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CROWDSERVING: A LAST MILE DELIVERY METHOD FOR BRICK-AND-MORTAR RETAILERS

Ryan L. Skiver, University of Wisconsin Oshkosh
Michael Godfrey, University of Wisconsin Oshkosh

ABSTRACT

The retail industry increasingly is shifting to online sales. According to Forrester Researchers, ecommerce has seen an increase of over 10% per year. To be able to compete, brick-and-mortar retailers have begun offering customers free online order pickup options at their retail stores. However, customer demands are shifting to a same-day home delivery model. This home delivery model has companies such as Amazon searching for new technologies to deliver faster. For brick-and-mortar stores to compete, they must try to match this same-day home delivery model to meet customer demands. Last mile delivery (LMD) is an option for brick-and-mortar stores given that they store products at multiple retail facilities and distribution centers. Some brick-and-mortar stores now are incorporating third party carriers to provide same-day delivery. The drawback to LMD is the increased transportation cost, which includes vehicle, fuel, and driver costs. This article explores the option of a variation of crowdsourcing along with current technologies in the way of cell phone apps utilizing GPS technology and real-time notifications to explore a viable customer delivery method for LMD. This new method will provide a way to reduce transportation costs and to make LMD more feasible at many brick-and-mortar retailers.

JEL: M110

KEYWORDS: Crowdsourcing, Crowdserving, Last Mile Delivery, Ecommerce, Brick–And-Mortar

INTRODUCTION

Brick-and-mortar stores began with a basic idea—centrally locate stores in optimal locations to minimize customer travel distance to the stores. The challenge to retailers is that this model of delivery is changing. Ecommerce has entered the picture and has changed the structure of goods delivery. In the past, delivery has been primarily business-to-business (B2B). B2B was accomplished primarily through manufacturers shipping their goods to larger distribution centers. Then these goods would be shipped later to large retail stores. The new structure of delivery is business-to-customer (B2C)—skipping the retail store and shipping products directly to the customer (Joerss, Schroder, Neuhaus, Klink, and Mann, 2016). This new model of goods delivery changes final destination from the retail store to the customer's home. Many brick-and-mortar stores are trying to compete with this new model of home delivery with in-store pick up of online items to eliminate customer delivery charges. At the same time, online companies such as Amazon now are offering same-day delivery. Some online retailers are looking for even faster ways to get products to a customer's home with instant delivery options (Joerss et al., 2016). Similar to pizza delivery, goods are delivered quickly from a facility using drones as the carrier. This new system of delivery in which the carrier is autonomous and not a physical person is referred to as X2C (Joerss et al., 2016). However, this drone method faces several challenges including, but not limited to, the following: atmospheric conditions, load limits, and privacy issues of flying over houses at close range. Because of these challenges, drones may not be as feasible for long distance as some people believe. One short-term method to overcome these challenges would be using an autonomous vehicle with delivery drones as the package handlers. The autonomous vehicle could be parked in front of a customer's home while the drone retrieves packages from the vehicle and delivers the packages to the customer's doorstep. Because this option would decrease flying distance, there would be fewer problems dealing with atmospheric conditions. In addition, multiple trips could be used when more than one package has to be delivered to overcome load limits (carrying capacity) of the drone, and privacy would no longer be an issue because drones would not need to fly over houses. It is estimated that by the year 2025 up to 25% of the retail market will be made up of either instant or same-day deliveries (Joerss et al., 2016). This figure will cause more of a necessity for brick-and-mortar stores to create new methods to compete in the near future. However, the costs of facilities and last mile delivery will create challenges for brick-and-mortar retailers. Specifically, brick-and-mortar retailers must be able to drive down cost enough to compete with their online competitors.

The remainder of this paper is organized as follows. The next section reviews the literature on three topics related to the model presented later in this paper—ecommerce, last mile delivery, and crowdsourcing. The next section presents the methodology used to develop the last mile delivery model. After that, results and discussions are presented. The last section includes the conclusions with limitation and future research.

LITERATURE REVIEW

Ecommerce

It is very common for customers to look online for purchases of goods that they traditionally would have purchased though a brick-and–mortar store (Esper, Jensen, Turnipseed, & Burton, 2003; Song, Cherrett, McLeod, & Guan, 2009). Forrester Researchers show ecommerce to be increasing at a rate of nearly 10% per year (Forrester Research eCommerce Forecast, 2014-2019 (US) Online Retailing Tops $300 Billion in 2015). With this type of growth, ecommerce has shifted the structure of the current retail market from B2B to B2C (Joerss et al., 2016). Because of this shift, ecommerce has become a prerequisite for success in retailing. Today ecommerce requires more than selling online—it also requires delivering a product to a customer's home in a reasonable time. Brick-and-mortar stores increasingly are using in-store pick up of items sold online to create a faster option compared to normal online delivery to a customer's home. Ecommerce companies such as Amazon now are offering same-day, or sometimes instant delivery (within 30 minutes), to compete with in-store pickup. Even more recently, brick-and-mortar stores have started using third party carriers such as Google Express and Shipt to deliver items to the customer's home. Shipt also has created a separate business in delivering items from stores that do not offer same-day delivery (Shieber, 2017). Shipt has employees who will shop for the order placed and deliver it to the buyer's home. This creates the option for same-day delivery even when the brick-and-mortar store does not offer this delivery. However, these delivery options can be expensive to the customer ordering the items with yearly membership fees of $99, $7 extra costs if a $35 minimum amount is not ordered, and a cost of over 13% more per item (How Are Your Prices Determined?). Online retailers dealing with some of the issues of last mile delivery discussed in the next section are searching for new and less expensive methods of transportation to reduce the cost of last mile delivery. Many new methods of transportation such as autonomous vehicles and drones have joined the conversation as ways to make last mile delivery cost less. These types of deliveries have been named X2C in which a human carrier is not present (Joerss et al., 2016). X2C is expected to be the future of delivery and will put a significant strain on brick-and-mortar stores as X2C delivery is expected to cost much less than traditional LMD. As the push for home delivery increases, the need for LMD in the transportation field continues to increase.

Last Mile Delivery Challenges

Home delivery is becoming an important part of retail. In the transportation industry home delivery is referred to as last mile delivery (Gevaers, Van de Voorde, & Vanelslander, 2011; Lee & Whang, 2001; Song et al., 2009). The term LMD was created to reflect that many stores were located centrally within their delivery areas such that the distance between most customers and the store was approximately one mile. Pizza and sub-sandwich restaurants that deliver have made a business out of this last mile type of service delivery. There are many challenges when it comes to last mile delivery for ecommerce. Those challenges include transparency/technology, delivery charges, environmental issues, speed of delivery, and perishable items (Gevaers et al., 2011; Joerrs et al., 2016; Lee & Whang, 2001; Song et al., 2009; 4 Challenges of Last Mile Delivery for eCommerce). Because of these challenges, many businesses have failed when trying to create a last mile delivery system (Punakivi, Yrjölä, and Holmstrom, 2001). We discuss each of these problems and provide a summary of this information in Table 1 below.

Delivery accuracy or transparency is very important to online shoppers—89% of online shoppers rate on-time delivery as high importance (Esper et al., 2003). Research has shown that tracking delivery dates alone is not enough; instead, real-time information with full visibility is now the key for delivery success (4 Challenges of Last Mile Delivery for eCommerce). Customers also demand to be able to offer input on their orders such as specifics about the product and how it is delivered (4 Challenges of Last Mile Delivery for eCommerce).

Last mile delivery costs more due to the cost of the vehicle, maintenance to the vehicle, delivery driver pay, and fuel. As much as 28% of the total delivery cost to a business comes from the last mile (4 Challenges of Last Mile Delivery for eCommerce). According to Joerss et al. (2016), last mile delivery costs more than $87.3 billion and has a growth rate near 10% annually worldwide. Last mile delivery in the United States, China, and Germany cost $35 billion annually (Joerss et al., 2016). These costs get pushed along to customers through shipping charges or many times in the product costs themselves (Gevaers et al., 2011; Joerss et al., 2016). This increased cost is exacerbated by the security issue of the customer not being home for a delivery, which can lead to lost or stolen packages if packages are left at the door or, alternatively, issues with drivers having to re-deliver packages when the customer is not home, which increases fuel cost and environmental issues.

Last mile delivery has been cited as a serious issue causing harm to the environment (Gevaers et al., 2011). Given the expected rate of increase in LMD of close to 10% per year, this problem will grow (Joerss et al., 2016). Less-than-truckload shipments, size and efficiency of vehicle, repeat deliveries when the customer is not home, and inefficient travel routes can lead to higher emissions and are the driving force behind environmental issues (Gevaers et al., 2011).

According to Joerss et al. (2016), 23% of customers would pay more for same-day delivery, only 2% would pay more for instant delivery (within a half hour), and 5% would pay more for timed delivery. With timed delivery, a customer is notified of a narrow delivery window on a given day (Joerss et al., 2016). This means that retail customers would like to see their items delivered same-day within a specified narrow time window and would pay a premium for that service, but they do not at this point care as much about instant delivery. When retailers offer same-day delivery; however, the delivery cost increases due to less-than-truckload shipments and fuel consumption due to inefficiencies in routes.

Preservation temperature regulations are a severe issue in last mile delivery (Brooksher, 1999; Witt, 1999). Certain foods must be kept cold or refrigerated during transport and require shipping in refrigerated or frozen trucks. At the same time, these orders of perishable items usually are small and thus drive up the cost of delivery substantially (Brooksher, 1999; Witt, 1999). Table 1 below summarizes the problems associated with last mile delivery discussed above.

Table 1: Current Challenges Associated with Last Mile Delivery

Current Challenge	Explanation of the Challenge	Reference
Transparency/Technology	On-time delivery Lack of ability for customer to input specifics on the item	Esper et al., 2003; 4 Challenges of Last Mile Delivery for eCommerce
Delivery Charges	Last mile delivery costs more than $87.3 billion due to cost of the vehicle, maintenance to the vehicle, delivery driver pay, and fuel	Joerss et al., 2016; 4 Challenges of Last Mile Delivery for eCommerce
Environmental	Less-than-truckload shipments, type of vehicle, repeat deliveries when customer is not home, and inefficient travel routes can lead to higher emissions.	Gevaers et al., 2011
Speed of delivery	Significant demand for same-day delivery with timed delivery	Joerss et al., 2016
Perishable items	Preservation temperature regulations	Brooksher, 1999; Witt, 1999

This table shows the current problems associated with last mile delivery and references cited for those problems.

Crowdsourcing

Howe (2006a) coined the term "crowdsourcing" in *Wired* magazine. The idea of crowdsourcing was used primarily by companies for creativity or an intellectual task for which a company posted a problem that normally would have been solved by employees, but instead opened that problem up to be solved by anyone willing to solve the problem (Brabham, 2008; Howe, 2006a). The winner, or problem solver, would receive some type of award (usually a monetary prize). Howe (2006b) later expanded on the definition of crowdsourcing by stating, "It's only crowdsourcing once a company takes that design, fabricates it in mass quantity and sells it" (Para. 1). The design that Howe (2006b) was referring to was a creative design that an individual in the crowd created. Many examples of crowdsourcing include creating computer programs, developing a design for a product, or creating a slogan. Crowdsourcing refers to the search for the creative or intellectual solution to a problem (Brabham, 2008; Howe, 2006a; Howe, 2006b). This search is achieved by an open call to the population (Brabham, 2008; Howe, 2006a; Howe, 2006b). The concept of utilizing the creativity of a crowd to solve a problem has shifted to crowds performing other labor-intensive tasks in the service industry. For example, companies such as Uber have been touted as users of crowdsourcing even through their business model does not fit the scope of the definitions described above. Because there is no design idea generated by the crowd or fabrication of that design as Howe (2006b) defined crowdsourcing, then Uber is not using crowdsourcing. For this reason, we refer to the approach used by Uber as crowdserving, as, "a business or individual who places an open call to perform a defined service that originally would have been performed by an employee, or contractor." Crowdsourcing utilizes creativity while crowdserving requires a service from someone to complete a specified task. Crowdserving has been an efficient way for Uber to provide a cheaper option for transportation of customers. However, the Uber model does not have brick-and-mortar stores in which customers shop. Due to the lack of physical retail stores, Uber cannot utilize assets that are at their disposal (i.e., customers who are in the retail store and will drive home after shopping). This is because Uber notifies customers based on their willingness to drive and not based on the routes they will be traveling, which decreases efficiency in the network scheme. In the following section, the methodology is discussed in the context of systems theory.

METHODOLOGY

Systems Theory

In organizations, systems consist of people, structures, and processes that work together to make an organization healthy or unhealthy (Ackoff, 1978; Bailey, 1994; Bánáthy, 1996; Bausch, 2001; Buckley, 1967; Capra, 1997). Systems thinking has been defined as an approach to problem solving by viewing problems as parts of an overall system (Davidson, 1983; François, 1999; Gorelik, 1975). Companies are not judged solely by being in a given market; instead, they are judged by what they achieve in that market in terms of outcomes to their shareholders and stakeholders (François, 1999). Due to cost and the other issues presented in the previous section, one firm alone cannot handle the complexity of last mile delivery. A retailer needs the help and collaboration of an entire system in the delivery of a product; therefore, system resources (employees, customers, and suppliers) are needed to create the most successful outcomes (Davidson, 1983; Gorelik, 1975). Systems thinking is not one simple concept, but rather a set of habits or mechanisms within a framework that is based on the belief that the parts of a system can be understood best in the context of relationships with each other and with other systems, rather than in isolation (Checkland, 1981, 1997; Churchman, 1968, 1971).

The current study uses systems theory to explain that the retail store alone is not capable of providing the most cost efficient method of last mile delivery. However, a retail store has customers who potentially could deliver goods to other customers' homes. Given that customers leaving a store might be driving past the residence of another customer requesting home delivery, the marginal cost of that delivery should be low. When the retailer and customers partner for home delivery, both can profit. On a day-to-day basis, customers are driving to brick-and-mortar stores to shop for products anyway. Systems theory can be used to explain that the most cost-effective means for home delivery would be to have customers who are driving past the residence of a customer requesting home delivery drop off products at that customer's home. To make this model beneficial to all system members, there would need to be a monetary reward for the customers providing the home delivery service for the brick-and-mortar stores. Customers delivering products would receive payment from the retailer, and the customer receiving the delivery would pay the retailer a very small nominal fee (much less than a traditional delivery fee).

Model

Using systems theory, we created the new LMD design shown in Figure 1 below. Figure 1 shows the information and product flow in for a retail store for which customers are third party deliverers. First, a customer places an order online for home delivery. Second, that order information is transmitted to the store. Third, store personnel prepare the order and at the same time, the store places an open call for a customer in the store headed in the area of the delivery. Fourth, a customer in the store accepts the agreement to deliver, and the customer who placed the order is notified of a small delivery window. Fifth, information on the sale is sent to the factory so that the factory can replenish the inventory of the item. Sixth, the customer making the delivery picks up the products and delivers those products to the home of the receiving customer who placed the order.

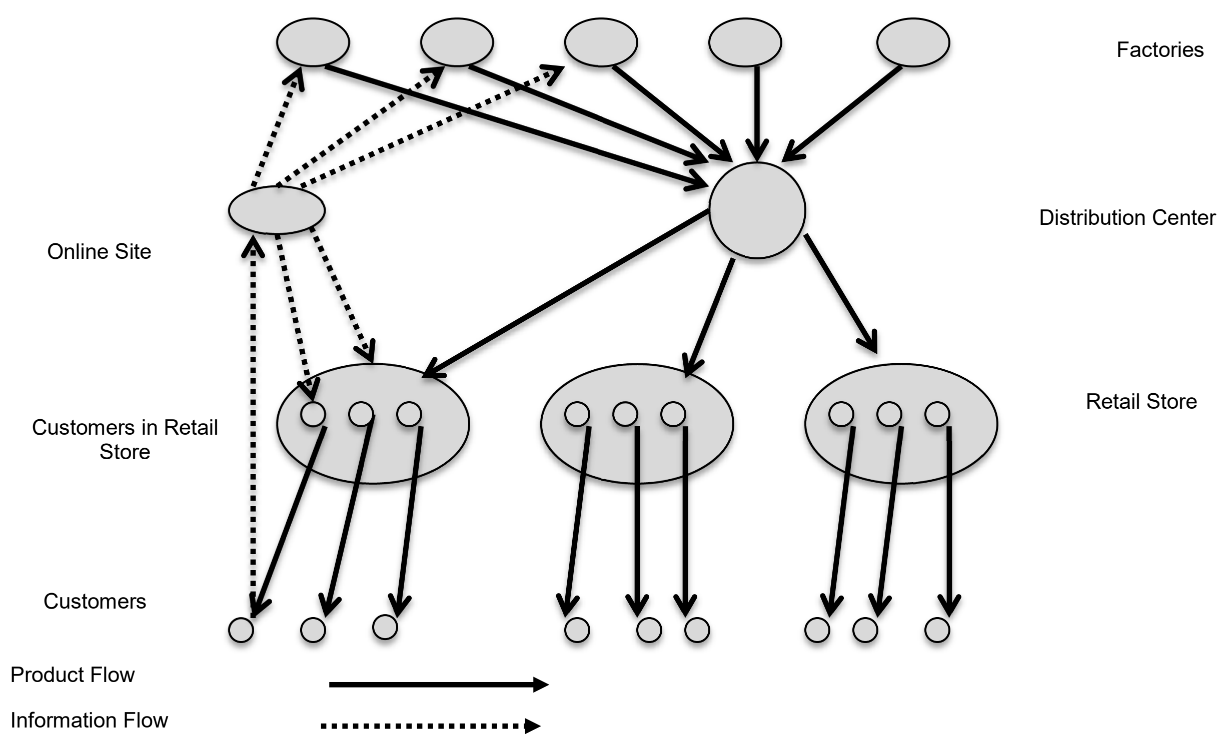
RESULTS AND DISCUSSIONS

Next, we address how this new last mile delivery system utilizes crowdserving. We examine how crowdserving would enable a retail store to operate efficiently and how using in-store customers to make deliveries would help the store overcome the previously identified problems associated with last mile delivery. An analysis of how the proposed LMD system would address the different challenges associated with traditional LMD follows.

Crowdserving Last Mile Delivery Opportunities

The key to the functionality of the new LMD system will be the technology used. The customer delivering the order must have a cell phone with an app that allows GPS location. Their cell phone would notify them when they are in the store that a delivery is needed on their route back home if the delivery would fit in their vehicle. The customer delivering the product would need to subscribe to the free app and enter their home address and vehicle information. If the in-store customer is headed somewhere other than their home, they would need to enter that address in the app when walking into the store. The app should allow for an easy change of destination for this reason. The app would have to default to the delivering customer's home address the next time that person walks into the store. The customer placing an order online should be able to do so using an online portal or app to select and purchase products. This portal or app should allow for some customization, e.g., in terms of produce. For example, a customer placing an order should be able to specify the desired ripeness of bananas. Allowing customization creates a frictionless transaction, which can be an issue with traditional last mile delivery. The app should send notification of a pending order when the customer (potential deliverer) enters the store, allow that customer to accept or reject the delivery, and provide that customer with information on order status and the delivery location. If an order is in process at the store, the app should provide an estimated pickup time. Once the customer agrees to make the delivery, that customer should pick up the items at the designated time in the designated pickup area in the store. Then, the app should notify the customer who placed the order of the estimated delivery window. Specifying a delivery window should eliminate the problem of second and third deliveries associated with traditional last mile delivery. At pickup, store personnel should help the customer making the delivery load their vehicle. After the packages are in the vehicle, the customer who placed the order should be notified that the package is being shipped and provided an exact time of delivery. GPS on the delivering customer's phone will direct that customer to the ordering customer's home. Similar to the transparency of Uber to its customers, the customer waiting for a delivery could view location and delivery status of their order in real-time (timed delivery). Providing this delivery status information will eliminate transparency problems of traditional last mile delivery. At delivery, the customer receiving the delivery will inspect the packages and sign on the delivering customer's cell phone to verify that the items were delivered and intact.

Figure 1: Retail Storage with Customer Last Mile Delivery



This figure shows the basic details of the crowdserving model. It is a shift from the current online ordering model as it adds the availability of the shopping customer as a last mile delivery option.

Security would be a newly introduced issue for which the store would have to account. Store personnel could provide security by installing and using a camera to record the scanning of items and the placement of those items into a box that hides its contents. Note: To reduce the probability of theft, the customer making the delivery should not have any knowledge regarding the items being delivered. Item placement would occur on a weighted scale, much like what occurs at self-checkout lanes in retail stores today. Store personnel would need to secure boxes with tamper proof tape. The customer making the delivery would need to sign for the shipment and verify that all tape was secure. The online customer would need to inspect the tape, the boxes, and the items within boxes upon arrival and sign as well.

We view the proposed LMD method as a way to increase sales; therefore, any amount paid by the customer placing the order should be passed through and given to the customer making the delivery. This would provide a higher cost incentive to make more in-store customers willing to make deliveries. The brick-and-mortar store probably would have to subsidize this payment initially—this is no different than an online retailer paying for free shipping, which is becoming common due to increased competitive pressure. The retailer would need to specify a flat delivery fee plus a variable fee based on size and weight for the items delivered. Vehicles would need to have sufficient capacity to transport any items in an order.

When the new LMD system is rolled out, speed would be slow. Initially, it might take several hours to locate a customer in the store with the app installed who is traveling in the correct direction. This would most likely be a same-day delivery service. Current customers desire same-day delivery that provides timed delivery (as described above), as 28% of online shoppers are willing to pay more for this option (Joerss et al., 2016). Same-day delivery with timed delivery is possible with this system. As more customers enroll in the system to make deliveries and install the app, delivery speed would improve. Once enough customers have enrolled in the delivery system, total delivery time could be reduced to the amount of time it takes to box the items, load the items into the delivery customer's vehicle, and drive to the receiving customer's home. The delivery could be tracked in real-time using the same online service through which the ordering customer placed the order (online portal or cell phone app). This would work by linking the delivery customers directional GPS on his app to the online ordering server to allow this tracking. This real-time tracking data of the delivery matches the definition of timed delivery by providing customers an exact delivery time. We assume that once same-day delivery becomes normal operation, customers would push for instant delivery (within 30 minutes), a requirement that this model should be capable of handling in the near future.

Environmental issues associated with traditional LMD were discussed earlier as stemming from less-than-truckload shipments, the type of delivery vehicle, and inefficient travel routes (Gevaers et al., 2011). The new LMD system automatically optimizes routes by selecting customers who are traveling in the direction of the delivery. If the customer making a delivery needs to drive that route anyway, then the additional environmental effects should be negligible. Also, the receiving customer will be aware of the pending delivery time, thereby eliminating re-deliveries due to the customer not being home.

Because brick-and-mortar stores are located centrally and customers already transport frozen and refrigerated foods to their own homes, the issues associated above with perishable foods in last mile delivery should no longer occur. Any perishable items would need to be stored in a refrigerated/frozen section until packed in the vehicle. These perishable items could be pre-packed in a separate sealed, insulated box to speed up the loading process. Fruits and vegetables should be picked out by experienced store staff to ensure quality and accuracy of the customer's order.

As mentioned above, the retail store would need to subsidize shipping cost initially. The retail store must have a security camera dedicated to the shipping area, which most stores already have. The retail store also would need to add some personnel to select and stage customer orders for pickup. These personnel could be cashiers who are no longer needed due to decreased volume from in-store shoppers. Employees will need to help customers carry large packages to their vehicle—this already occurs at brick-and-mortar retail stores. The retail store would need to purchase additional packaging containers and materials also. The increased sales and slight reduction of cashiers should cover all of these costs.

When we compare our system to traditional last mile delivery, we find that many of the obstacles are removed as shown in Table 2 below. Customers will be able to purchase large quantities of products and have them delivered at a reasonable price. As more customers sign up to make deliveries for a store, the faster the delivery speed will become in the system. Real-time visibility in the form of transparency becomes greater and delivery becomes faster, as is the case with the Uber system. GPS technology of the app will provide real-time data and thus lead to efficiencies in delivery, thereby reducing extra gas or mileage. One potential problem could occur if/when the delivery service becomes too popular such that a store has insufficient delivery capacity. One option could be for the retail store to charge customers more for home delivery. A second option could be for the retail store to invest in autonomous delivery vehicles and drone technology. Now, the second option is not feasible due to the technology of the vehicle and drone. The market also is not ready for this option, as not enough customers would order product, creating the same problems as traditional last mile delivery, i.e., less-than-truckload shipments and routes that are less efficient. However, if the model that we suggest became too popular and continuous orders were placed, then the stores could be used as the preparer of the order, the routes could be planned to maximize delivery efficiency, full trucks could be utilized, and real-time delivery status would be provided to all parties.

CONCLUSIONS

The model displayed in Figure 1 as well as the methods that we have explained would alleviate the problems associated in the literature with last mile delivery for brick-and-mortar stores. The model does not need to be just for large companies, but also could be used by any business including restaurants that deliver to customers. Anywhere that there are customers and goods, this system could be used to create a last mile delivery system at a fraction of the cost.

Table 2: Current Challenges Associated with Last Mile Delivery and Opportunities with a New Crowdserving Model

Last mile delivery current Challenge	Explanation of the challenge	Reference	Crowdserving model opportunities
Transparency	1. On-time delivery 2. Lack of ability to input specifics on the item	Esper et al., 2003; 4 Challenges of Last Mile Delivery for eCommerce	Allows for real-time visibility of deliveries with down to the minute accuracy
Delivery Charges	Last mile delivery costs more than $87.3 billion due to cost of the vehicle, maintenance to the vehicle, delivery driver pay, and fuel	Joerss et al., 2016; 4 Challenges of Last Mile Delivery for eCommerce	Drastically reduced cost given that cost would be based primarily on the size and weight of the delivery.
Environmental	Less than truckload shipments, type of vehicle, repeat deliveries when a customer is not home, and inefficient travel routes can lead to higher emissions	Gevaers et al., 2011	1. Minimal environmental impact as a customer will be driving a route anyway 2. Minimal repeat deliveries
Speed of delivery	Significant demand for same-day delivery with timed delivery	Joerss et al., 2016	Allows same-day or faster delivery
Perishable items	Preservation temperature regulations	Brooksher, 1999; Witt, 1999	No need for a separate refrigeration vehicle due to short distances

This table shows the current problems associated with last mile delivery, the references associated with those problems, and how the proposed crowdserving model could alleviate those problems.

This new model would include several limitations-- the first being the possibility of a slow start up process. Finding customers could be a challenge at first for some companies because not everybody would know about the new delivery option. To counter the initial shortage of customers willing to make deliveries during the startup, the brick-an-mortar could utilize a third party carrier in conjunction with the crowdserving model. This would guarantee delivery in the window provided to the purchasing customer by having a staff on-hand ready to deliver. Once enough customers enrolled in the system, this third party would no longer be necessary. Other limitations include distance between houses in extremely rural communities. Whereas there still might be some benefits to this model, the cost savings and logistics of the length of travel would have to be examined further to see if the customers would be willing to make the delivery. Also in rural areas privacy is an issue so some customers may not want their items delivered to their homes.

Future research is needed in the area to discover exactly what customers are willing to spend for home delivery in different markets and how much delivery customers would want to deliver those items. We proposed that the delivery charge cover a fixed fee and include a variable charge based on size and weight carried. However, we would need to conduct additional cost analysis to determine a feasible fixed charge along with a variable delivery charge per size and weight. Other areas of further research would include the cost to transition from a crowdserving model to a drone carrying autonomous vehicles to see if their would be cost savings once autonomous technology would be 100% effective in the near future.

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BIOGRAPHY

Dr. Skiver is an Assistant Professor of Supply Chain Management at the University of Wisconsin Oshkosh. He holds a Ph.D. in Manufacturing and Technology Management. His research interests include creating innovation in organizations through operation strategy in complex environments. Before joining UW Oshkosh, he worked in industry for several years as an executive team lead of operations management for a Fortune 500 company. He has published articles in national and international refereed journals. Email: skiverr@uwosh.edu

Dr. Godfrey earned his B.S. in Operations Management and M.S. in Management Information Systems from Northern Illinois University, and his Ph.D. in Production & Operations Management from the University of Nebraska - Lincoln. Prior to that, he worked in industry as a supervisor and an operations manager in the transportation industry. He is A Full Professor of Supply Chain Management in the College of Business at the University of Wisconsin. He is a CFPIM through APICS. Email: godfrey@uwosh.edu