TRENDS FOR FIRST- AND LAST-MILE FREIGHT IN MINNESOTA

White Paper

September 2019

MINNESOTA FREIGHT ADVISORY COMMITTEE

MFAC

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Introduction

Freight transportation is changing in dramatic ways. E-commerce has pushed two criteria to the forefront of considering the goods and services we choose and the way we purchase them, from groceries to clothing to cars: 1) Is it available right now? and 2) How soon can I get it? To those in the freight industry and their supply-chain staffs, this means satisfying a market that appears to be demanding, "I want it all, and I want it now."

The Minnesota Freight Advisory Committee wants to explore and understand these changes, the implications for the immediate future and beyond, and how the industry is responding to the changes. This paper begins that effort, focusing on those activities that most experts feel are likely to be of the highest impact: what it takes to get a customer's order to their door. In other words, we are discussing what is involved with that last segment—the last mile.[1]

[1] Due to the proprietary nature of actual shipping practices, this paper does not assert any knowledge of what technologies are being used by any companies mentioned. Rather, these are provided as examples of how the innovation could create change. Also, this paper is intended as an overview of the coming changes, and the reader is directed to any and all of the references for a more detailed discussion of any point.

Defining the First-Mile/Last-Mile Issue

Broadly speaking, the "last mile" in freight delivery can be defined as the "final step of the delivery process from a distribution center or facility to the end user" (3). While the term is "last mile," this step can range from several blocks to several miles (3). In many cases, especially in states like Minnesota where manufacturers and other shippers can be spread widely in small towns or rural areas, the challenge of moving the "first mile," from the shipper to warehouses or distribution centers, can raise similar issues (4). Consequently, while much of the terminology in this paper will refer to the "last mile," many of the innovative technologies and practices could apply to these first-mile issues as well.

Understanding and responding to these last-mile changes is a high priority across the country due to the magnitude and rate of the innovations in this area. For example, the Transportation Research Board's Urban Freight Committee has selected "identifying warehousing trends" as its top research topic in 2019 (2). At the same time, major players are seeking to new ways to complete the delivery, such as Amazon's application to the FAA to use drones to accomplish this task (1). Further, in a series of reports examining emerging freight mobility trends, the multinational management consulting firm McKinsey and Company estimates e-commerce will make up a significant part of the 25 billion parcels that are expected to ship each year by 2025 (5). Given that the final destination for these goods is increasingly the customer's front door rather than a retail store, and that those doors can be located in wide and varied locations, covering the last mile can account for up to 25 percent of the total shipping cost (8). Nevertheless, consumers are expecting—and willing to pay for—increasingly rapid delivery. The McKinsey study noted that about 25 percent of customers would be willing to pay extra for same-day and instant delivery (5), a number that is likely to increase as new technologies allow the costs of providing such rapid service to decrease (7). As stated by an e-commerce company officer, "Online customers expect speedy delivery of their purchases for little or no cost, as well as transparency and the ability to return products. But at the end of the day, they don't care about the complex logistics planning and execution needed to make that possible" (6).

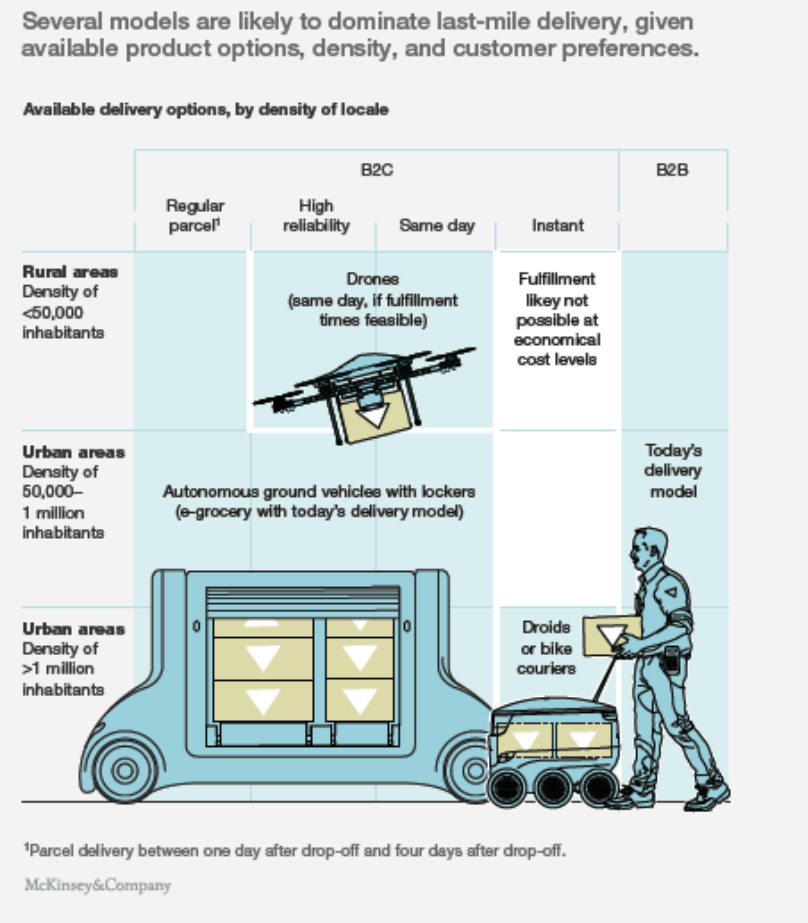
In other words, the freight industry is in the middle of a self-perpetuating cycle: the market is responding to improvements in the number of goods that can be delivered to the customer's door in shorter and shorter time frames by demanding even greater deliveries and faster speeds. The exact nature of the issues and challenges that result can vary depending upon one's position. For example, while a transportation planner may be concerned about possible congestion impacts resulting from increases in delivery vehicle traffic, a small carrier may be concerned about its very existence: whether and how it should try to compete against, or collaborate with, a company like Amazon as it moves towards the use of drones.

Emerging Innovations and Technologies

Vehicle automation

One major innovation driving this changing landscape is increasing vehicle automation. Traditionally, humans have been responsible for covering this last mile, whether they were professional drivers or, more commonly, human consumers bringing the goods home from a retail location. Now, technology is emerging that can substitute for both methods. This technology can come in many different forms, from simply replacing a human-driven vehicle with one powered by autonomous or automated technologies, to new delivery methods. These latter methods include small drones delivering individual packages from a larger vehicle, as well as smaller self-driving boxes that are able to safely maneuver in dense environments. Figure 1 shows the variety of technologies that are pushing this along (5).

Figure 1: Emerging delivery technologies



A key reason for increasing automation is decreasing costs. As shown in Figure 2, McKinsey notes that greater cost savings will be realized as technology allows for increasing vehicle automation, but Figure 3 shows they estimate that the greatest automation is least mature as of 2018 (7). McKinsey does hedge their statement by noting that innovation is moving more rapidly than they had expected in 2016, and Amazon's FAA filing (1) shows that this rapid change continues to take place. Along these same lines, a separate McKinsey report predicts that highly automated commercial vehicles (i.e., those with a remote backup for when the vehicle encounters a situation it cannot handle and needs human intervention) could cover 60 to 70 percent of all miles driven in the United States in the first half of the 2020s, should other factors, such as regulation, customer preferences, and competitive landscape allow it to happen (12).

Figure 2: Decreasing cost with increasing automation

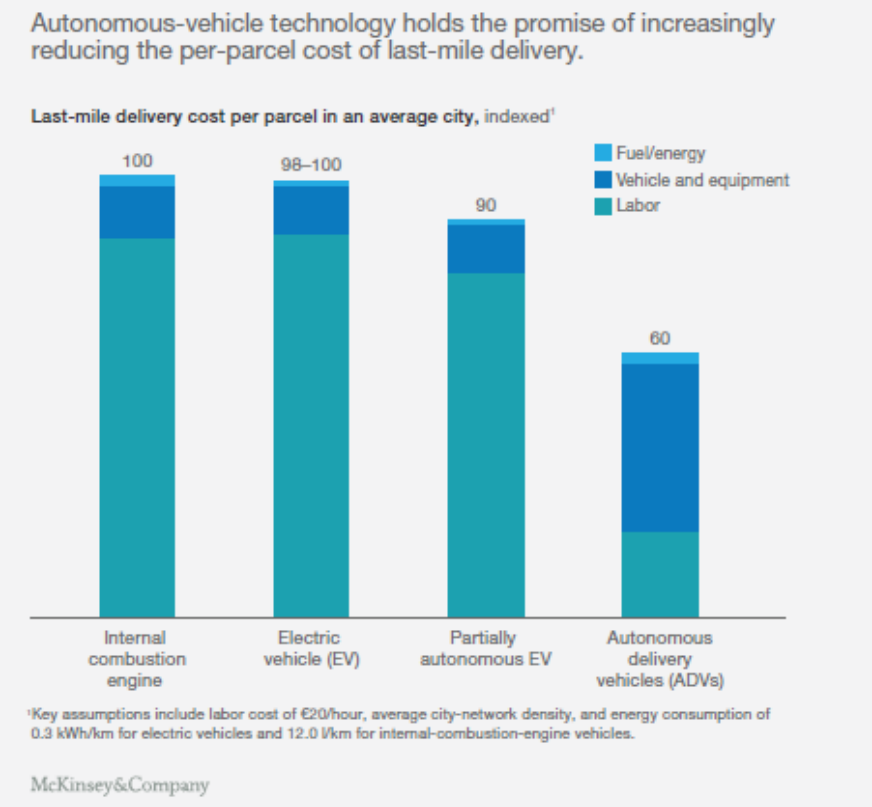
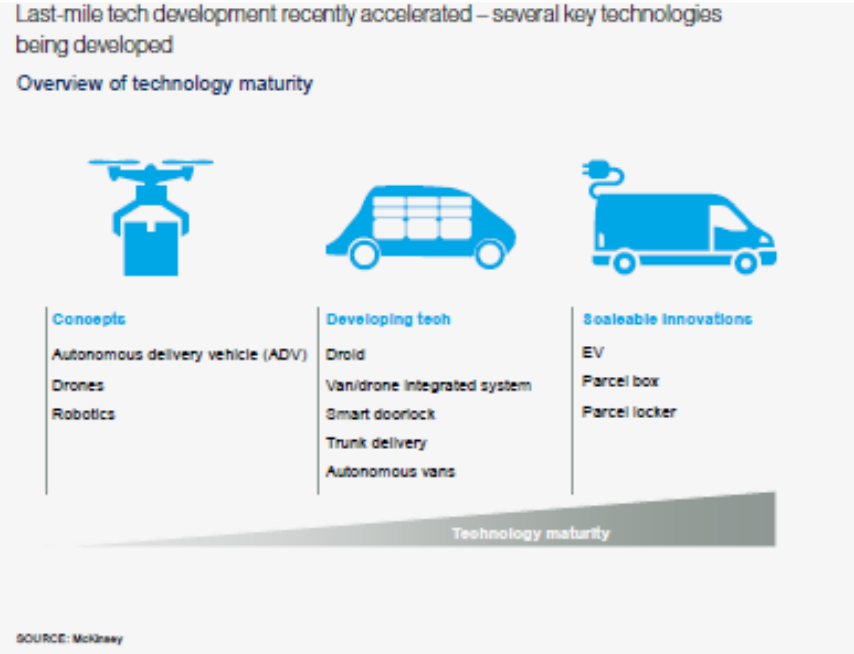


Figure 3: Vehicle automation technology maturity



Warehousing changes allow embrace of automation

In the meantime, changes at the distribution centers and warehouses where the last-mile journey begins are likely even more central to the greater and faster deliveries the market is calling for. As a *Wired* magazine description of an Amazon sorting facility in Colorado points out, new robotic and other technologies are making it possible for parcels to be sorted, shipped, and tracked to their destination faster and at lower cost (9). The greatest difference from the transportation changes discussed above, however, is that robots and other automated procedures complement and enhance human activities rather than replacing them. Instead of using humans to read shipping labels and physically carry and place parcels in areas that will lead to eventual shipment to their next destination, humans now program and monitor robots that tirelessly and consistently perform this duty. Most important, the humans need to be on-site to address any problems that may occur (9).

For companies that do not have the resources of Amazon to develop such capacity on its own, third-party vendors such as FourKites (10) and carriers like FedEx embed internet-connected sensors in packages. These sensors provide real-time analytics and related services to shippers that allow for previously non-existent logistical analysis and response (16). Large companies, such as Target, have found such services to be so valuable that they have purchased these companies outright to bring the services in-house exclusively (13).

Examples and Implications for Minnesota

A large share of these changes in freight transportation appear to be taking place—with benefits accruing—outside of Minnesota. Changes are happening in this state as well, with significant opportunities arising as a result. First, Amazon is employing humans and robots in similar ways as discussed in the *Wired* article (14), and sources to the *Minneapolis/St. Paul Business Journal* recently indicated that Amazon is building a new facility in Maple Grove, Minnesota (15). Though it is not clear whether this is a futuristic sorting facility as discussed in the *Wired* article (9), the description of the function—disassembling pallets of packages so they may be delivered to customers—is consistent (15).

Perhaps more significant are the logistical changes presented by the new tracking technologies. A Minnesota company engaged in shipping packages of all different sizes, such as Schwan's or Digi-Key, which has made its name selling parts in any quantity (11), can maintain or improve its market share through these innovations. Likewise, since these and similar companies are located in smaller towns with limited labor forces, the changes in warehousing practices can further increase the productivity of their human workers.

Conclusion

Though these changes are fascinating, they do not portend the end of all current practices. Robots and other automated technologies still have their limitations. As the head of one automated delivery start-up put it, “The last 50 feet is not going to be automated for a very long time. Definitely not in the next five years, probably not in the next 10” (8). While Amazon’s delivery drones may accelerate that timeline somewhat, considerable opportunity remains for existing lower-tech solutions that employ the assistance of consumers themselves, such as delivery lockers and kiosks (3), or even encouraging the consumer to handle the entire last mile themselves by having them pick up the ordered item at the store.

Perhaps a greater limitation, however, comes in the form of rural broadband and highways. The sensors, robots, and all of the other technologies described here will rely to some extent on the internet of things and other connectivity issues. To the extent that this connectivity does not exist, particularly in the smaller towns and rural areas mentioned in this paper, potential benefits and competitive advantages could be lost. Similarly, if the last- (or first-) mile traveled is one that cannot be easily traversed, it may not be covered at all (except for possibly by a drone) (4, 17).

The technologies and practices discussed in this paper are still developing, and their ultimate impact on industry, urban form, and Minnesota's transportation system remains unclear. The Minnesota Freight Advisory Committee should continue to monitor additional first- and last-mile freight trends and communicate issues to other stakeholders such as government partners. In the long term, it is expected that these changes will impact Minnesota businesses and MFAC should work with the state freight community to coordinate on how to successfully implement or adopt future technologies.

About MFAC

The Minnesota Freight Advisory Committee (MFAC) was established in 1998 to advise the Minnesota Department of Transportation (MnDOT) and other public agencies and officials on the performance and importance of Minnesota’s freight transportation system to support the state’s economic competitiveness.

Prepared by:

Center for Transportation Studies
University of Minnesota
200 Transportation and Safety Building
511 Washington Avenue S.E.
Minneapolis, MN 55455-0375
612-626-1077 | cts@umn.edu | cts.umn.edu

Writer: Frank Douma
Editor: Michael McCarthy
Graphic Designer: Angela Kronebusch
Cover photos: Rochester International Airport and Michael McCarthy/CTS

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Acknowledgments

This research would not have been possible without the support of the Minnesota Freight Advisory Committee, and specifically the direction provided by MFAC chair Ron Dvorak and MnDOT freight planner Andrew Andrusko. Similarly, the author benefitted greatly from the support of Gina Baas and her staff at the University of Minnesota Center for Transportation Studies. Finally, the author would like to thank Vicki Schwartz for her insight on the topic as well. Despite all of this indispensable help, however, any errors contained in the paper are those of the author alone.