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AN ANALYSIS OF ONLNE GROCERY LAST-MILE DELIVERY MODELS

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ABSTRACT

The online grocery industry has evolved many times because of the evolution in technology: first changed about sixteen years ago by broadband internet and recently by the wide accessibility of smartphones. However, one thing remains the same: the challenge all online grocers face during last-mile delivery. Without addressing this challenge properly, it is hard to run a sustainable operation and remain competitive. Webvan could not overcome the last mile challenge and failed after two years; Peapod operates on a hybrid model to reduce delivery cost and stay in the business after twenty-seven years. The Last-mile model is crucial for all online grocery retailers. The purpose of this thesis is to analyze different viable last-mile models and understand the criteria that suit each model, specifically Pure Play, Hybrid, Intermediary and Fast Gratification. The Pure play model is best to operate in high customer density areas at a regional scale. The Hybrid model works well for brick and mortar grocery stores as a competitive differentiator; but once the volume reaches a higher level, it should invest in a distribution center to avoid disruption from picking congestion. The Intermediary model requires relatively low initial investment, and therefore has a low barrier to entry. Lastly, the Fast Gratification model can provide high service level delivery in a short delivery window, but the high fixed and variable costs require this model to be used in combination with other models.

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Chapter 1

Introduction

In recent years, the online grocery industry has been booming, with both pure online grocers and brick-and-mortar stores entering the market. In 2015, the industry reported $13.1 billion revenue with 3,121 businesses selling groceries online in some form. During the past five years (2010 to 2015), industry revenue grew 16.6 percent on average. Compared to low margins in the traditional grocery industry, which was approximately 1.5 percent in 2015, online grocers saw a margin of eight percent on average (Mckitterick, 2015; Hurley, 2016). The continuous development of the internet and growth of website capability have contributed significantly to the success of the online grocery market (Boyer and Hult, 2005).

However, online grocery sellers face the additional challenges compared to their traditional brick-and-mortar counterparts as well as other e-commerce business. Firstly, online grocers need to extend their supply chain to each customer's doorstep. This challenge significantly increases distribution cost. According to a 2003 study, Delaney-Klinger, Boyer, and Frohlich estimate the cost for a single delivery of groceries runs between $10 and $20 per order with complications. The cost is affected by many factors, such as delivery window length. The longer the delivery window, the more orders a driver can deliver per route; the total delivery time increases, but the time per stop decreases, therefore naturally the cost per delivery decreases as well (Boyer, Prud'homme, and Chung, 2009). Secondly, because of the nature of grocery shopping, the process customers go through must be designed with convenience in mind since customers will need to go through the process many times (Vanelslander, Deketele, & Van

Hove, 2013). Major players within the industry develop different supply chain strategies to overcome these two challenges.

Walmart utilizes existing supply chain channels and fill online orders from their national distribution centers. It also offers free grocery pick-up after ordering online(Layne and Ramakrishnan, 2015). This service largely appeals to customers who are more cost conscience or who cannot be home for the length of delivery windows.

Several innovative tech start-ups, such as Instacart, do not hold any inventory; instead, they hire “personal shoppers” to procure each order from partnered local grocery stores and national chains. For instance, Instacart customers within the 10128 zip code on Manhattan’s Upper East Side can shop from five different stores including Whole Foods and Fairway. Customers living in Center City, Philadelphia’s 19102 zip code can choose from eight stores.

Companies with a strong online presence, such as Amazon, hold their own inventory in existing fulfillment centers and hire a fleet to deliver the groceries to customers’ doorsteps. Amazon alone offers three types of grocery delivery service: Amazon Fresh offers one-day fresh produce delivery; Amazon Pantry ships packaged goods to its customers; Amazon Prime Now offers to drop orders at the customers’ doorsteps within one hour.

Peapod, the oldest internet grocer, founded in 1989, uses a combination of fulfilment methods across its operation regions. The subsidiary of Dutch food retailing group Royal Ahold collaborates with Ahold USA supermarket brands, such as Stop & Shop and Giant, in regional markets like New Jersey, Massachusetts, and Connecticut, where stores are widespread. In Maryland and northern Virginia, the company operates out of a warehouse instead (Spring, 2014).

Overall, online grocers can source from distribution centers (DC), existing stores, or partner with traditional grocers. They can deliver through dedicated fleets or individual couriers. With the exception of grocers sourcing from the DC, online grocers have the option to make pick-up service available.

This thesis will examine various combinations of sourcing and delivery methods, analyze the benefits as well as limitations and discuss how these combinations appeal to their key demographics. The focus will be only on online grocery retailers that offer perishable products, since the storage and transportation requirements set unique limitations on the potential last-mile delivery models. Data and information are obtained through an extensive review of public documents, including research articles, media, and company websites.

The next section of this thesis will further discuss the profiles and operation models of the major players in the online grocery industry. The paper will introduce the main demographics of online grocery customers to build the foundation for the later analysis on each combination.

Chapter 2

Industry Background

The online grocery market has changed dramatically since Peapod was founded in 1989. Internet accessibility has increased and methods to access the internet have increased as well. According to Pew Research Center (Perrin and Duggan, 2015), over 207 million people in the U.S., or eighty-four percent of the adult population, use the internet, growing from fifty-two percent in 2000. Additionally, the smartphone has become a major technology used to access the internet. About seventy-two percent of American adults own a smartphone (Poushter, 2016). More and more online grocers offer mobile applications, through which customers can order from their smartphones. Peapod's customers in 1999 put in their orders very differently; they first had to receive a disk loaded with Peapod's software in the mail, then install Peapod's ordering portal on their computers; at the end, they would put in the order on the portal via Modem (Lunce, Lunce, Kawai, & Maniam, 2006). It is much easier to order online in 2016. Customers can simply go to online retailers' websites or put in their orders in the apps on their smart phone. Amazon Prime Now users can even check their orders' real-time location on a map within the app. Because of the rapid advancement of technology and much wider accessibility of the internet, the online grocery industry is in the growth stage of its lifecycle, with its revenue growing faster than U.S. GDP for the next ten years. The industry revenue has been growing continuously since 2005, with the only exception in 2009, due to a sharp decline in per capita disposable income that year (McKitterick, 2015).

There has been mixed reviews from investors and academia regarding the development and the future of online grocery shopping ever since the collapse of Webvan and other popular

online grocers around 2002 (Yrjölä, 2003). On one hand, customers are attracted by the convenience and better selection provided by the service; on the other hand, they are also put off by the additional delivery charges, price markups, and the inability to select produce themselves. Additionally, online grocers still face the last mile challenge and the high costs associated as they did before. Even if price markups are discounted, the cost of buying groceries online is inherently higher, due to the additional steps necessary by grocers. The retailer picks each item and delivers the grocery items to the customers' doorstep; these are traditionally done by customers instead. The costs of completing these additional steps are high due to their labor intensive nature. It is nearly impossible to compensate for these costs and offer customers competitive pricing at the same time. Many have tried and remained unsuccessful, such as Webvan, Kozmo, and Albertson. It is estimated that under Webvan's model, delivery cost was at least $15 per order, when all the facilities were operated at full capacity (Delaney-Klinger et al, 2003). Even at its highest point, the delivery fee was less than $10. Webvan's facilities were rarely under full capacity due to the company's overestimation of demand. Furthermore, it could not compensate for the delivery cost from price markups since it marketed itself as a low-cost grocery comparable to bricks-and-mortar stores. It is inevitable that customers will spend more online than at traditional stores for similar groceries; therefore, Webvan's approach was a misalignment between customer demand and market strategy.

Online grocers have found that their success is dependent on providing customers with convenience instead of low pricing. Essentially, online grocers have very different customers from supermarkets and grocery stores. Grocery shoppers generally fall into two categories: "bargain hunters" and "time savers" (Ogawara, Chen, & Zhang, 2003). The second group is more likely to pay additional delivery fees for grocery delivery to save the time that would have

been spent on shopping in stores. Successful online grocery retailers are aware that they are not able to tap into the entire grocery market; they should focus only on the convenience seeking, less price sensitive customers instead.

Within the online market, “time savers” are not the majority, but the group is growing. Thirteen percent are using online delivery service regularly and sixty-five percent are willing to try it in the future (The Nielsen Company, 2015). About fifteen percent of shoppers are willing to pay for overnight delivery, with the average amount they are willing to pay being $11. About forty-five percent of these shoppers are willing to pay over $10 for overnight delivery. Same day delivery is valuable enough for fourteen percent of online shoppers that they are willing to pay on average $13.9 for the service. Over sixty percent of these shoppers are willing to pay over $10 (Shannon-Missal, 2014).

More specifically, these shoppers are most likely to fall within the three demographic groups: 1) Single or dual income households with no children and who are technically savvy, affluent and time-poor; 2) above average-earning families with young children; and 3) elderly, disabled and those individuals who find it difficult to get to traditional grocery stores. The convenience brought by online grocery services is more important to these groups than to others. The first two groups are stressed with time, less sensitive with grocery costs, and comfortable with technology. The third group enjoys the independence grocery delivery services can offer. Interestingly, the gender demographic has shifted since the last internet boom. In 2002, over eighty percent of online grocery shoppers were college educated females (Morganosky and Cude, 2002). In 2015, the gender gap has narrowed significantly to around nine percent (McKitterick, 2015).

Chapter 3

Sample Online Retailers

The U.S. online grocery industry is a very competitive market with very low concentration. There are 3,121 businesses in the industry. The largest player only takes 5.4 percent of total market share. This chapter aims to provide some background on some noteworthy players in this industry.

Peapod is the oldest and largest player in the online grocery industry in the United States. The company was founded in 1989 by the Parkinson brothers in Illinois. It was later purchased by Dutch grocer Royal Ahold in 2001 during a financial struggle from Peapod's overexpansion in competition against Webvan. The company has been hugely successful since. Two years after it was acquired, Peapod reached its fifth millionth order. In 2015, the company claimed 5.4 percent of market share with $712 million in revenue (Mckitterick, 2015). This online grocer offers a wide range of products including both perishable and non-perishable items to customers in five separate markets, mostly in the Northeast and Midwest regions. It fulfills customer orders through a hybrid store-warehouse model. It owns warehouses in all of its five markets, but it also stays close to the two grocery chains, Giant and Stop & Shop, owned by Peapod's parent company Royal Ahold. In some areas, Peapod stills sources from these stores locally. It operates its own fleet of delivery trucks in all existing markets. After selecting items online, customers can choose a two-hour window for attended delivery, or a longer six-and-half-hour window with discounted delivery fees. Pick-up service is available through stores or dedicated pick-up locations in suburban areas. Peapod also started to offer pick up service in three subway stations in the D.C. area with a $2.95 fee. (Springer, 2004; Guy, 2016).

Webvan came into prominence during the same period as Peapod, but its fate was quite different. Webvan was founded in 1999 by the Borders brothers in San Francisco with the hope of tapping into the multi-billion dollar grocery market. Although the company was hugely successful in raising capital, it is seen as one of the biggest failures in the dot-com era (German, 2012). The company initially planned to operate in twenty-six metropolitan areas through a hub-and-spoke structure, seen in Figure 1 below, where Webvan centralized order fulfillment and decentralized delivery (Lunce *et al*, 2006). Orders were picked in a large automated distribution center and then sent to local delivery stations via large delivery trucks within a thirty-minute delivery window chosen by customers (Delany-Klinger et al, 2003). Webvan was very popular among investors and it raised $375 million dollars in its IPO, which was used to fund an automated warehouse and advanced information technology (Aspray, Royer, & Ocepek, 2013). Despite these advantages over Peapod, Its demise in 2002 was largely due to inaccurate segmentation, a complex infrastructure model and reckless expansion (Relan, 2013).

On the other hand, Ocado, a U.K.-based company, is very successfully operating under the similar hub-and-spoke model since it was founded in 2000 by three ex-Goldman Sachs directors. It has become the largest online grocery retailer in the world with £1,108 million ($1,575.6 million) revenue in 2015 (Ocado Group plc, 2016). Ocado started with one Central Fulfillment Centre (CFC) and solely focused on customers in the London metropolitan area. Similar to Webvan, Ocado invested heavily in automation and information technology. Its highly automated CFCs can pick orders at the speed of 300 items per hour, three times faster than regular shoppers in a traditional grocery store (Delany-Klinger et al, 2003). In addition to its profitable online grocery business, Ocado has developed a sophisticated operation platform call Ocado Smart Platform, which enables users to integrate end-to-end processes and achieve high

capital and operational efficiency. Morrison, one of the largest U.K. grocery chains, has purchased this platform to support its online operation.

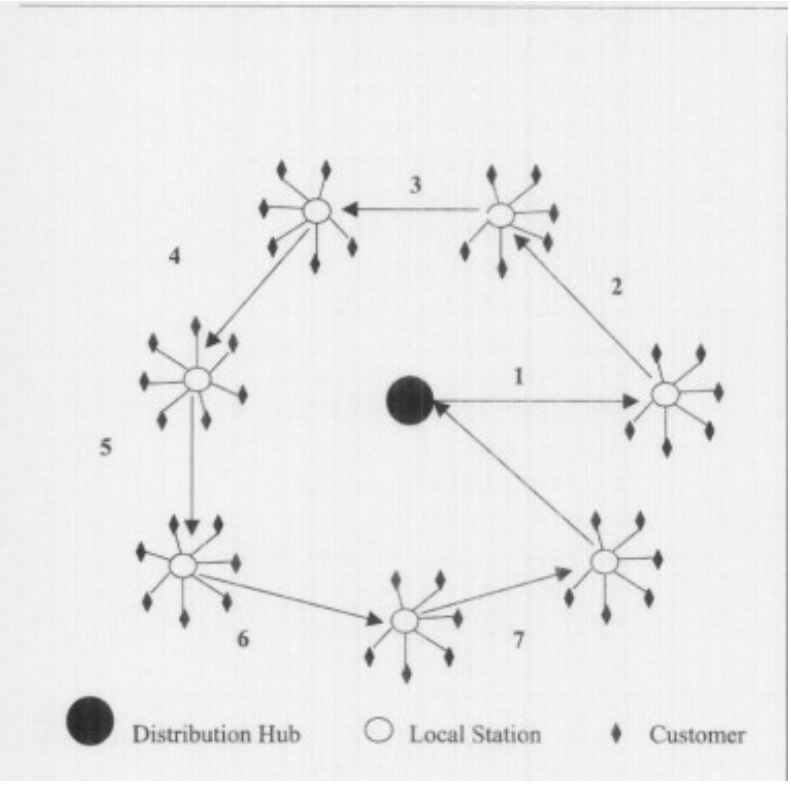

Figure 1: Hub-and-Spoke Delivery System

Currently, Ocado operates three CFCs and covers over seventy percent of the U.K. population. One third of orders are shipped directly to customers from one of the CFCs, and two thirds are shipped to one of the sixteen spoke sites first before being delivered to customers. Delivery fees vary from £2.99 to £6.99 depending on time slots chosen for orders under £75. For orders above that amount, customers might receive free delivery depending on several factors, such as destination and delivery window selected (Ocado Group plc, 2016).

FreshDirect, founded in 2002 is the second largest online grocery retailer in the United States after Peapod. It is a regional grocer with the majority of its customers located in Manhattan, Brooklyn and Queens. It has expanded to serve some areas in Connecticut, Long

Island, New Jersey and Westchester County. Even though FreshDirect only operates in smaller geographic regions compared to other online grocers this chapter mentions, it had $584.3 million in revenue and 4.5 percent of the market share in 2015, because of high penetration of its existing markets (Mckitterick, 2015). FreshDirect currently operates out of its Long Island City warehouse and delivers with trucks. Customers can choose a two-hour delivery window for the next day. FreshDirect focuses on high quality and locally sourced produce to compete against other online grocers. It sources directly from food producers and farmers to eliminate unnecessary intermediaries, which makes its produce four to seven days fresher than that of its competitors. In addition to the delivery window on its main website, FreshDirect launched a new service delivering fresh ingredients, pre-made meals and alcohol in one- or two-hour time frames. This is an initiative to compete with more instant delivery service such as Instacart and Amazon Prime Now (Colbert, 2016; Hollander, 2016).

Amazon currently offers two types of online grocery services. One of them is AmazonFresh. It is a grocery delivery service first offered to customers living in Seattle in 2007, where Amazon tested and adjusted the service (Chmielewski, 2015). After the initial trial, the service was made available to customers in wider geographic regions with a $299 per year AmazonFresh subscription. This yearly subscription includes all benefits available to Prime subscribers as well as free unlimited delivery for grocery orders above $50. Customers can select a one hour attended delivery window or a three-hour unattended window. Orders are delivered through trucks by Amazon itself, instead of through carriers such as UPS or U.S.P.S., who deliver packages for the e-retailer (Hutchins, 2016). Another grocery service from Amazon is called Amazon Prime Now. It is a rapid-delivery service offered by Amazon which started in December 2014 and is available only to its $99 per year Prime service subscribers. Prime Now

offers two-hour delivery for free and one-hour delivery for $7.99. It was first available in New York City, fulfilled by a midtown warehouse just blocks away from the Empire State building (Eadicicco, 2015). The service is now available in sixteen U.S. metropolitan areas to Amazon Prime subscribers and each order is delivered by professional couriers. Prime Now uses a hybrid fulfillment method. In addition to ordering from Amazon's urban warehouses, Prime Now customers can also order from local grocery stores. According to a survey conducted by Cowen & Co., thirty-six percent of goods purchased on Prime Now are from these local grocery stores. Couriers will go into the store and pick items based on customers' orders (Wahba, 2016). The operation supporting orders directly from Amazon's warehouse is different. Each Prime Now urban warehouse is set up very much like an Amazon fulfillment center using random assortment to achieve higher efficiency and avoid possible picking congestion. Each order is prepared by pickers in the warehouse. Couriers only come to the warehouse to pick up orders when they are ready and then use public transportation, walk, or drive depending on the destination and traffic. Prime Now service has been very popular since its launch. According to the same Cowen & Co. survey, roughly a quarter of Prime subscribers have used the service.

Instacart is a grocery delivery service. It first launched its service in 2012 in San Francisco and has since expanded into nineteen states. According to Forbes, Instacart is the most promising company in 2015 with a two-billion-dollar evaluation and $100 million in revenue in 2015 (Strauss, 2015). Instacart does not hold any inventory itself; instead, it hires freelanced personal shoppers to shop for its customers at the local grocery stores. At the beginning, personal shoppers from Instacart simply went into each store and picked items as customers ordered. The company gained revenue from marking up prices as well as charging delivery fees. After gaining momentum in the grocery industry, Instacart started to partner with grocery stores, as they saw

the benefit of reaching a wider geography without additional cost. In return, Instacart can save infrastructure costs and take advantage of existing supply chain channels. To avoid similar mistakes made by Webvan, Instacart's business model pushes more risks externally. Instacart also takes advantage in crowdsourcing for its couriers. Most personal shoppers at Instacart are independent contractors who use their own cars to make the delivery; only until very recently, Instacart offered to hire them as part time employees with less flexible schedules.

Albertsons was originally founded by Joe Albertson in 1939 in Boise, Idaho. It operates over 2,200 stores across thirty-three states under sixteen different brand names, with the majority of its operation on the west coast. In 2015, it merged with the abovementioned Safeway and now owns both the Safeway and Vons brands. As a result of the merger, Albertsons will manage the online grocery delivery channels of Safeway. This is not the first time Albertsons joined the online grocery industry. Albertsons briefly offered grocery delivery service between 2002 and 2006. It was an initiative to retain market share from pure-play online grocers, namely Peapod and Webvan at the time. Concerned about the convenience these online grocers provided might decrease traditional retailers' market share, Albertsons, among many other traditional grocery retailers, decided to take advantage of its existing infrastructure and fulfill online customers' orders in-store. The service was first offered to customers in the San Francisco Bay Area, and later extended to areas such as Sacramento and Phoenix. E-shoppers of Albertsons would pick up ordered items directly from store shelves one by one. Orders were delivered via vans to customers' doorsteps. Albertsons charged $9.95 for the delivery service. Customers can also pick up their orders in store for a lesser fee of $4.95 (Chandler, 2006). This operation was later terminated due to unprofitability (Lucky, 2008).

Figure 2 shows order information for five online grocery retailers that deliver to the Upper East Side in New York City. This area is optimal for online delivery because of the high population density (about 71,000 people per square mile), above average household income ($114,160 median annual income), and high percentage of families with children (47.7 percent). Delivery costs are gathered using the sample zip code 10128. Among the five retailers, Peapod and Instacart both utilize pricing as an incentive for customers to pick time slots that make delivery more efficient. Instacart delivery fees vary most significantly, ranging from $5.99 to $13.99 depending on partnered stores, order size, and time slot chosen. AmazonFresh and Amazon Prime Now both require annual subscription while Instacart offers it as an option. FreshDirect charges $5.99 for home delivery regardless of time slot selected or order size, as long as it is above the order minimum of $30. FreshDirect has the largest market share in the crowded New York City online market. It invests heavily in advertisements that emphasize the freshness of its products and its direct sourcing method to alleviate customer concerns originated from not being able to pick out produce and meat products themselves.

Online Retailer	Peapod	FreshDirect	AmazonFresh	Amazon Prime Now	Instacart
Sourcing	DC or Store	DC	DC	DC or partnered Stores	Partnered Stores
Delivery	Fleets	Fleets	Fleets	Couriers	Couriers
Order Minimum	$60	$30	$50	$15	$10
Fees per Order	Orders over $60: $9.95 Orders over $100: $6.95 (Discount available for some time slot)	$5.99	Free with subscription $299/yr	2 hours – Free 1 hour - $7.99 (+ Prime Subscription $99/yr)	$5.99 and above, depending on order size and time slots; Or $149/yr for all orders above $35
Delivery Window	2 hours	2 hours	1 hours	1 or 2 hours	1 or 2 horus
Lead time	Next day depending on availability	12 hours	8 hours	1 or 2 hours	Based on availability

Figure 2: Order Information at Zip Code 10128

Chapter 4

Introduction to Fulfillment and Delivery Methods

The three main methods online grocers use for order fulfillment are: 1) picking at dedicated regional DCs owned by the company; 2) picking at existing stores owned by the company; and 3) picking at partnered traditional grocery stores. The two different order delivery methods are: 1) delivering via a fleet of vehicles owned by the company; and 2) delivering by individual couriers.

Order Fulfillment Methods

One order fulfillment method available to online grocers is to pick orders from stand-alone regional DCs owned by the company and ship to individual customers. The regional DCs are not attached to stores open to customers. It is a widely used and established method in the industry. The key to this method is customer density (Hays, Keskinocak and Lopéz, 2005). This sourcing method gives the most control to online grocers. They have the ability to control the product mix, negotiate prices with upstream suppliers, and control volumes. With a certain level of demand, regional DCs also provide the highest labor efficiency. This is also the most direct method since it eliminates the additional steps between DCs and stores, which lessens the chances for product damage. The disadvantage of this method is the high set up cost. The initial cost is estimated by Kämäräinen, Smaros, Holmstrom, & Jaakola (2001) to be between $20 and $35 million for an automated and labor efficient facility and between $4 and $6 million for a less automated facility. Due to the initial capital cost, future expansions can put great financial

burdens on online retailers, especially during the beginning of expansion when the customer density is not enough to achieve efficiency.

Another order fulfillment method is unique to traditional stores with an online presence. The online grocer uses inventory from its existing stores to fulfill individual orders. Once an order is received, it is sent to the closest store. This method is simple and inexpensive to set up, since it largely utilizes existing supply chain infrastructure until delivery. As these stores tend to be closer to customers than DCs, this method allows greater transportation flexibility and reduces transportation costs. On the down side, this method is labor intensive compared to sourcing from regional DCs, and less scalable as well (Lucky, 2008). Additionally, when operating near capacity, the online operation can create additional disruptions to already crowded stores. There is a potential risk of diminishing the shopping experience of in-store customers. To avoid disruption, some grocers move fulfillment from on-shelf to warerooms. Fulfilling from warerooms or non-customer areas combines some advantages of DCs with the existing channels used by stores; however, compared to fulfilling from DCs, retailers have less visibility into inventory levels. This exposes them to the risk of delivering incomplete orders, since the relatively short lead time in the online grocery market leaves no opportunity for retailers to replenish.

The third method online grocers can use is to pick each order at traditional grocery stores it partners with. This method gives online grocers the least control but requires the least set up cost. It benefits both the online grocer and the traditional stores it partners with. Online grocery bridges traditional grocery stores with customers from a wider geography. The online grocer sourcing from the partnered stores avoids inventory costs and store management issues. Subsequently, this method can provide a high product variety through sourcing from multiple

stores. However, this also means orders are fulfilled at multiple locations and it is difficult to condense order delivery. This method is the easiest to rescale since there is no significant capital investment needed for entering or exiting a market. Online grocers using this method have to rely on its partners heavily. When sourcing purely through partners, online grocers need to give up control over product quality and availability.

Order Delivery Methods

Online grocers can deliver using vehicles and hire operating employees for the fleet. This method works very well with high demand density. Compared to using couriers to deliver, using vehicles can accommodate a larger number of orders per trip. Usually, grocers use dynamic routing programs to determine optimal routes and achieve efficiency. There has been significant research done on related topics. Online retailers always face the tradeoff between higher delivery cost and longer delivery windows, especially in a less dense area (Boyer et al, 2009). The advantage of using a fleet to deliver is that the online grocer has full control of the delivery route and customer service level. It helps provide customers with a consistent experience for each delivery. Due to the nature of groceries, one downside of delivering via a fleet includes the complications involving shipping temperature-controlled items. Online retailers therefore need to invest in trucks with refrigerated compartments to keep groceries from expiring during transportation. This investment signals a high initial cost. In addition, this method is limited to customer-dense areas.

Alternatively, online grocers can contract couriers to deliver orders to individual customers. Using his method, each order is delivered individually; therefore, online grocers can

offer a shorter lead time, narrower delivery window, and higher personalization. Delivery cost per order can be calculated easily to share the cost with customers. The delivery cost and time needed using this method are largely correlated with distance traveled for individual deliveries. In a dense environment, courier delivery is less efficient than fleet delivery mentioned above, because couriers have to return to pick up locations after every order delivered. Crowdsourcing delivery, a newer form of courier delivery has recently come into popularity. Crowdsourcing delivery can be defined as the process during which a delivery request is proposed to a group of participative individuals via open calls (adapted from Rougès and Montreuil, 2014). Crowdsourcing delivery offers the additional benefit of workforce flexibility, meaning companies do not have to employ extra personnel for peak demand time. At the same time, this flexibility also increases instability and management issues. Since couriers from crowdsourcing are not employees of the companies, trust building and reinforcement are very important to ensure continuous demand growth.

Based on their fulfillment and delivery methods, the sample online grocery retailers can be put into the matrix (Figure 3) below. Peapod and Amazon Prime Now both use hybrid methods to fulfill online orders. Interestingly, Peapod was operating under the Intermediary method when it was founded and gradually moved toward the Hybrid and Pure Play models as it increased the number of customer orders.

The next chapter will explain each model individually, with the exception of Partnered Stores-Fleet model since it does not achieve supply chain efficiency intuitively. If an online retailer partners with multiple traditional grocery retailers, it would avoid using a fleet to deliver because this method means the vehicles also have to travel through multiple grocery stores to pick up orders. It adds significant difficulty into optimizing vehicle routing. Even though

currently there is no online retailers operating under the Stores – Couriers model, this model is worth exploring.

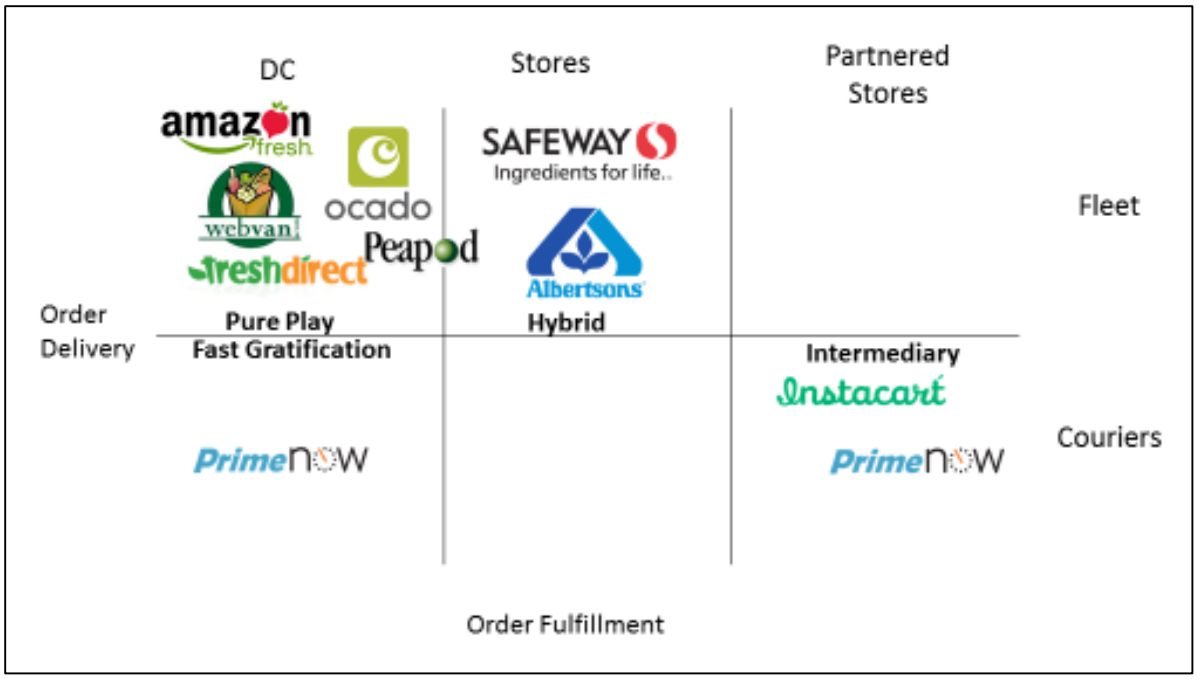

Figure 3: Operation Model Metrix

Chapter 5

Analysis of Operation Models

Pure Play (DC- Fleet)

The Pure Play model is the most efficient grocery delivery model when online grocers have a relatively high order volume. The efficiency comes from a fulfillment center that is tailored specially to grocery picking and the aggregation of order delivery on one delivery trip. Managing and operating both the facility and delivery trucks provide high visibility into inventory level and order volume that could not come from the other methods. This efficiency also comes at a cost: the DC – Fleet model requires the highest initial capital investment among all the operating models mentioned in this thesis. Because some grocery products are perishable, both the trucks and the DC need at least three different temperatures to preserve the goods properly: ambient, chilled and frozen (Yrjölä, 2003). These requirements further increase the set up cost.

This model has been proven effective by Peapod and FreshDirect, the two online grocers with the highest market share. FreshDirect is a pure play online grocer with no traditional grocery store presence or collaboration with traditional stores. It started as a pure play online grocer and has operated under the same model for the past fourteen years. Peapod, one the other hand, transitioned from a purely Partnered Stores – Courier model, to adding the DC – Fleet model in some areas and eventually grew out of its original model and settled with a hybrid Stores / DC – Fleet model. Ocado, the biggest online grocer in the world, also operates under this model and serves over seventy percent of U.K.

Because of the high capital investment, sustainable expansion is a difficult but important strategic problem that needs to be solved. When entering a new market, online grocers might not have enough customer density even though the area has great potential. It generally takes a new facility two to five years to secure enough orders to reach capacity and stay profitable. During the two to five years, online grocers face a substantial financial burden in the established market(s) in order to subsidize the new market. Additionally, online retailers need to invest heavily in customer acquisition to shorten the period before its facility attains profitability. Ocado has been very successful in its expansion process. In comparison, American grocers' efforts are less fruitful. Both Peapod and Webvan sunk into serious financial problems because of expansion. Ocado utilizes a hub-and-spoke model almost identical to Webvan's; but instead of rolling out four warehouses at once, Ocado focused on adjusting the picking and delivery processes from one facility and one area (Delaney-Klinger *et al*, 2003). Only after many trials and errors did Ocado offer its services to wider customer groups. Additonally, the U.K. grocer did not operate under full capacity right from the beginning; it took some time to optimize its infrastructure before outfitting the whole facility. It is inevitable that companies will eventually grow out of the existing capacity. Ocado and Peapod decided to acquire additional facilities; for FreshDirect, the decision was not as easy. Because this online grocer focuses mainly on customers located in three New York City boroughs, FreshDirect does not have the potential volume to justify running two facilities concurrently; therefore, it had to move its entire facility from Long Island to the Bronx in New York. In conclusion, capital investment costs create a unique set of risks for this operating model.

The key to profitability in this model is to create order density. In a low margin, high fixed cost environment, volume is one of the most, if not the most, important elements. Despite

being the financially strongest Pure Play online grocer during the dot.com era, Webvan failed at reaching the business level and customer density in every single market (Tanskanen, Yrjölä, & Holmström, 2002). If order density is below the point where delivery fees cannot offset the total delivery cost, cost savings from DCs will need to subsidize the transportation cost. Peapod sees the importance of demand density levels to its operating efficiency and takes these into account during its sales and promotion activities. For example, every day, Peapod offers discounts for some delivery windows as an incentive to increase the efficiency of delivery and dispatch. Also, through direct mailing and advertising in local stores, Peapod concentrates its marketing effort within neighborhoods that need more density through direct mail to increase routing efficiency.

Hybrid (Stores – Fleet)

The Stores – Fleet model is the easiest to set up for grocery retailers with traditional grocery store presence. It utilizes existing supply chain infrastructure and store employees. Grocery retailers using this model only need to invest in delivery vehicles. Since grocery stores are usually much closer to customers than DCs, online retailers may not need to invest in expensive refrigerated units like its Pure Play counterparts and use temperature sustained totes or boxes instead, depending on the density of stores and the size of service areas. Additionally, traditional grocery stores can use their buying power to negotiate for a lower price from its suppliers. This is a significant advantage over the regional Pure Play grocers, who do not have the same level of sales volume to negotiate with. At the same time, a grocery store is not set up to pick for online orders in an efficient way but to display products for customers' convenience. In a DC, products are usually set up based on sales volumes or space optimization instead

(Kamarainen *et al.*, 2001). Nonetheless, picking in the Hybrid model is still more efficient than picking by individual grocery shoppers, because store employees are generally more familiar with the store layout and can quickly locate each item. The picking and packaging steps can be done before or after normal business hours to avoid disruption from adding traffic to the stores. Depending on order cut off time and delivery window, picking during business hours might be unavoidable. Therefore, the Hybrid model is best used as a value adding service by traditional grocery retailers to compete with their local competitors. Since customers are familiar with the grocery retailer already, they are more likely to shop with this retailer online. In addition, from a marketing aspect, transferring existing brands digitally is much cheaper than creating new brands online, which pure play grocery retailers have to achieve. Online retailers operating under this model can benefit from the economies of scale as well, by dividing the store into picking zones and aggregating order delivery. To achieve a high enough level, traditional grocery stores need to consider three criteria before they make online delivery service available to a new market: 1) the area must have a dense population; 2) the area must be metropolitan; and 3) traditional stores' brand power must be strong in the area (Ogawara *et al*, 2003). Nonetheless, the picking process is less efficient than the previously mentioned DC – Fleet model when being used on a large scale. An average sixty-item order costs roughly $8 to pick in store. It can be hard to pass picking cost and delivery cost completely to customers; furthermore, markups will be confusing if the customers are aware of the pricing levels from shopping in-store from time to time. Another disadvantage of this method is the lower visibility into inventory. Most grocery stores experience a stock out level of five to eight percent. It is difficult to find a perfect substitute to a perishable grocery item; these discouraging situations will lead to customer dissatisfaction.

The Store – Fleet model can also be implemented as a market test before a traditional grocer wants to expand its business online on a larger scale. Once a market shows potential for high online volume, Stores – Fleet online grocers should consider transitioning toward the DC – Fleet model. For a 1,200 square meters DC, roughly 13,000 square feet, the savings from a sales volume of €2 million ($2.2 million) can justify the investment needed for a less automated DC (Yrjölä, 2003).

Intermediary (Partnered stores – Couriers)

This model requires the least investment, but also gives the least control and visibility into inventory. The biggest online grocer in U.S., Peapod, started with this operating model in 1989. Because online grocers using this model do not hold inventory but buy directly from traditional stores instead, the competitive differentiator was its online platform that connects customers to traditional grocery stores' products. During Peapod's early era, when broadband internet was inaccessible, it sold its ordering platform on disk to its customers at $20 each. This became one source of revenue for Peapod. At the same time, once customers committed to buying the software, it is more likely that they will use Peapod's service more often. It would be much harder to charge customers a software fee for newer companies such as Instacart now, since its website can be imitated by others. In a sense, software fees are similar to subscription fees Amazon and Instacart charge to acquire customers for the long term. Specifically, Instacart charges its customers $149 a year, an increase from $99 since December, 2015, to deliver any orders above $35 for free. On average, Instacart marks up item prices at least fifteen percent, which means for every $35 order, Instacart takes in $5.25.

This service is best for customers who need occasional deliveries, but when they do, they need quick home delivery. Under this model, online grocers act as an intermediary between customers and traditional grocery stores. It helps push more risks externally and avoids expansion mistakes made by Webvan. As an intermediary, Instacart and Google Express have the flexibility to buy from multiple stores and provide a large variety to its customers, which is one important advantage of using this model; however, this makes it difficult to aggregate deliveries. The relationship with traditional grocery stores are extremely important for this model. Instacart has been very successful in terms of building relationships with well-established grocery stores. One of its biggest partners is national natural and organic foods retailer Whole Foods Market since September 2014 (Viskan, 2016). Once an online intermediary has a national partner, it becomes relatively easy to expand because it can now leverage the infrastructure and brand exposure of this partner. Instacart currently provides delivery service for Whole Foods in sixteen states. In a mere four years, Instacart has expanded and serves customers in nineteen states. This flexible scalability is unique to the intermediary model because of the low fixed cost in this model. Also, it has the lowest threshold for sales volume among the four models. All these characteristics create a low barrier to entry, which will intensify the competition. Peapod eventually transitioned out of this model because of that reason (Liebeck, 1998). In the long term, the intermediary online grocer can convert to a pure play model in high order density regions to gain independence from its traditional partners. The partnership tends to be less critical for traditional stores than to online grocers, because generally the sales from online channels are less significant when compared to its total sales. Some traditional grocery stores also worry about putting their brand image on the service of online grocers. For that reason, Trader Joes, a specialty grocery store chain based in California, banned Instacart from delivering

grocery items from its stores in 2013 (Somerville, 2015). Additionally, online grocers using this model will face more severe stock out problems, since they have even less inventory visibility than their Hybrid competitors.

Fast Gratification (DC – Courier)

The DC – Courier model is very expensive to maintain. Amazon is the major competitor in this model with its new Prime Now service. Online grocery retailer using this model invests in a DC located near or within a metropolitan area. It takes advantage of this close proximity to a large customer group to provide fast delivery. The combination of high inventory control in the DC and individual delivery through couriers help provide a high customer service level and satisfaction. The targeted customers of this model are the online shoppers with strong need-it-now mentality and the will to pay for it. This model benefits from the high efficiency of picking in a DC and the flexibility of delivery through a courier. Prime Now's warehouses employ the same picking process as other Amazon DC. Once the order is ready, a courier will be notifies via a message on their smartphone (Rubin, 2015). The Fast Gratification model bypasses the need for courier navigating through a store or for an order waiting to be shipped out with other orders. The short and predictable delivery lead time appeals to their mindset of instant gratification. To use Amazon Prime Now, customers have to pay $99 a year for a Prime subscription and an additional $7.99 per one-hour delivery. However, even with the steep price tag, this model is hard to turn profitable by itself and is generally used in combination with other business models. Online grocers operating under this model can offer products with larger profit margin along

with grocery. In the case of Prime Now, Amazon offers electronics and toys in addition to common grocery products.

This model can also be combined with DC – Fleet model. These two models can share the acquisition and operating cost of a DC and use one facility to serve two groups of customers. Online grocers can offer fast delivery at a premium to its existing customers. This increases revenue per order and promotes customer loyalty toward this grocer.

Chapter 6

Conclusion

The best model to operate online grocery delivery is determined by many factors, such as customer population and density, targeted customer preference, distance to markets, and capital investment availability. The Pure Play model is widest used in the industry. It has the highest picking and delivery efficiency, but online grocers using this model also face heavy financial burden due to the capital investment requirement initially and during any expansion. The Hybrid model works well for traditional grocery store as a value added service against its competitors. Once the market shows potential and online order volume increases, it is better to transition toward the pure play model and invent separate supply chain channels for online orders, in order to avoid picking congestion in stores and diminish in-store experience. Online grocer using the Intermediary model can quickly establish a business because of the low barriers to entry; however, the success of this model relies substantially on the brick-and-mortar partners. Lastly, the Fast Gratification model enables delivery in a shorter lead time than the previously mentioned models and provides the same visibility into inventory as the Pure Play model. The biggest disadvantage of this model is the high cost associated. It is unlikely to find enough customers in the same market to reach the capacity level necessary to remain profitable. Therefore, the Fast Gratification works best in combination with other models and provides a value-adding service to promote brand loyalty. Figure 4 below shows the necessary trade offs among all the mentioned models.

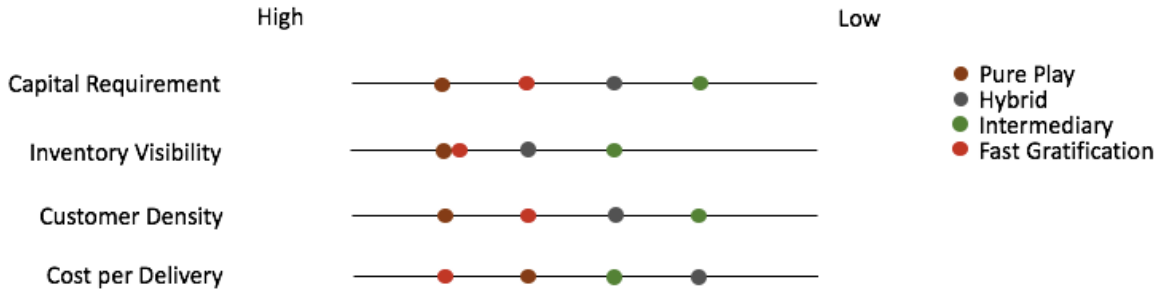

Figure 4: Operation Model Trade Offs

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WORK EXPERIENCE

PricewaterhouseCoopers — **Philadelphia, PA**
Management Consulting Associate — *June-August 2015*
- Consulted clients to help them redesign its aggregate procurement channels to achieve higher efficiency
- Conducted focus groups to interview different functions of the hospital with colleagues to anticipate potential resistance force against implementation
- Helped draw specific implementation steps to address internal resistance
- Participated in the design of single-used medical device recycle process to achieve higher collection rate

The First Affiliated Hospital of Jinan University — **Guangzhou, Guangdong, China**
Procurement Intern — *June-August 2014*
- Conducted electrode price negotiation and reduced price by 10%
- Monitored inventory level of medical consumables and placed order with individual suppliers
- Communicated with hospital departments to adjust demand forecast
- Managed implementation of new logistics platform and presented ideas for possible changes

Penn State Career Services — **University Park, PA**
Peer Adviser — *January 2014-Present*
- Present workshops regarding résumé writing and interview techniques for groups of 20 students
- Assist students with researching career resources and providing job search strategies
- Mentor students by offering feedback on student résumés and conduct mock interview

LEADERSHIP EXPERIENCE/ ACTIVITIES

Schreyer Consulting Group (SCG) — **University Park, PA**
Case Study Chair — *Spring 2015-Present*
- Organized eight case study workshops for the Schreyer Honors College
- Initiated a new mentoring pilot program with six pairs of consulting professionals and students
- Collected feedbacks from participants and made adjustments to program guidelines
- Act as liaison between SCG and corporate sponsors and invite them to college recruiting events

Career Development Chair — *Fall 2014- Spring 2015*
- Coordinated with five other professional clubs to organize *Connect 2015*, the biggest alumni networking event at Schreyer Honor College, with over 100 participants

Korean International Club — **University Park, PA**
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International Relations and Advertising Chair — *Fall 2013-Spring 2014*
- Manage “Language Partner Program” by matching Korean natives with Korean learners
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