Last-Mile Delivery Roundtable

Summary Report

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Executive Summary

MIT CTL's Last-Mile Delivery Roundtable featured speakers and participants from the US, Europe, Asia and South America sharing their successes and challenges in serving the urban last mile. Challenges arose not only from designing efficient routes in congested areas but also from finding, hiring, and training the talent for last-mile delivery. In addition to driving the truck, drivers might be route managers, merchandisers, installers, and sales people. Long-term relationships between drivers and customers improve trust, efficiency, and boosts sales. One presenter coined the term "business to life" (B2L) because last-mile delivery drivers come into people's homes and into their lives. Drivers need to know how to gracefully and tactfully handle unusual domestic situations to provide high customer satisfaction and reduce the rate of returns.

In **designing networks for last-mile delivery**, companies collect data from onboard computers (such as miles-per-gallon, travel speed and idle time) and "war stories" from drivers to optimize routes. They also provide information to drivers (such as parking instructions and gate codes) using iPads or smartphone apps. Companies **drive excellence in last mile operations** by using KPIs derived from corporate goals, piloting different strategies in different parts of the organization, and sharing best practices.

Last-mile consolidation remains an open question. Consolidation improves truck utilization, thereby reducing costs, congestion, and emissions. But, companies may prefer to retain sole control, maintain personal contact with the customer, and create competitive advantage through proprietary last mile, go-to-market strategies. Couriers, outsourcing, and crowdsourcing might reduce costs but can sacrifice branding and flexibility in go-to-market strategies.

Participants discussed **omni-channel delivery** and the challenges of creating a single, blended inventory. Omni-channel offers the opportunity to accelerate "speed to guest" and bring online customers into the physical store, thereby reducing e-commerce delivery costs and enabling an additional sales. But, carrying enough inventory within 24-hours of customers' homes increases costs. Greater integration of online and physical channels also comes with added cybersecurity challenges.

Unmanned aerial vehicles (a.k.a. drones) are being considered for last-mile delivery but won't be used any time soon because of the threat of vandalism to drones. The challenges are less technological than social, given the privacy and safety fears around drones. Countries such as Australia or Japan lead the U.S. both in terms of technology development and drone-friendly regulations. Drone trucks could be one way to deal with the shortage of drivers.

In emerging-country **megacities**, regulations are restrictive and change frequently, and route-planning software may lack the data needed for precise geocoding of addresses. One company employs a person to work with and educate government officials on the importance of last-mile delivery, so that officials understand the business and societal implications of new laws. Municipalities gain benefits such as less traffic congestion and better air quality while the company receives reduced fees and regulations in loading/unloading areas, access to restricted areas for vehicles with a particular load, and access to city infrastructure for consolidation.

1. Network Design for Last-Mile Delivery

A provider of integrated logistics and transportation solutions described how the company does network design for last-mile delivery. This service provider is a $6+ billion company with 30+ million sq. ft. of DC space across 200+ DCs. The company has 30,000 employees and 170,000+ pieces of fleet equipment. Two-thirds of its business is fleet management services, with supply chain solutions comprising the other third. Of its supply chain service offering, more than half is dedicated fleet, while distribution management makes up one-third.

1.1. Data Collection

Companies collect data to improve routing and operations. For example, one company equips its grocery-delivery employees with smartphones and apps; its other drivers have onboard computers and tablets. The onboard computers also monitor truck telemetry, shifting, miles per gallon, send alerts when maintenance is needed, and capture data that can be used for accident investigation. Data such as MPG, idle time, etc. can be used to improve routes and driver productivity, such as by knowing that the average speed through a city will be faster or slower than originally predicted. Similarly, a railroad company is using much more data now, using GPS data to know where its engines are and how much time is spent at a customer site given the amount of work that is scheduled to take place. An omni-channel retailer mentioned it would also like data on its drivers.

A logistics company said that his company also collects qualitative data in the form of drivers' "war stories" to inform future route design. The company uses an issue management process and database to capture the drivers' war stories. The stories are typed into a database using a combination of text and codes, such as a route ID, driver ID and stop ID. Similarly, at an omni-channel retailer, drivers and independent contractors are queried to note exceptions, such as lost cargo, late arrival, high-value items, or a customer not being home. Finally, a European-owned company has drivers report any problems to their home DC, and data is collected through daily direct communication.

Data collection can be more intensive for companies that repeatedly deliver to a fixed set of destinations. Several of the participants had last-mile routes to retailers, customer DCs, or customer manufacturing locations. The smaller, fixed numbers of destinations enable further optimization of routes. Data collection also needs to be more intensive for deliveries to retailers if the delivery routinely involves additional services such as merchandising and competitor analysis. In addition, a logistics company uses the Pareto method (identifying the 20% of the delivery or routing issues that impose 80% of the delays or exceptions) and focuses its efforts on those pain points.

1.2. Route Design for the Final Mile

Engineers use the quantitative and qualitative data collected to build routes that optimize certain metrics. Cost per mile is only one metric or issue that gets factored into the route design, however. Other metrics include the total delivered cost or the level of carbon emissions. A retailer tries to reduce the number of trucks delivering into the same store by combining networks. A railroad company wants to do same-day optimization to balance labor so that one person is not scheduled for 15 hours of work while another only has 2 hours. This is especially important to comply with work-hour regulations while still being able to service all customers on a given day.

A logistics company does a strategic design and then validates it with facts based on actual driving times as well as with information from previous routes to identify where the volume is and then to optimize expected performance. Route designers test different designs, cross-docking, and so forth. They build skeleton routes with generic assumptions and then test those assumptions against daily data gathered from the route; then they optimize the routes based on daily orders received. The number of trucks dispatched may vary by day of the week. Onboard computers can help drivers with route directions as well as special instructions about customers and where to leave packages if the customer is not home.

Some companies use commercial software to design routes. A beverage company uses Roadnet and will be testing it in one DC in the US and one in Brazil. If the software works well and there is a good business case, the company will roll it out to the rest of its network. Although the company uses Roadnet to plan routes, drivers have flexibility to modify routes during execution. Drivers have a lot of knowledge but the challenge is how to scale it. An omni-channel retailer also uses Roadnet but pointed out that the software does not capture business intelligence adequately. Just as during its infancy of ERP software which only had core modules on finance, Roadnet needs to expand beyond its core to bring in business intelligence. A European company uses Roadshow software to do the routing.

Companies vary in how much forewarning or control they have over deliveries. In a grocery delivery service operated by a logistics company, customers choose which day they want delivery, including the option for same-day delivery. Same-day delivery makes routing and loading difficult; loads must be built as orders come in so that they can be completed on time. There may be days when the company sends three trucks to the same neighborhood on the same day, but the company does that because the company does not want to delay delivery orders merely to save on costs.

1.3. Insourcing, Outsourcing or Crowdsourcing Last-Mile Delivery?

Companies varied in their use of private fleets versus outsourced delivery. An office products company said that transportation is always accounted as an expense not an asset, and it is one of the biggest expenses, so management is tempted to improve it by shifting from a private fleet to couriers or back again depending on prices. Customer opinions can vary, too, with some customer wanting a branded delivery whereas others may only care about on-time delivery or lowest cost delivery. Outsourcing can reduce costs but may be less flexible. A food company pointed out it may have lost capabilities when it sold its private fleet. The company reduced fixed costs but now does not have the flexibility to change its go-to-market strategy for the last mile.

The decision whether to use dedicated operations depends not only on density but also on the type of shipment. For example, some accounts are white-glove, others are small packages. Thus, the final-mile network depends on the shipment characteristics as well. A quick-service restaurant mentioned that the last-mile network depends on whether the company is aiming to increase market share or whether it is serving a mature market. Some strategies seek the highest service level while others will look at minimizing landed costs.

The participants also discussed the possibilities of crowdsourcing or using other Internet-based last-mile delivery options. Recently, Wal-Mart publicly suggested that maybe neighbors might pick up orders for each other. Or, crowdsourcing might use services similar to Uber, Lyft, or TaskRabbit to handle last-mile. During the discussion crowdsourcing was pointed as a viable option, but the open question was about fulfilling the promise to the customer if something goes wrong.

A QSR participant said he didn't think that services like Uber were ready for prime time yet, but niche carriers (smaller than LTLs) who silently move cargo by ground from location to location are fairly sophisticated and have underutilized capacity. These carriers need a consortium to improve professionalism, cover more geography, and optimize that last mile. Some of the niche carriers focus on repair parts, others on pharmaceuticals or temperature control. Urban environments need timely fresh food deliveries, which applies to QSRs as well as to retail outlets or restaurants and hotels. Weight and density is a challenge. A single company may not have the density to make three deliveries a day (e.g. one per meal).

2. Drivers of Trucks vs. Drivers of Sales

Throughout the day, many speakers and Roundtable participants spoke of the crucial and multifaceted roles of drivers in the last mile. At a beverage and snack products company, delivery drivers for some product lines have three jobs: deliver the order to the retailer, replenish store shelves, and take orders. This "one person does all" model is great for building a relationship with the store owner, but it also means that the driver can only serve ten stores a day, which is very expensive. The amount of contact that the last-mile person has with customer changes the nature of their job.

2.1. Drivers as Route Managers

"A military plan doesn't survive first contact with the enemy," a speaker quipped, making the analogy that whatever plan a company puts in place may go out the window upon first encounter with the customer. Despite the planned routes, there will be daily exceptions to the plan, and drivers are empowered to make changes to their routes. For example, in one case the street was too small for the delivery truck to enter, so the driver hired a taxi to be able to make his grocery deliveries. Another driver was delivering a mini-fridge to a sailboat, and the fridge turned the boat over and sank the fridge. Those kinds of situations can't be pre-scripted and require hiring the right people to make the right decisions about how to handle them.

Indeed, one company's drivers are called "Route Managers" not "Drivers" to signal that they have the ultimate authority to make the final decision because they have the best information.

2.2. Drivers as Installers and Merchandisers

In some cases, drivers help to merchandise or install the product. For example, in small-format stores with no back room, drivers for a beverage company also put product on the shelf. The driver's merchandising tasks include checking stock levels, putting in promotion displays, and monitoring competitor activity. Other last-mile services include white glove service such as in-home/office setup, training, and removal of old equipment. At a transportation company, some employees wear shipper-branded uniforms and are trained to deliver and install the branded technology products and train customers to use them. These different driver tasks demand differ kinds of last-mile talent.

2.3. Drivers as Salespeople

Drivers can be a profit center, a participant said, citing the example of home delivery of frozen foods and ice cream. The drivers are called "route business developers" because in addition to making 100 deliveries a day, they are tasked with bringing in new business along their routes. Thus, they spend time talking with potential new customers. The company is leveraging drivers to not just deliver but also to build business.

A food company uses the same drivers to cover the same routes over years, serving the same customers. It calls its drivers "Sales Assistants" because those drivers develop close relationships with their customers over time. The company invests in the education of the drivers so that they are prepared to deal with many kinds of problems, such as billing or claims about products. Complaints are at very low levels -- 1% -- as drivers have worked with the customers for 5, 10 or 15 years. On the other hand, a 3PL warned that deeper relationships may have an efficiency trade-off: when delivery drivers build long-term relationship with customers, those customers will then often chat with the driver or offer him a meal (if it is a restaurant), which increases the time per delivery.

A quick-service restaurant defines the last mile not by size of establishment but by purpose. One side is a retail model that looks at activity-based costing and is labor-intensive. The other side focuses on increasing sales rather than reducing the total amount of touches. Thus, the sales side can be effective even if it takes more time because it drives more value. The participant cautioned about optimizing the transport piece to the detriment of overall sales. Giving the driver -- "sales assistant" -- a few more minutes of chat time will increase the "stickiness" of the customer relationship and will typically translate to higher sales to that location.

2.4. "Business to Life"

A speaker coined a term to describe last-mile operations to consumers: B2L, or "Business to Life." In traditional retailing, customers visit a retail store or place of business intentionally. That is, they get dressed, they decide whether to go alone or bring someone along, and so forth. They follow a certain protocol. In last-mile deliveries to consumers, in contrast, the delivery person is coming into a customer's home -- and into the customer's life. The customer may not be fully dressed when the delivery arrives, or may be in the middle of an argument with a spouse or any of a number of unexpected situations. This means that the delivery drivers have to be trained and prepared to deal with unusual situations when going into people's homes.

At the company, last-mile drivers must be well-dressed and follow strict appearance standards (such as no visible tattoos). Drivers have strict guidelines on messaging and scripts to customers. Indeed, the company even supports these drivers directly by offering a special Customer Service number that drivers can call for assistance. In short, last-mile delivery drivers are not just drivers who are trying to be efficient in their routes; they must also know how to engage with customers.

2.5. Trust and Brand

Several Roundtable participants noted the importance of trust in last-mile deliveries, especially in consumer home delivery and emerging-market megacities. An omni-channel retailer mentioned the importance of livery and branded trucks for deliveries to consumers. Perhaps grandma forgets that she ordered something, and she sees a rusty unmarked van pull up to her house. Local couriers may be cost-effective, but if they are not wearing a uniform, customers may not trust them. A retailer who's seen as upscale wants to uphold that upscale image in the last mile. Delivery people who show up at a consumer's house must be clean-shaven and presentable. In the end, customer service is the key to repeat business, and the last mile is business-to-life: consumers are letting drivers into their lives, so trust is key.

Two firms mentioned the need to balance whether the last-mile driver will be interacting with the customer or not. If there

is no interaction, then the last-mile driver doesn't need to be uniformed or specially-trained in upselling, which will reduce the cost of that person. But, if there will be interaction, then the expense of branding the truck, uniform, and training the person will pay off. Perhaps the demographics of the customer area will dictate the training and branding, the participant suggested, or some other scientific way to determine the appropriate last-mile investment to make.

In megacities, trust between parties could expedite delivery. A Colombian food company uses its own employees to do both final-mile delivery and to make sales to mom-and-pop stores. Each driver builds a long-term relationship with the store owners on their route, who place orders for future items during the delivery. In many cases, the customer trusts the driver to deliver the correct order and may simply let them set the order down and leave, rather than force the driver to wait while the shopkeeper checks all the items in an order. Long-term relationships build trust, which can reduce delivery time.

In contrast, participants from both Brazil and Colombia noted that a supermarkets may want to validate that everything on the invoice was delivered, so they will check each item on the order, thereby taking more time. Indeed, deliveries to large stores in Brazil can take 40 minutes because the stock room manager opens all the boxes and checks all the quantities of each item. Even deliveries between the same company from one facility to another will be checked, meat weighed, and so forth. The Colombian food company outsources delivery to supermarkets -- which send electronic orders and receive their goods in a DC -- because personal relationships with supermarkets are not the same as with mom-and-pop shops.

2.6. Hiring

Presenters from both the U.S. and Bangkok noted the difficulties in attracting enough drivers. Four companies mentioned supply chain talent as a key learning from the Roundtable. A food company mentioned the need for a spectrum of supply chain talent needed for the last mile, and a transportation company described hiring college-educated drivers so that they can be trained to be route managers.

Operational excellence starts with hiring the right people. In southern California, a logistics company operates a grocery delivery service direct to people's homes. Most of the deliveries are repeat deliveries to the same customers. In order to find the right caliber of employee for its approximately 200 driver positions, the company interviewed more than 800 people and pre-screened an order of magnitude more candidates before that interview round. In the qualification process, the company was candid about the job requirements, working conditions, and requirements for success. The company disclosed these details to avoid turnover and the expense of training new hires who would not be able to handle the processes, procedures and verbal dialogue with customers.

Instead of hiring drivers as employees, some companies use independent contractors. The drivers enter people's homes to deliver and install appliances, so there is a degree of potential injury. The drivers must be licensed to drive the equipment, and are responsible for their own Workers Compensation insurance and Liability insurance, but they do not need to have a Commercial Driver's License (CDL). Outsourcing and independent contractors can help insulate a company and reduce liability when going into people's homes -- although some states are challenging the "independent contractor" status.

2.7. Training

With the added roles -- especially ones with contact with customers -- comes the need for added training, such as customer interaction scripts, delivery completion checklists, and follow-up with customers to ensure they are properly taken care of. Delivery people need to have scripts or protocols or be otherwise prepared to handle "business to life" situations. For example, an omni-channel retailer works hard to teach drivers pleasantries like saying "good morning" or "where would you like your box?" And a Spanish food company that delivers water to customers' homes has dedicated drivers whom it invests in training so that they treat customers well. A QSR chain works with delivery service providers to transfer the company's personality and culture by giving drivers personality profiles and cultural sensitivity training to transfer its philosophy of "performance with the lens of humanity."

Companies also use incentive pay structures to improve driver performance. A transportation company tries to create incentives that will make drivers as productive as possible, such as by paying per delivery rather than per hour. At a Spanish food company, drivers earn a salary that is partially fixed and partially variable based on the number of deliveries they make that day.

2.8. Driver Support

Although drivers may be autonomous, but they are not unsupported. A logistics company provides as much information as it can to drivers via phone apps that provide special delivery instructions about time, location, gate codes, and so forth. A food and beverage company gives each of its retail delivery drivers an iPad and all the technology needed to see what is in stock, what the competition is doing, how to deliver the order, and how to take an order and get payment all in one device. A railroad company, similarly, gives its conductors aerial shots of facilities with different areas and layouts labeled so that they know what to expect when they arrive at the location.

Finally, companies may in fact want to think about their last-mile delivery drivers as "customers" who may need to have their own customer service center to call for assistance if needed. At one 3PL, drivers can call a central dispatch team if they have questions or issues and want to talk through their options, such as if a truck breaks down. In those cases, the company may send another driver or may swap the cargo out of one truck onto another. The central team is dedicated to the grocery business, so the central staff are not trying to juggle multiple customers on one call desk. Companies support their drivers however they can.

3. Excellence in Last-Mile Operations

A global beverage company presented its approach to improving the performance of last-mile operations around the world.

The company operates in six geographic zones and has grown primarily through acquisitions. The company's last-mile operations deliver to key accounts (such as Wal-Mart and Costco) and points of consumption (such as a bar or restaurant) in 19 countries through 12,000 trucks a day; 30,000 drivers, handlers, pickers and routers deliver 10 million cases per day and make more than 200,000 stops per day.

The company's definition of excellence arises from the company's goals of Service Levels, Quality, and Cost Efficiency. How these goals filter down to affect last-mile activities can be complex. Reaching the goals depends on the functioning of five pillars: safety, distribution planning, delivery, warehouse, and fleet. Each pillar has its own subgoals and elements of excellence. Within the Distribution Planning pillar, for example, would be fundamentals such as budget planning and routing planning, as well as sustaining practices such as inventory policy, and then new methods that can improve operations, such as risk management.

3.1. 3-Level Strategy

The company's last-mile strategy focuses on three levels. The first level is Fundamentals, namely the tools and processes that every DC should have to improve operations. For example, DPO - Distribution Process Optimization -- is an operating manual based on standard operating procedures, general operating procedures, and key performance indicators (KPIs). The company devised a set of questions that each facility or newly-acquired company must answer. The company ranks each plant and works to standardize plants wherever possible to improve efficiency.

The second level focuses on sharing best practices, namely for one operating company to adopt the effective practices that others are using. For example, DPO is fairly new at the company, 18 months old. DPO was developed by DC managers, but the key to sustaining it is getting drivers to understand and be part of it. The speaker was pleased when he was in a remote part of Shanghai and heard people talking about the program, using the same report and KPIs as are used in Boston.

Level three is called "new news" and means being connected with new technologies and solutions that have the capability to improve existing operations. Representatives from each of the six geographic areas meet for one week once a year to identify best practices and devise the operating procedures. This is the only time of year when changes can be made. The company benchmarks other company and tries to see where business is going so that it can stay ahead of the curve.

3.2. Key Performance Indicators

Some of the KPIs (Key Performance Indicators) that a beverage company uses are related to people, such as avoiding injury, absenteeism and turnover. The company also has KPIs related to transport, such as how many cases are on a truck. The company is constantly ranking and sharing information between DCs to get improvements. There are differences, of course, between emerging markets and mature ones, but the company is rolling out a standard way of operating that it

wants its locations to follow, and it will be rolling this out to its wholesalers, too.

KPIs vary by market, a retailer said. For example, when the company does big truckloads or intermodal, it measures cube, density and distance. During last-mile operations, however, the company will sacrifice cube to get the product there more frequently. Cube utilization will be degraded in urban markets in favor of smaller, more frequent deliveries.

3.3. Obstacles to Excellence

The challenges which the company identified include safety of the 30,000 people who deliver its products every day, so the company ensures it has the right incentives in place and has trained its people right. The company is also considering different levels of service to different customers, such as having a premium delivery model to its high-end bars and restaurants. Another challenge is related to megacities, given the traffic and restrictions in those areas. Finally, the company is seeking to optimize costs but is at the same time seeing complexity rise as it increases SKUs to keep pace with the craft beer trend.

A retailer sees the power of analytics but also the danger that if data is dirty, all the results are flawed. The retailer is struggling with identifying the right metrics to measure, and to have only a few key metrics, not 100 of them. The difficulty is that merchants and delivery people want different metrics. For example, some people can't impact whether something is one the shelf, so that metric is meaningless to them. A beverage maker, likewise, uses simple and understandable KPIs and will remove some and adds others as necessary to keep the KPIs simple.

Participants discussed the confounding issue that sometimes when a company helps its suppliers, it inadvertently helps its competitors, too, because the supplier becomes more efficient or smarter and then offers those services to competitors. While some companies felt that the leaders who helped suppliers continue to stay one step ahead of competitors, even if those competitors benefit later, others mentioned that competitors do benefit, particularly smaller players who benefit from larger players' investments.

3.5. Improving Customer Service

Companies survey customers to help improve service. Follow-up is necessary given the difficulty of managing drivers and driver attitudes when they are out on routes. An omni-channel retailer sends out customer surveys (usually incentivized through coupons) to get data from customers. One company reduced returns of delivered appliances by giving drivers a post-installation checklist to follow, having drivers call the company, and having the customer speak to the company before the driver leaves, to confirm that the product was installed where and how they wanted it. Returns dropped from 15% to 5% after that new process was instituted.

4. Last-Mile Consolidation

Consolidation of last-mile shipments can reduce the number of trucks and deliveries coming to a given area or retailer. Several factors motivate consolidation. Consolidation improves truck utilization and basic cost efficiency. A lack of parking near megacity retail outlets means retailers want to reduce the number of trucks congesting the space. At the same time, vehicle size limits and limited back-room storage space place upper bounds on consolidation. A Colombian food company described how it handles consolidation, and other participants discussed the issue.

The food company operates seven business units, with 37 manufacturing plants in 11 countries selling to 72 countries. It is the fourth-largest food company in Latin America by market capitalization, with a portfolio of 157 brands and 36,000 employees. The company services more than one million clients through 11,500 sellers. In Colombia, the company has high market share in the categories in which it competes, but it has world-class competitors in every category, so the challenge is to retain its leading position.

4.1. The Colombian Context

The CPG's business model focuses on delivering to mom & pop stores, because those stores constitute 58% of the grocery purchases made in Colombia, with supermarkets constituting only 24%. The majority of the Colombian population (70%) has low purchasing power. Product mix varies based on the store's location. For example, a store near a school will have a much higher proportion of snacks compared to a store in a residential neighborhood. The food company delivers direct to the stores in most cases, rarely using wholesalers. The company's logistics arm sells to 950 of Colombia's 1132 towns,

promising 24-48 hour delivery in cities (72 in towns), delivering 1200 SKUs through a private sales force of 670 people and 59 commercial agencies.

Delivering to tiny mom & pop stores presents a unique distribution challenge. The company faces the challenge of how to reach 700,000 grocery and candy clients efficiently when 80% are served on a weekly basis. Small locations require small delivery sizes, and 70% of the company's transactions are for less than $2. Colombia has a population of 47 million, one-third of which lives in rural areas. The GDP is $8000/year, and 95% of transportation is by road. The trouble is, only 8.4% of roads are paved. The country is 1.6 times the size of Texas but is located at the end of the Andes and thus has many mountains. The average speed of trucks is half that of the US. The cost to bring a container from the port in Barranquilla to Bogota is four times the cost to bring it from China to the port.

4.2. Consolidating the Last Mile

The CPG company has gotten value out of the last mile by consolidating with a focus on increasing sales rather than cutting costs. Before 2010, the company's business units each had their own distribution; they separately delivered to mom-and-pop stores, convenience stores and supermarkets. As a result, different employees from the same company were often in the same store at the same time but delivering different brands. So, the company merged last-mile operations so that one truck would deliver multiple brands. Now, the food company sells and distributes all the dry-goods products of four business units together, but it does not combine cold-food delivery with dry-goods delivery.

Shifting to consolidated deliveries takes time. At the food company, the last-mile consolidation process took 18 months. The company will eventually close some facilities, but at the beginning it operated with multiple existing warehouses, because trying to create a new network with new facilities would have complicated the process. Another company -- which delivers to DCs but which acquired a competitor who delivered direct to corporate customers -- operated the two divisions independently at first, and then slowly consolidated, ensuring that it wouldn't have to take a large one-time hit of extra SKUs if it closed a DC immediately.

In contrast to the consumer grocery last mile, in the automotive vertical a company's call center can be integrated across multiple customers because that industry is so mature. In the automotive sector, if a supplier makes tailgate latches for one OEM, chances are that they make tailgate latches for all the OEMs. Thus, products from multiple vendors may be on the same truck. Some customers are willing to share truck space with competitors; others are less willing, but it occurs anyway when they ship LTL. If those customers use the transportation company for the last mile, they have the added benefit of visibility and control onto the shared truck.

4.3. Consolidation through Collaboration

The session ended with the open question of whether the last mile would be consolidated, or whether companies would want to keep control of the last mile as a way to compete and gain a competitive advantage. A QSR added that companies who aren't trucking companies will never have as high a utilization rate as a 3PL. A company might invest in a private fleet to support a growing business or ensure more predictable delivery, but that investment is not sustainable as the market matures, the participant said. His company is looking to collaborate on consolidating the last mile because of the cost. The cost of last-mile delivery could be shared by multiple companies.

A participant asked whether it was possible for the same delivery van to deliver to a small DC first and then to deliver to end customers, thereby managing both high-service and low-cost at the same time. A logistics company replied that currently their focus is by customer, and that trucks deliver to end customers but they come back empty. This is in contrast to trucks that service Coinstar, for example, in which case the van goes out empty but goes from retail store to retail store picking up coins. In more mature industries, some shared costs could be designed. The risk to a company is if they share space on a truck, there's a chance of their product not being delivered because something else is going on with the truck. Collaboration among companies can, however, have the benefit of bringing innovative solutions. For example, a retail store owner had a large store that he offered for use as a transit point for small delivery vehicles, who could cross-dock there at night when the area wasn't being used.

5. Unmanned Aerial Vehicles (a.k.a. Drones)

Amazon's announcement of research into aerial drones for delivering packages excited interest in this potential new mode for last-mile deliveries. Prof. Mary Cummins, one of the first women Navy pilots and a professor at Duke specializing in drones, talked about her experience flying aircraft that were increasingly more automated. The A4 Echo she flew was manually-controlled, with the pilot doing the flying, but then the F18 was so automated that pilots were bored and listened to Oprah shows during flights. Pilots were previously taught that they were superior, but now the computer is superior to them, to the point that now takeoffs and landings on aircraft carriers are fully automated. Before being allowed to take off from an aircraft carrier, pilots have to hold up their hands to show the controller that the pilot is not touching anything.

5.1. Drone Research

Drones seem like a new development, but they aren't. The military began drone research in the 1940s for use in surveillance and target practice. Today, the US is not a leader in drone research, however, and indeed has fallen far behind. The most advanced research comes from Israel. Japan has been using drones for crop dusting for the last 20 years -- a fact that surprised the Senate when Prof. Cummings testified there recently.

The US government is unlikely to lead the way in drone development, for several reasons. First, DoD procurement tends to spend money on hardware rather than on software that would be needed for future drones. Second, government salaries are not high enough to attract the best and brightest, the way NASA did in the 1960s. Third, attitudes in the DoD and FAA favor manned cockpits, which is inimical to drone development and operations. So, private companies and other countries will have to lead the way in drone development. Prof. Cummings estimated the drone industry to be $89 billion, not including all the surrounding areas such as drone maintenance. It's possible that there's a next Bill Gates or Steve Jobs in a garage developing a drone now with $10 parts and clever software.

5.2. Civilian Uses of Drones

Drones are being used for a variety of civilian purposes, such as monitoring construction sites to protect the buildings, resources, trucks, and workers. Drones can also be used as a productivity tool, indicating who is working and how work is progressing. Drones are used to prevent cattle rustling and recently caught cattle thieves in North Dakota. There are privacy implications to drone use, but the business cases to protect assets are compelling. For example, drones are being used to inspect the Alaska pipeline, something which is dangerous for people to do. Similarly, drones are used for infrastructure inspection, such as by the Michigan Department of Transportation, which uses drones equipped with infrared sensors that enable the drones to inspect the infrastructure better than humans can.

As already mentioned, drones can be crop dusters, which is the most dangerous civilian aviation job. Drones can also be used to improve crop health, because they can identify which areas need pesticide or remediation. Putting drones in the hands of farmers means that they could apply pesticide only where it is needed, not spraying broadly everywhere. In California, drones are being used for firefighting, because planes heavily loaded with water (and flying in the heat) are especially dangerous for human pilots.

Transport is the second-biggest use of drones after agriculture. The military has used drones to carry 3 million pounds of cargo in Afghanistan, saving countless lives by not putting people in harm's way. Commercial aircraft already have the internal automation to go from gate to gate; freight is not going to care if the cockpit is empty. Drones could also be used to deliver medical supplies to rural areas and disaster zones. Amazon's plan to use drones for delivery won't replace all deliveries, but it will be one kind of mode. Rather than using drones for last-mile delivery, it may make sense to use drones to transport cargo to DCs rather than be delayed on congested highways.

5.3. Government (Over)Regulations

Regulations regarding drones in the US present challenges, because the FAA doesn't take drones seriously. Drones violate the FAA's mindset of what it means to be a "pilot," Prof. Cummings said. The test sites the FAA designated require that private companies give up proprietary data if they use the test site, so private companies are more likely to go to other countries to test drones.

In contrast, Australia doesn't have drone-inhibiting regulations, is further along in drone development, and is using PPPs. In Australia, a company called Zookal announced its plan to use drones for delivery (six months before Amazon did). Canada

also has a good regulatory framework regarding drones and thus, along with Australia, could be a more drone-friendly country than the US in which to test drones.

5.4. Challenges with Drones

Most of the challenges with drones are social or political, not technical. One of the biggest challenges to drones is the threat of vandalism to drones because the US population has a deep-seated hatred of drones due to privacy issues. People may be tempted to shoot down, damage, or try to steal a drone or its cargo. Or 10-year-old boys might hit drones with a stick just because that's the kind of thing boys do. The US is a visually-oriented culture and can see drones, but doesn't grasp that the greater privacy danger is the trail of data we give to businesses via our smartphones, PCs, and Facebook. Fears about drones being used by a terrorist, such as to release anthrax into a stadium, are over-hyped -- terrorists were able to hijack manned airplanes in 9/11.

Military and transport pilots are not happy about drones because drones will replace pilots. In some ways, commercial airplanes are already drones and don't need pilots except for being a legitimate authority on board in case of disruptive passengers. San Francisco's BART transit system could be operated without human drivers, but the public didn't want to enter unmanned vehicles due to the "shared fate" psychology. People believe that pilots would do everything they could to save their own lives and thus feel safer with a pilot in control, sharing their fate.

Some technical challenges do remain. For example, wind – which is common in cities -- poses operating challenges to drones. Compensating for gusty winds takes tremendous energy, which limits the payload and range of the drone. Collisions are actually less of a problem because the devices will be able to communicate. The ceiling limit for drones will likely be the same as for other aircraft. Finally, GPS-free navigation will be important so that the drones aren't hindered by GPS jammers, which are surprisingly common in some parts of the US.

6. Speed to Guest: Delivering Omni-Channel

A large US-based retailer presented its work on omni-channel retailing as a last-mile strategy. The retail landscape and last-mile delivery is getting more competitive every day, with Google Shopping Express offering same-day delivery, Instacart offering same-day service in Seattle, Wal-Mart offering drive-through pickup of groceries, and Amazon offering Amazon Fresh, Dash and plans with delivery drones. Rising consumer use of technologies such as smartphones and the rising volume of e-commerce makes retailers interested in omni-channel retailing to combine the power of online and offline shopping. The retailer's supply chain imperatives include "speed to guest" -- getting the items to consumers are quickly as possible while supporting growth and improving profitability, assortment and reliability.

6.1. Omni-Channel Strategy

One of the motivators for "speed to guest" is Amazon's growing network of warehouses, which is upping the ante on fast product delivery. The retailer foresees that customers will come to expect next-day delivery, so the retailer is building its capability to offer next-day delivery for the majority of its assortment, and is moving to enable same-day delivery in key markets. The company currently has the potential to deliver next-day to 25% of the US population, but doing so in actuality would be cost-prohibitive. At present, the company's delivery speed is about four days, which is middle-of-the-pack for brick-and-mortar stores but slower than Amazon's two-day service for Prime members.

In the future, the retailer will be leveraging its stores for pickup and for supplying and optimizing its distribution network to include direct-to-customer fulfillment from more locations. This strategy makes use of the retailer's existing stores and facilities, and it will enable the company to reach 91% of the US population with cost-effective, next-day delivery in 2015, and 99% of the population within two days. Another retailer puts a fulfillment center inside its stores, such that couriers like FedEx an UPS deliver from there.

6.2. Store Pickup of Online Deliveries

In 2013, a retailer rolled out in-store pickup, in which consumers could order items online and then pick them up in stores. Since the launch, about 15% of online orders are picked up at the store, with a peak of 46% of mobile orders placed before Christmas being picked up in the store. Customers -- whom the retailer calls "guests" -- can pick up their orders within four hours (nearly 80% of orders are ready within an hour). In-store pickup reduces the retailer's fulfillment costs by $5 an order.

Another benefit is that the in-store pickup motivates a trip to the store; early results show that 30% of customers purchase another item in addition to their online purchase when they visit the store. Omni-channel also supports the returns process -- the reverse last mile. Consumers can return products to the store, and the retailer then resells the product at a markdown rather than shipping the product back to the DC. Overall, the program has been well-received by customers and has surpassed the retailer's expectations.

In-store pickup does have challenges. One challenge with in-store pickup is the high cancel rate -- 30% -- due to guests abandoning the order because it is not paid for until at the store. The retailer also tells customers (15% of the time) that their order had to be cancelled due to the item not being in stock or not being found, sometimes because another customer has purchased it in the meantime. Another challenge is the physical space to hold the online orders, which varies by store and by time of year. The retailer is evolving the space around its Guest Service desk for this purpose. Despite the challenges, the retailer plans to continue offering the service and indeed will be expanding it in the coming year. Underpinning this strategy is the need to create one blended inventory that merges online inventory and store inventory into one system.

6.3. Urban Format Stores

One element of omni-channel is to build stores that reach people where they live in cities rather than expecting customers to drive out to the suburban big-box outlets. This is a reversal of a previous trend. In the US, retailers began as small-format stores, then became big-boxes and superstore size, and are now going back to smaller formats. For example, one retailer has created new urban format stores which are about half the square footage of the typical store and also even smaller express-format stores.

US companies can learn about small-format stores from the developing world, where stores are still those small-format sizes operating in diverse environments. In fact, small-format stores are growing in number in some megacities. Prof. Claudio Cunha suggested that determining some best practices for small-format stores, namely the appropriate size, inventory, and areas for unloading or storage that would be good to do. The limited storage in these smaller areas means that more frequent deliveries are required, which puts a premium on the proximity of distribution centers. For example, Wal-Mart uses a last-mile approach called "tethering," in which it uses space in the back room of a larger Supercenter store from which to ship to smaller stores.

6.4. Challenges of Blended Inventory

With omni-channel, there's a tradeoff that, on the one hand, inventory can be grouped and shipped all together to the customer, rather than through multiple deliveries. On the other hand, there is the inventory carrying cost of carrying every item at every fulfillment center in order to enable making that one delivery. Currently, 95% of the retailer's online orders are filled from one of two fulfillment centers, either in the southern or northern US. The company also has 37 DCs that are 1.5 million square feet and are automated. The future plan for 2015 would be to put three fulfillment centers into DCs to increase network capacity and coverage.

Currently, the retailer does not use its large-format stores as fulfillment centers for online orders because the typical store carries 80,000 SKUs compared to the 900,000 SKUs available online. Adding more SKUs to the large stores is difficult because the stores don't have huge back rooms to carry so much extra inventory.

Blending inventory will take time and faces some challenges. A retailer is planning a 2-3 year process to reach one blended inventory. A healthcare services company is planning a 7-year process to consolidate its five business segments into an integrated TMS. A retailer mentioned the difficulty of combining inventory of its retail stores, online, and other acquisitions because of the need to decide which SKUs to keep. Obsolete inventory has to be written off, which means the company will take a hit when it consolidates.

One reason for the long implementation times is the need to assure information security. For any cases in which a vendor can access a company's system, the company must put up firewalls, two-factor authentication, and other security protocols that take time, money and resources to create. A QSR added that mobile app developers who use a company's systems must also be audited to ensure they have robust standards and permissions, otherwise a company faces Sarbanes-Oxley issues.

7. Megacities: Madrid, Bangkok & São Paulo

The final presentations of the Roundtable moved from a focus on companies to a focus on cities and their unique situations. Three short presentations gave an overview of the last-mile issues in megacities, which are very large, very high-density urban environments. The three cities discussed -- Madrid, Sao Paulo, and Bangkok -- have widely varying socioeconomic conditions, but they all share common issues of congestion and regulation.

7.1. Madrid

Madrid has almost 7 million inhabitants and a density of nearly 5,500 people per square kilometer. A Spanish company makes 37,000 delivers a month to Madrid, of which 45% go to the city center on 83 trucks (four of which are refrigerated). Hotels and restaurants comprise 68% of the deliveries, with food stores another 23%. The company's Madrid DC is located 12 km from Madrid at the Madrid airport.

Case Study

The food company is a 100% Spanish-owned company offering 25 product families and 500 SKUs. It employs 2600 people (and another 7000 indirectly) and has sales of 769 Euros. It was the first company in Spain to have electric and compressed natural gas vehicles. Quality and innovation are pillars of the company. The company has a multichannel logistics structure with 150,000 points of sale and 25+ DCs across Spain. It operates 500+ vans for last-mile delivery, 350 long-distance trucks and 600 commercial vehicles.

Order to Cash

Two-thirds (66%) of the company's orders come from its 55 direct salespeople, 30% from its phone sales reps, and 4% online. Orders received by 3pm will be delivered the next day, giving the company less than 24 hours to process and deliver an order; nonetheless, the company has a 99.2% service level.

The picking process includes preparing one delivery batch for one deliverer. Each batch includes an average of 25 orders. The company averages 30 deliveries per truck per day. Deliveries before 1pm face parking constraints in the center of Madrid; 50% of orders are paid in cash.

The company delivers through 78 independent contractors with whom it has long-term relationships. The contractors wear company uniforms, receive training from the company, and communicate with the company's commercial department about customer information. On average, the company interacts with 1800 customers each day. The contractors deliver to 15,000 points of service (8000 hotels and restaurants, 5000 food stores and 100 vendors). The return rate is 1.6% a day.

Collaboration

The company also distributes products on behalf of six other distributors and manufacturers. The partnerships are not with direct competitors but with companies that offer products in other categories that sell through the same outlets as the company. Given the company's three pillars of quality, innovation and healthy products, the company only makes strategic agreements with partners who share these values.

The company offers these other distributors a reliable last-mile logistics solution, integrated information systems, promotional analysis, and assortment planning for each point of sale. The company offers inventory management and procurement management through its demand forecast department. In turn, from its partnerships with other distributors, the company gains higher efficiency in logistics distribution, better GHG emissions efficiency, and a fee for its logistics services. Strategic collaboration lets the company grow, diversify, and offer its distribution model to other brands.

Partnering with Municipalities

The company also partners with municipalities on urban freight issues. Municipalities gain benefits such as less traffic congestion and better air quality via the company's consolidated delivery processes and use of 17 electric vehicles. In turn, the company receives reduced fees and regulations in loading/unloading areas, access to restricted areas for vehicles with a particular load, and access to city infrastructure for consolidation. Partnering with municipalities means that the company doesn't get as many traffic fines.

One person's sole job at Calidad Pascual is managing these municipal relationships. The employee educates the city about the company's logistics operations and the special challenges of delivering to a dense city. Dr. Blanco added that this was the first instance he's heard of a company employing a person dedicated to work with and educate city officials. Another CPG company agreed that cities can benefit by working with companies to establish receipt during off hours or granting access to restricted areas. All this translates to a better level of service that the company can offer relative to its competitors.

7.2. Sao Paulo

Sao Paulo has over 20 million people living in 39 different municipalities. The density of the city is 20,000 people per square mile. Despite the density, 50% of all personal trips are made by car, which translates into massive traffic jams. Congestion also grows due to the slow pace of the bureaucracy and underinvestment in large-scale infrastructure. Each new administration prefers to invest in short-term projects that can be completed before the next election.

Sao Paulo Regulations

To reduce traffic congestion, Sao Paulo authorities banned larger trucks from major roads and central areas, and they restricted parking for loading/unloading. Only small delivery vehicles are allowed in the city due to narrower traffic lanes. The exceptions to the truck ban include garbage collection, perishable foods transportation, hazardous materials, earth removal from civil constructions, urban infrastructure operations and services, moving furniture, essential public services, armored trucks, postal services and emergencies.

City officials have continued to expand the restricted area in Sao Paulo; it now encompasses more than 100 square kilometers, which is larger than all of Manhattan Island and five times greater than the central London congestion area. Sao Paulo has no ring road for trucks, so delivery trucks moving east/west have to drive 80km around the constrained area rather than the 23 km through it.

The speaker pointed out that city regulations may change suddenly and without discussion or warning. Local authorities may not have the proper knowledge of urban logistics or understand the implications of their decisions. Therefore, engaging with authorities to educate them on last-mile logistics would be beneficial.

Sao Paulo Challenges

The last mile in a city like São Paulo depends on local knowledge. Companies trying to use software such as Roadnet to plan routes face challenges of poor geocoding accuracy. A company tried to geocode 1000 addresses and failed to get accurate coordinates for any of them. Instead, companies need to go out in the field to understand the last mile and learn how to expedite delivery procedures. Sometimes, a driver may wait 20-30 minutes because the store owner is too busy to take the delivery. Another time, a store may not be open because the store owner owns another store down the street and hasn't opened the first one yet. Delivery efficiency depends on local knowledge of when, where, and how to make deliveries.

Sao Paulo has peculiarities, such as slums (favelas) right next to upscale neighborhoods. Shanties with no running water sit next to high-rise luxury apartments with outdoor pools on every balcony. The order drop size to these different neighborhoods is completely different, even though they are physically next to each other.

Security is an issue in all major cities, and it is an issue at all hours, not only in off-hours. Even low-cost items such as beer or soda are targets for theft if the items can be easily sold in informal markets. Unassisted deliveries are unusual in Sao Paulo, and leaving a home delivery on the doorstep is unheard of. Delivery vehicles may need armed escorts.

7.3. Bangkok

Bangkok has a population of 8 million and density of 14,000 people per square mile. Urban planning creates problems in Bangkok -- laws now prohibit building DCs inside Bangkok, which means an extra 90 minutes travel time from DCs outside of the city. Other challenges include a lack of proper loading bays and parking signage. Kiosks on sidewalks block access to buildings. The result is drop-and-go deliveries, which increase theft of items and problems of food safety.

The company owns nearly 8000 convenience stores (third largest in the world) and is growing at an annual rate of 550 stores, meaning that it will have 10,000 stores by 2019. Each store serves an average of 1400 people per day, translating to over 7 million customers a day. The company employs 140,000 people and has 3 DCs and chilled DCs supporting the eastern and western areas of Bangkok. Deliveries from the dry-goods DC and chilled-goods DC come to the stores, as do

direct-store deliveries from some vendors such as Coca Cola, Kudsan and Wall's ice cream. A total of 1699 vehicles (3592 trips) serve 2139 stores in Bangkok and another 1176 in the suburbs of Bangkok.

The city of Bangkok has strict size, location, and time-of-day restrictions on trucks. Regulations have banned trucks in specific time windows, thereby also reducing the time available for consolidation at DCs. Time-of-day restrictions on trucks also pose challenges for delivering fresh food for breakfast, lunch and dinner times. The company expects to replenish stores three times daily with fresh food, but in Bangkok they can only deliver once a day.

The company is tackling these challenges by working with the City Council of Bangkok and the Thai Government to reconsider zoning for building warehouses/hubs, to provide load and unloading bays, and to authorize frequent-parking vehicles. The company is collaborating with Makro, SCG, Sahapat and other Thai companies to get these regulations. The company is also purchasing a new type of truck to fit the city's size regulations. The truck meets the four-wheel small-truck size limits but can carry 1.5 tons cargo -- 50% more than a standard 4-wheel delivery truck. The company is also using computers, GIS and demand forecasting to optimize routes and arrangement of items.

8. Next Steps for the Last Mile

During the final discussions of the Roundtable, Dr. Blanco noted that there are multiple definitions of the "last mile" depending various factors that were mentioned during the Roundtable. Omni-channel delivery to consumers in the middle of the US is different from convenience store deliveries in Bangkok, or whether delivering to a Staples in Boston or to Starbucks. Density is also a dimension. The scale of the US adds miles to each delivery, but the density of megacities presents its own challenge. Deliveries per driver per day, value per drop, and delivery volume variability all vary from company to company, product to product, and location to location. Last mile also varies by the skills required of the driver, which might include merchandizing, installation, sales, and even emotional "life" coping skills in addition to driving and solving routing problems. Dr. Blanco liked some of the new terms used at the Roundtable, such as "Speed to Guest" and B2L - "Business to Life" in that when deliveries are made to consumers' homes, the delivery person is entering that person's life.

8.1. Growing Regulations in Megacities

Dr. Blanco pointed out that another challenge is how quickly regulations in megacities may change, such as loading zones or parking regulations in emerging cities. The frequency of the changes adds to the disruptiveness of the change. For that reason, especially in megacities, drivers need to have the mentality of a route manager, not just a truck driver. Moreover, many megacities are agglomerations of municipalities, with the potential for fragmented and conflicting regulation in different parts of the city.

Prof. Eva Ponce reiterated the need to educate government officials on the importance of last-mile delivery, so that they understand the business and societal implications of the new laws they enact. A healthcare services company added the need to talk with law enforcement officials, not just urban planners, because of the theft issues that may happen during the last mile.

Dr. Blanco agreed that companies operating in megacities face problems of high disparities in income, fast-changing regulations and increasing traffic restrictions. There is a need for companies to collaborate with the public sector. Constraints arise because of permanent issues like regulations, or temporary constraints like the World Cup. Proof of correlated impacts between urban planning and logistics cost/efficiency is needed, as are green logistics solutions and smart traffic routing.

8.2. Drones: Is the Future Up in the Air?

Prof. Mary Cummings doubted that drones would be used for last-mile deliveries in cities any time soon because of the threats of vandalism against drones. The challenges will be less on the technology side than on the business model side, she said. Countries such as Australia or Japan lead the U.S. in in terms of technology development and drone-friendly regulations. Drones need not be airborne or only used in the last mile. A transportation company suggested that drone trucks might be one way to deal with the shortage of drivers.

8.3. Future Consolidation of the Last Mile and Last-Mile Service Providers

It remains an open question whether the last mile will consolidate or not. Dr. Blanco suggested the possibilities: Will package delivery companies such as UPS, FedEx or DHL take over that last mile? Or will a unique 3PL arise that focuses just on that last mile? Or will brands (either manufacturers or retailers) eschew consolidation and retain last-mile distribution in order manage it themselves to gain competitive advantage? On one hand, consolidation saves money, reduces empty space on trucks, and removes trucks from congested roads. On the other hand, brands want to retain control, maintain personal contact with the customer, and create competitive advantage through propriety last mile, go-to-market strategies.

A food company pointed out the advantage of thinking about the last mile in terms of value creation, not just cost reduction. This may require changing the incentives in the distribution function and for drivers. For example, a company might switch from rewarding reduced time per delivery stop to rewarding new business generated by spending more time with the customer. At issue is whether the last mile is a cost to be minimized or an opportunity to be maximized.