from the larger DCs will also be crucial to maximizing throughput and decreasing the pain points in last mile logistics.

Companies too small to afford their own micro-warehouses will enter into co-opetitions, sharing the cost of micro-warehouses with other businesses who also value that location.

By targeting their resources in this way, they will begin to compete with the few businesses that have, to date, dominated ecommerce. Not only will increasingly small ecommerce operations be able to offer delivery of high-value items in an hour but, as our discussion will show, they will also be able to do it in a way that is socially responsible.

Automating the picking process in retail stores

Introducing automation in warehouses lowered costs while increasing throughput and efficiency. The same thing will need to happen at the grocery level for manually picked, online orders.

In rural areas – or anywhere else with under-used square footage – automation might look like pick-to-voice. This will enable employees to fill online orders more easily in batches, without having the

visual distraction of a paper list. This both speeds up their process and helps them stay aware of their surroundings, including customers who are sharing their aisles.[13]

Urban settings will likely see more benefit from using off-site micro-fulfillment centers that are as close to fully automated as possible. This will allow their virtual storefronts to be hyper-local while maximizing their retail space for more profitable ventures such as cooked foods, bulk items, or an increased product selection.[11]

In both cases, maximizing the use of automation in the picking process will help bridge the gap between costs and customer demands.

Strategically located distribution networks

Mere weeks into 2020, the US experienced a major shift in how they acquire groceries. A major surge in grocery delivery services resulted in record sales growth for grocery delivery services to segments of the population that might never have otherwise moved from their brick-and-mortar habits.

However, the current supply chain is ill-equipped to handle this spike in business.[18]

By identifying key markets and locating micro-warehouses in targeted locations, a company won't simply lower the distance of the final delivery. They'll also open up opportunities to change how micro-warehouses are replenished, and how consumers interact with the sales space.

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DCs will still exist after micro-fulfillment centers become the norm, and some portion of their business will still involve loading UPS trucks and sending them out for final deliveries.

However, another portion of the business of a DC will be to replenish micro-warehouses. How exactly this is done will depend on the nature of the micro-warehouse. But in every case, it will involve an automated system of loading trailers at the DC and unloading them, or dropping them off, at the destination.

Because these trucks are not making final delivery, they can travel at off-peak hours, including overnight. This will lower their negative impacts on traffic congestion and carbon emissions and will increase their CSR.

Consumers will have many options in how these micro-fulfillment centers are accessed. One that many consumers like is click-and-collect, curbside, or on-site pickup.[19] Consumers can place an order online or via an app, go to a conveniently located

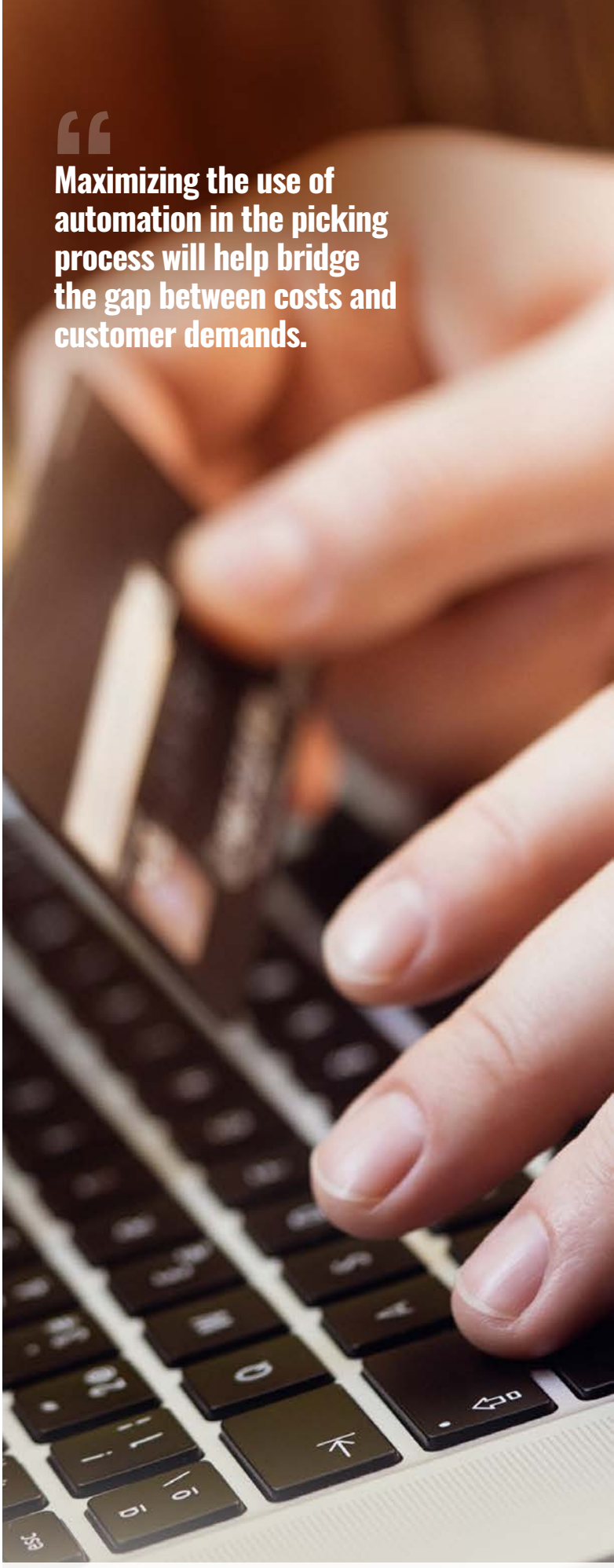
micro-warehouse, and their items will be ready. In rural settings, where the "critical mass" isn't met, click-and-collect will be a crucial component of satisfying consumer demands for convenience in a way that is cost-effective for the retailer.

The other alternative, delivery, can take many forms. Instead of large UPS or FedEx trucks, it may look like smaller, electric, automated compact cars. Self-driving vehicles can be environmentally friendly, allow for their stowage capacity to be maximized, and will find parking and navigating city streets easier than the large trucks now in use. Solutions such as these are also economical and environmentally friendly enough to be used in rural settings.

Another delivery option from these conveniently located micro-warehouses, especially in urban settings, will be by courier. These may be employees of the business or they be contractors in the style of Lyft, Uber, and AmazonFlex. By simply installing an app on their phone, these contractors can be called to the micro-warehouse where they will pick up an order for delivery.

Earlier we discussed the huge sums paid in parking fines paid by FedEx and UPS in New York City alone. It shouldn't be forgotten that these fines are being assessed because the needs of these businesses in last mile delivery negatively impact the ability of the inhabitants of the city to even move around their own neighborhoods.

Intelligent leveraging of micro-warehousing will alleviate these fines. Not only can this improve the bottom lines of these delivery companies, but it also will make them better corporate citizens.



By diffusing the warehousing, offsetting the movement of these large delivery vehicles over congested streets, and diversifying last mile delivery options, the balance between the costs of last mile delivery and the need to meet corporate social responsibilities can be found.

The coming changes will be radically flexible

The last two decades of ecommerce have been dominated by a few large players such as Amazon and Alibaba. Their success has come from their ability to leverage technology to balance the needs of their business with the demands of the consumer.

The near future won't see a radical change in the dynamic between technology and success. Businesses that make the best use of the latest technologies will continue to fare better than those that don't.

What will radically change, however, is that consumer demands will be met in increasingly flexible ways that will allow corporations to be both profitable and socially conscious.

Smaller ecommerce retailers will also be able to benefit from these flexible solutions. By leveraging big data analytics, micro-distribution techniques, and finding fruitful co-opetitions, they too will be able to deliver high-value merchandise to a customer's door in as little as a single hour.

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About PeakLogix

PeakLogix, an Alta Material Handling company, is a leader in material handling, excelling at making manufacturing facilities, distribution centers, and warehouses more efficient and more profitable by streamlining operations. PeakLogix specializes in concept design and engineering; automation, systems integration and equipment solutions; turnkey project management and implementation; and service and support. PeakLogix has experience within a number of industries, including healthcare/medical, food and beverage, fulfillment, third-party logistics, secured data centers, document storage, and the U.S. government. You can find case studies highlighting specific projects online at **www.peaklogix.com**.

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