Online grocery retailing: Distribution and order fulfillment
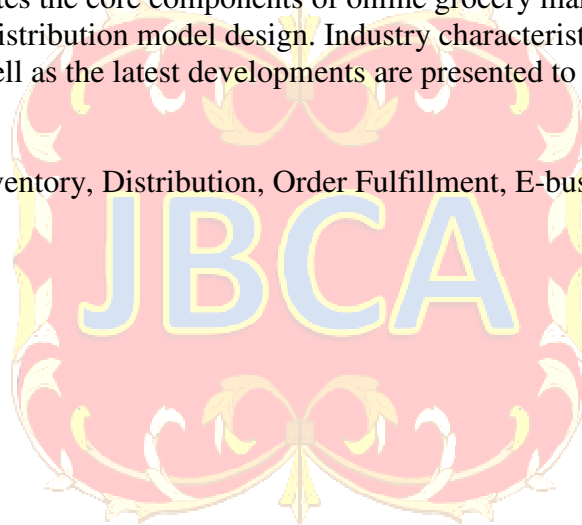
Lifang Wu
Xavier University

Xuemei Su
California State University Long Beach

ABSTRACT

At $600 billion a year in sales, grocery was by far the largest retail category in the U.S. by a wide margin. For several reasons, it was also the category that had been the least disrupted by e-commerce. While consumer shopping habits were changing, niche online grocery services competing on convenience and selection were gaining traction. After purchasing Whole Foods, Amazon particularly presented a threat to all existing grocery retailers including Wal-Mart and Kroger. This case illustrates the core components of online grocery market competition in terms of order fulfillment and distribution model design. Industry characteristics, distribution options and their trade-offs, as well as the latest developments are presented to help students analyze the business challenges.

Keywords: Perishable Inventory, Distribution, Order Fulfillment, E-business, Supply Chain

INTRODUCTION

Grocery stores sell perishable food including fresh produce, meats, seafood, and a wide variety of non-perishable food products to retail consumers. Traditionally brick and mortar grocers keep inventory in stores and products are readily picked up and bought by walk-in customers. Overall grocery has been the largest retail sector in the U.S. and accounted for about a fifth of consumer spending (Bensinger and Stevens, 2016a), with total grocery store sales reaching $630 billion in 2016 (YCharts, 2017). Average U.S. households made about 1.5 grocery store visits every week, spending $107 in goods (roughly $5,500 a year) (Bensinger and Stevens, 2016b). Selling grocery is of course crucial due to its sheer size, fixed high shopping frequency, and other lucrative selling opportunities for non-food items. With digital technologies, new grocery shopping options these days were increasingly becoming available, especially concerning the last mile delivery. Interestingly, grocery as a product category had been the least disrupted by e-commerce and online grocery purchases only made up about 2% of U.S. grocery sales as of 2015 (Smith, 2015). Online groceries shopping still had a long way to go before it attracts the mainstream grocery shoppers, who still mostly buy grocery in person (Newport and Brenan, 2017). In the long term, though, online grocery shopping could grow 500%, with U.S. consumers spending over $100 billion by 2025 (Daniels, 2017).

On the other hand, the grocery retail industry was well known for its razor thin margin (e.g., Kroger net profit margin was 1.71% in 2016) (Google Finance, 2017) and fierce price competition. The industry had been struggling to figure out how to sell fresh food online effectively (Bensinger and Stevens 2016b). Various new initiatives of online grocery retailing, including Amazon Fresh and Kroger's ClickList program, did not have much traction in mainstream market, yet. Amazon's decision to buy Whole Foods Inc. could disrupt the industry, pressing grocers to develop effective ways to sell fresh food online (Jargon et al., 2017). And the market was closely monitoring whether Kroger and other firms could hold on to their customers. On 08/24/2017, the news of Amazon cutting Whole Foods' prices on select perishable products roughly slashed $11 billion off the market value of five grocery store chains including Kroger, Wal-Mart, and Costco (Shen, 2017).

Groceries represent the latest effort by Amazon to conquer a new market to become a central shop for retail customers (Bensinger and Stevens, 2016b). Amazon was being careful to avoid following the fate of Webvan Group Inc., the online grocery company that went out of business in 2001 after burning through more than $800 million in less than three years (Webvan, 2017). Amazon had carefully scaled its Amazon Fresh service after testing it in Seattle for six years, extending it to seven U.S. cities and London since 2013 (Bensinger and Stevens, 2016a). Delivering perishable items, such as fresh meats and fruits in adverse weather conditions, was complicated than usual. The service was consequently costlier, requiring indispensable resources such as refrigerated equipment. As such, there was a last leg delivery problem of getting fresh produce to customer home. It was not at all transparent whether Amazon could do in fresh vegetables what it had done in books and electronics (Escobar, 2016).

After two decades of centering its business on online stores, Amazon recently added brick-and-mortar store Whole Foods to its arsenal (Shen, 2017). Considering the fact Amazon had been testing Amazon Fresh for almost a decade, the acquisition deal clearly demonstrated the value of physical store asset and limitations of online business model, at least in the grocery business. Beyond Wal-Mart, Amazon also faced a broad range of competitors in grocery sector, from national supermarket chain Kroger to regional companies like FreshDirect and fast-growing

startups such as Instacart. Comparatively speaking, Amazon and Whole Foods combined still had a very small fraction grocery market share in the U.S.

As indicated in Table 1 (Appendix)

Typical grocery supermarkets have packaged goods, canned food, condiments, and other so-called center of store products located in the middle of the store. Perishable food items, including fruits and vegetables, fresh meats, and prepared meals, are typically located in the perimeter areas of the store (called perimeter items) (Escobar, 2016). Fresh food is usually stored in the refrigerated environment to preserve quality and extend shelf life. Some fresh fruits and vegetables, however, would store quite well out of the refrigerator as long as they stay in a cool place. In general, perishable food items have the following noticeable characteristics (Aked, 2012; Bachmann and Earles, 2000; Tripp, 2013):

- Appropriate cooling temperature and appropriate humidity are often needed throughout the supply chain, from farms to retail stores.
- Fresh produce has limited shelf life, typically few weeks to be displayed and sold in controlled atmosphere.
- Post-harvest deteriorations are common. Quality gradually deteriorates to certain degree under normal storage, processing, and packaging conditions. Accordingly, product market value decreases over the time.
- Products close to the end of shelf life or "sell before date" are often discounted to sell or simply thrown away.
- Appearance of perishable food matters to customers (e.g., freshness, size, color, texture, firmness, flavor). Many customers are careful in picking fresh produce and meats based on their personal preferences. Therefore, fulfilling fresh produce orders is different. Delivering produce with stale signs by any e-business would definitely result in customer dissatisfaction.

DISTRIBUTION AND ORDER FULFILLMENT

Customer value is affected by many factors, especially the following ones in the grocery retailing business:

- Food quality
- Response time
- Shopping convenience
- Product availability
- Cost
- Customer experience
- Returnability and other customer service

The distribution network and order fulfilment processes will most likely define many of the above factors and greatly shape the operating cost baseline for the retailer, therefore are the key to success of any new online initiatives. The design option for a distribution network includes considerations concerning structural elements such as inventory, facility, information, order fulfillment operations, and transportation (Chopra and Meindl, 2016). To configure a supply chain delivering food from farms to forks, one has to consider the following key decisions:

- Where to keep inventory? Perishable inventory used for fulfilling orders could be kept at different places such as farm/factory storage, distributor warehouses, or retail stores.

- What supply chain facilities are needed? In addition to storage facilities, supply chains might need in-transit facilities like cross-docking distribution centers even lockers.
- How to manage information flows? Order, inventory, and processing information has to be integrated to provide customer satisfaction.
- What value-adding operations are needed? Many fresh products like leafy vegetables need further sorting, picking, and packing in the distribution process to maximize marketable value.
- How about transportation network? Refrigerated trucks are normally used to transport perishable food items throughout distributional systems. Several options were available for making the last mile delivery, including package carrier, company truck, third-party shopper service, and customer self-pickup. New technologies including self-driving vehicles and drones were also in the testing phrase.
- How to fulfill customer orders? One has to define order fulfillment processes to link all the supply chain resources with the customer orders. These broad processes would shape the actual customer shopping experience, which in turn define the value created for the final customers.

How to answer these questions about inventory, facility, transportation, order fulfillment, and information would have profound impact over both supply and demand side performance of the supply chain. While the supply side impact is mainly about cost, the influence on demand would be more about customer experience and value perception. The distribution system would definitely decide how customers were actually being served and impact how much they would like to pay. Given this industry's poor track record in selling grocery online (Newport and Brenan, 2017), one could argue that answers for these questions would potentially decide life or death for many grocers in the long term.

Based on the above discussion, one of the many distinct delivery methods could be used to move perishable food from their sources to customers. These design options are classified as follows:

1. Warehouse storage with home delivery
2. Warehouse storage with customer pickup
3. Store storage with home delivery
4. Store storage with customer pickup
5. Farm storage with direct shipping
6. Hybrid delivery mode

Choosing different delivery method obviously has relevant operations and financial implications. In fact, three key issues revolving around the digital transformation of the retail industry were enhancing order fulfillment capabilities, incorporating an extensive use of stores for fulfillment, and end-to-end supply chain planning (Gibson et al., 2017). How could store-based retailers compete with Amazon when Amazon was adding physical stores to its supply chain? More or less, it should be about leveraging stores as well as other critical supply chain assets/resources in order fulfillment and customer service. The goal is to create better shopping experience and better customer value without sacrificing the firm's cost competitiveness.

Warehouse storage with home delivery

Under this option, fresh produce and other grocery items are held in intermediate warehouses and online orders would be fulfilled there. Either third party carrier or distributor's

own fleet could be used to complete the last-leg delivery. Some online grocery businesses like Peapod, FreshDirect, and Amazon Fresh used this model for serving their online clients (Mccorvey, 2013). This model of distribution had been extensively used by Amazon and other e-commerce companies to sell non-food items. Holding inventory in a few warehouses instead of hundreds of stores would cut inventory level and help facilitate process improvement like automation, both resulted in cost savings. For perishable inventory, however, the warehouses have to be close enough to the target market as longer shipping time could add to quality and cost issues. That was the primary reason why currently fresh produce delivery from warehouse was limited to major metro areas in the U.S. Further, many grocery items like watermelon and bottled water are not suitable for long haul package delivery due to low value-weight ratio.

Founded in 1989, Peapod is an internet grocer which had delivered 40 million online orders in 24 U.S. markets (until August 2017) (Peapod, 2017). Peapod customers typically made two purchases every month with average order size exceeding $160. Customers could order online for home or workplace deliveries. For a fee of $6.95, customers could place orders for delivery as soon as next-day or up to two weeks in advance. Same day or instant delivery was not available. With 4 warehouse fulfillment centers and 21 warerooms, Peapod operated a centralized distribution system with two facility choices. Warerooms were dedicated areas attached to existing structure, were mainly used in new markets to control risk. Across its different facilities, Peapod had between 10,000 – 16,000 product SKUs including produce, meat, and prepared foods.

FreshDirect is an online grocer delivering to residences and offices in the New York City metropolitan area (FreshDirect, 2017). By 2013, FreshDirect had 250,000 customers, $400 million in annual sales, and was "being described internationally as a home delivery success story." Depending on the product nature, online orders were sent to the kitchen, bakery, deli as well as fresh storage rooms and production areas. All orders were custom-picked, packaged, and priced, then labeled and loaded into refrigerated delivery trucks.

Amazon had launched multiple programs for selling grocery products to online customers. Amazon Prime Pantry was offered as a service available only to Amazon Prime members that packages everyday non-perishable grocery items into a single box for delivery for a flat fee of $5.99. Each box holds up to 45 pounds, allowing bulky staples to be shipped at a low rate (Amazon Pantry, 2017). Prime Pantry allowed Amazon to expand its selection and offer thousands of items to Prime Members that are otherwise cost prohibitive to ship for free individually.

On the other hand, Amazon Fresh was available in 20 U.S. cities (as of August 2017) (Amazon Fresh, 2017). With a $15 monthly fee, customers could use the service to order fresh groceries online, like fresh fruits, meats, and vegetables. Items ordered through Amazon Fresh were available for home delivery on the same day or the next day. Amazon used the warehouse storage and home delivery mode to reach customers. It was reported that there were over 95,000 different items available for Amazon Fresh clients (Mccorvey, 2013). In contrast, the warehouse selection was almost twice the SKU number available at a typical Kroger store which was around 40,000 (Kroger, 2017).

One problem with Amazon Fresh was the high cost of losses caused by fresh food going bad, an issue it had never faced with durable goods (Soper and Zaleski, 2017). For conventional grocery stores, browning bananas or other produce with stale signs could be sold at a discount to customers with different needs. Fresh meats nearing their expiration dates could be marked down as well, serving those customers with immediate consumption needs. With Amazon Fresh or any

other e-grocer using warehouse to sell grocery, such items had to be discarded or would be returned by frustrated customers, tending to cause even bigger losses. Alternatively, selling these items in a separate discounted area online would not be perceived as a good idea as well since customers do not have chance to see the actual condition of the discounted products in person, therefore few people would buy them. Food quality was particularly a lingering issue for Amazon grocery business (Soper and Zaleski, 2017). Despite multiple attempts to break into the gigantic industry and ten years of grocery operations, Amazon still had not figured out how to attract mass market shoppers to buy meats and fruits online, in the same way they purchased books and toys (Soper and Zaleski, 2017).

Warehouse storage with customer pickup

In addition to home delivery from retailer's warehouses, one alternative was to offer customer pickup service. The orders were still fulfilled from inventory held in the central warehouse, but were only delivered to some intermediate pickup sites. Peapod had reportedly over 200 pickup sites at Ahold's Stop & Shop and Giant store locations (Peapod Facts, 2017). Customers could order groceries online and choose to pick them up from these locations at time convenient to them. Similarly, Amazon Locker was a self-service parcel delivery service allowing customers to pick up their orders at a convenient time (Amazon Locker, 2017). When checking out, Amazon customers could "select any Locker location as their delivery address, and retrieve their orders at that location by entering a unique pick-up code provided by Amazon in the email." At the case write-up time, the availability of locker locations was still limited in many markets where the service was available. In mid-2017, Amazon announced plans to launch Amazon Lockers at select Whole Foods Market locations as well (Bhatarai, 2017).

Store storage with home delivery

To improve service responsiveness, some grocery retailers used in-store inventory for online order fulfillment and home delivery. In most cases store-kept inventory is certainly much closer to customers than a centralized warehouse. Wal-Mart had been testing its grocery delivery service for years, starting with tests using its own service and trucks, and then starting from August 2017, using Uber (Perez, 2017). The grocery service was first offered in 4 cities including Dallas and Orlando. This seemed a natural step since Wal-Mart already had 900 locations with grocery order pickup service in 2017, up from 600 locations in 2016. Both the pickup and delivery services required a $30 minimum purchase, but delivery included a $9.95 additional fee. Earlier, Wal-Mart was reported to have its employees deliver packages to customers on their way home (Soper, 2017).

At the same time, several third-party companies including Instacart and Shipt offered grocery home delivery service. Customers used mobile app to order groceries from local stores and the third-party delivery company would send a personal shopper to handpick the items and deliver the order. In addition to the delivery charges, these third-party companies normally charged their own prices for items sold in store, which could be higher in many cases. Instacart delivery fee started at $3.99 for two-hour delivery and $5.99 for one-hour delivery for orders $35 or more (Instacart, 2017). Similarly, Shipt also offered next-hour or same day grocery delivery with free service for orders over $35. The service was offered in over 69 cities and counting, as of August 2017 (Shipt, 2017). Kroger's ClickList service also allowed customers to order online

and receive home delivery in select markets (Hobson Homestead, 2017). When checking out, if customers selected delivery instead of pickup, the order would be delivered to customer's home by Kroger's third-party delivery partner which was Shipt (Witsil, 2017).

New technologies of home delivery are under rapid development. It was reported that Ford was testing self-driving delivery vehicle for pizza deliveries (Durbin, 2017). That meant, in addition to drone technology, self-driving cars could be used for deliver time-sensitive grocery purchases in the future as well.

Store storage with customer pickup

This mode refers to two popular grocery retailing approaches. One is the traditional way of selling grocery: having customers visit the store in person, pick up whatever they want, and checkout from the store by themselves. No doubt almost all major grocers still heavily relied on this method for serving clients. This traditional way of grocery retailing, provided many benefits to both firms and customers. For example, there was no home delivery needed, and total supply chain transportation cost was much lower. Personal shopping was appealing in the sense that customers could pick whatever they want, and get quick face-to-face service (e.g., instant delivery, easy returnability). Relatively speaking, the order fulfillment cost was low since customers did all the order picking thing in store by themselves, many even checked out by themselves as well (customers were used as a free resource to fulfill orders in stores). On the other hand, personal shopping seemed time consuming and inconvenient to many people, therefore faced challenges from other more convenient modes especially online methods. With the store storage option, grocery selection was relatively limited, and inventory cost was high due to lack of aggregation. Facility cost and operating cost were particularly high due to the high number of facilities and lack of economy of scale.

The second popular way of buying grocery is to order online and pick up at stores, also known as click and collect model. Both Walmart and Kroger provided online order curb-side pickup service at large scale which was available nationwide (Soper, 2017; Witsil, 2017). After receiving online orders, store employees would pick orders using in-store inventory. Customers could then pick up their order from the store later. This service essentially saves customers some shopping time, which means convenience. It also does not create a number of issues (such as food going bad in adverse weather and waiting for delivery) caused by the home delivery service.

Walmart, operating 4,100 stores, gave customers the option of ordering groceries online and picking them up at one of its 900 participating locations (Soper, 2017). For Walmart, grocery pickup made many senses. It appealed to the typical Walmart customers who were cost-sensitive and busy driving around. The mode also made a lot of the cost sense as it could "leverage its existing store employees, its store square footage for things like extra coolers, its parking lots for dedicated pick-up spots and more (Ibbotson, 2017)".

With $4.95 per order, Kroger's ClickList allowed customers to order and purchase from a selection of over 40,000 SKUs online and then pick them up at the store (Witsil, 2017). When placing the order, customers were asked to select a one-hour window for pickup. Upon arrival and notification, a Kroger employee would come to the customer's car and load the ordered groceries. Many customers liked the service for time saving, and also the convenience in preparing and budgeting the grocery list. However, customers also reported freshness of the

produce could be occasionally an issue, and out-of-stock items were common which caused some inconvenience (Coolidge, 2017).

Meanwhile, the Amazon new grocery experiment, Amazon Go, was unveiled in December of 2016 (Amazon Go, 2017). In an Amazon Go store, products were embedded with tracking RFID tags. With cameras and sensors monitoring shoppers and their smartphones, customers could take items they want and walk out without passing a checkout kiosk (Rao, 2016). In the future, Amazon could even use facial-recognition technology to identify and then automatically charge in-store shoppers.

In August 2017, Amazon launched Instant Pickup, a service would let Prime members pick up "hundreds of need-it-now items like food, cold drinks, personal care items, technology essentials and Amazon devices" within two minutes of ordering them via the Amazon app (Mannetter, 2017). Upon receiving orders, Amazon employees at Instant Pickup locations would prepare the order and load it into lockers. Users could then pick up the items by scanning a bar code sent by Amazon. By offering a way to quickly deliver items that consumers wanted ASAP without losing the convenience of online shopping, Instant Pickup competed with convenience stores selling similar items at decent margins. As of 08/2017, Amazon had 22 basic order-pickup locations on U.S. college campuses, as well as pickup lockers available at over 1,800 locations in North America and Europe (Jhonsa, 2017).

From the above discussions, it was evident that Amazon was pushing deeper into the grocery business with plans to introduce physical stores as well as curbside pickup locations including lockers. Amazon aimed to compete more directly with grocery discounters, as well as Wal-Mart and Kroger alike, which had been expanding their own pickup services.

Farm storage with carrier delivery

For products like seasonal fresh produce, some farms or suppliers used online channels to collect orders in large quantity in advance, then ship to consumers directly after harvesting in the season (also called drop shipping). The advantages for this delivery mode included shipping time reduction, avoiding the middleman, increasing freshness of food, and getting access to valuable final client information. The main disadvantage was high shipping cost (the shipping quantity had to be big enough to justify the delivery cost). Therefore, in many cases the large receiving orders need to be broken down into smaller quantities for average customers to use this shopping mode. Quality control over the carrier's long-haul transportation process might also be one potential concern.

Hybrid delivery modes

Amazon had been the leader in renovating retail business models. For instance, Amazon offered a variety of hybrid delivery choices for meeting different customer needs. Amazon Prime Now was a service allowing Prime members to place orders for fast same-day delivery (Amazon Prime, 2017). There were two delivery choices: free delivery in a two-hour window and delivery within one hour for $7.99 per order. The service was available in 30 plus major metro areas in the U.S. and orders were fulfilled by the urban distribution centers (warehouses) as well as local stores. As of August 2017, Prime Now had over 25,000 items across 25 categories, including household items, groceries, and electronics (Leighton, 2017). But only 4,100 of the items were grocery products, which was about a tenth of a typical Kroger store selection.

MARKET COMPETITION AND TRENDS

Previously, Amazon did not score well in selling fresh produce and one of the main constraints was lacking of physical stores. Now it had been changed. Amazon now controlled 450 Whole Foods physical stores as well as the supporting distribution system for perishable goods (Shen, 2017). Adding so many physical stores to its arsenal would definitely help Amazon further develop its fresh product supply chain, with new capabilities to deliver fresh produce to more locations. For example, now the online giant is experimenting with drive-in grocery kiosks where consumers can pick up orders, and working on a hybrid supermarket that mixes the best of online and in-store shopping (Giammona, 2017). The following table summarizes an array of the delivery services provided by Amazon with varying SKU availability and delivery speed. As indicated in Table 2 (Appendix)

On the supply side, the last thing the U.S. grocery industry needs is more competition. LIDL, a German grocer known for low prices and efficient operations, is expected to add 630 locations in the U.S. over the next six years. To prepare, ALDI, which has more than 1,600 U.S. stores, has spent $1.6 billion to add more locations. This development had put pressure on Wal-Mart and other stores alike in attracting budget-conscious clients (Giammona, 2017).

On the market side, millennials were in charge. Also known as Generation Y, this age group was 20 to 37 years old in 2017 and there were 75.4 million of them, making up almost 25 percent of the U.S. population (Boldouc, 2016). The difference in attitude of consumption from this generations had a profound impact on grocery industry, which had sent grocery store supply chains into new territory. Grocery retailing trends were changing as the new generation wanted fresher, healthier foods and that tended to mean more shopping trips. In fact, millennial shoppers surveyed were more willing to buy groceries online in the future than other consumer groups (Kashanchi and Rigoni, 2017). As Americans were shopping more often and buying fewer grocery items per trip, they were slowly adopting online shopping for groceries (Giammona, 2017). Overall, the segment of online grocery retailing is expected to be more than $100 billion by 2025 (Coolidge, 2017b).

Amazon was excellent in providing high quality goods and world-class customer service at great prices. The e-commerce giant had been disrupting the retail industry for decades, and these latest developments signaled the next phase of its evolution. Younger, newer and more digitally engaged shoppers adopt new technologies more quickly, this would help define the future digital grocery shopping experience which is appealing to them. It would not be long until the grocery industry sees the future grocery business model take hold.

As Wal-Mart expanded its online presence, Amazon was buying physical stores. Therefore, the competition was not really between e-commerce and B&M stores, it was more about pursuing the right retailing business model in the new digital era. Facing pressure, only the grocers developing an understanding of their digitally driven customers, building a strategy around that understanding and cost-effectively executing their grocery supply chain strategy would be able to survive and thrive (Daniels, 2017). The core issue, is how they build their supply chain model for serving their current and future customers. This is probably one of the most significant challenges that grocers face today.

CASE QUESTIONS

      1.   What are the advantages and disadvantages for the grocery delivery methods discussed in the case? What are the tradeoffs businesses need to make in order to serve customers well?

      2.   It is expected that Amazon will revolutionize the grocery business and its associated logistics and distribution channels. Based on the case information, can you discuss the things Amazon can possibly do in the future to further improve their grocery business competitiveness? Why? What would the future grocery supply chain look like?

      3.   Do you see the rise of grocery e-commerce as leading to the demise of the brick-and-mortar supermarkets? If no, how can traditional grocery retailers like Wal-Mart and Kroger "reconfigure" their role for digital food shoppers, in terms of product offering, store operations, distribution network, delivery method, and customer service?

Note: Interested faculty may contact the authors for a copy of the teaching note.

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APPENDIX

Table 1
U.S. Top Grocery Retailers

Grocery Retailers	Market Share
Wal-Mart	17.3%
Kroger	8.9%
Albertsons/Safeway	5.6%
Costco	5.1%
Publix	3.4%
Sam's Club	3.3%
Ahold USA	2.5%
HEB Grocery	1.9%
Whole Foods	1.7%
ShopRite	1.7%
Amazon	1.1%

(Source: Wall Street Journal, October 12, 2016)

Table 2
Amazon Delivery Services

Amazon Services	Selection	Delivery Methods & Time	Storage
Amazon Fresh	95,000 SKUs	Same day or second day delivery	Warehouse storage
Amazon Pantry	Thousands non-perishable items	Ground shipping, 1-4 days	Warehouse storage
Prime Now	25,000 SKUs 4,100 grocery items	Delivery in 1-2 hours	Warehouse and store storage
Instant Pickup	Hundreds of items	Customer pickup in 2 minutes	Store storage

(Sources: Kroger, 2017; AmazonFresh, 2017; Wetekamp, 2017; Jhonsa, 2017)