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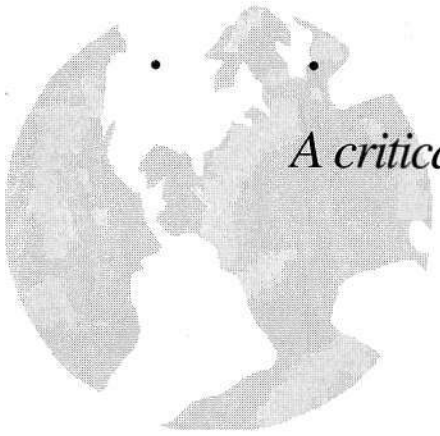
CSIB 750: Research Project

E-Delivery Opportunities & Challenges



A critical analysis of e-grocery business models

By
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E-Delivery Challenges & Opportunities

A critical analysis of e-grocery business models

Research Objectives

E-Delivery is defined as (on demand) delivery of physical goods purchased over the Internet. When the Internet is used for trading of digital (e.g. software) or digitizable (e.g., currency, music, travel tickets) products, the entire transaction can be completed virtually and full benefits of the powerful new medium, the Internet, are realized. However, majority of products are physical goods that require physical movement of goods - thereby, posing tremendous challenge to the business models that try to exploit the benefits of the new medium for majority of retail commerce categories.

Will the stark realities of handling and transportation of physical goods limit the potential of the Internet? Or, will new, perhaps revolutionary ways of moving the physical goods be found so that the new medium can go beyond revolutionizing information and financial transactions, and also revolutionize retail commerce of physical goods? [30]

Over the last two years, the world has seen dramatic rise and fall of "dot coms" and significant many of them in the so-called B2C (business to consumer) arena. It seems like every conceivable e-business model has been tried and tested, and final verdict has been delivered as one hears phrases like "B2C is dead". And the evidence is powerful - over 90% of B2C e-commerce companies have disappeared or are close to disappearing. Does it mean that B2C e-commerce is truly limited in potential? Are the troubles of the B2C e-commerce companies caused by lack of consideration to the challenges of physical delivery of goods (as the opinion of Fred Smith, CEO of Federal Express, seems to indicate)? Among the rubble of B2C e-commerce companies, are there any gems that will last forever and significantly change how we buy and consume our daily products?

To answer these questions, we critically analyzed one category of B2C e-commerce companies, namely, online grocery or e-grocery stores. We picked grocery retail for performing our analysis because handling and movement of groceries is among the most complex of all retail products. Therefore, arguably, if Internet business models can conquer grocery retail, penetration of most other retail categories would be rather simple.

Using a generalized cost model, we compared the theoretical costs of doing business for different e-grocery store models and contrasted with traditional brick and mortar grocery store. Using this analysis, we developed a set of conclusions about which models show promise for which market conditions. Then we looked at the financial performance of existing e-grocery companies and hypothesized the root causes of their troubles. Finally, we made some bold and perhaps provocative predictions about the future of retail industry.

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New Medium and New Channel

In an environment in which value of the companies and their business models is judged by short-term gyrations of stock market, one often faces questions such as:

- Is e-commerce a passing fad?
- Why aren't majority of e-tailing companies not making money? Do they really add value?
- What is the source of their value?
- Is the Internet a new distribution channel? How is it superior to traditional channels such as catalogue sales?

Shrinking the World

Internet is a network of networks. From a business perspective, it represents a new medium of communication. It is significantly different from any other medium that we have seen before. The following characteristics distinguish Internet from traditional media (TV, radio, newspaper, etc.) [32]:

- Utility Aspects:
  - Allows many to many communication
  - Allows mass customization of information
  - Allows high information velocity
  - Allows all of the above simultaneously (thereby making "horizontal business models" and "horizontal economy" possible)
  - Positive network externality as a result of acceptance and use by large number of consumers and businesses

- Cost Aspects:
  - Open architecture (public network with standardized protocols)
  - User friendly interface (hypertext interface of the web)
  - Inexpensive and highly scaleable

As a result of the above distinguishing characteristics, Internet has received a very rapid acceptance among consumer and business users.

Currently, there are over 370 million people connected to the Internet in the world (source: Nua Internet Surveys, http://www.nua.ie/surveys/how_many_online/index.html) and it is a virtual certainty that sometime in not so distant future all the 6 billion people on earth will be online and in all likelihood, even automobiles, refrigerators, light bulbs, garbage cans, and every conceivable appliance will be connected to the Internet in some fashion. The result is a new medium that allows us to communicate with anyone and anything at anytime inexpensively and quickly. The Internet, therefore, is shrinking the world …

And Expanding the Possibilities

The communication and computing revolutions that have culminated in the Internet present a not only a new medium, but also a new distribution channel for businesses to reach customers. The new channel provides value to businesses among all the three dimensions important to any business, namely, cost, quality, and speed.

Cost:

- Communication of product offerings very inexpensively to a large number of prospects (cost of email compared to cost of snail mail)
- Order taking and order processing with little or no human intervention (much lower cost than order taking by telephone which costs $3.80 per order, by one estimate)
- Self help (through automated comparison shopping and access to customer reviews) vs. sales agent advice
- Product offerings not constrained by physical limitations of a store result in scope economics
- Increased geographic reach resulting in scale economics
- Lower inventory due to centralized distribution (high inventory turnover) or zero inventory due to source direct model (also C2C model)
- Lower G & A expenses due to elimination of or reduced reliance on physical storefronts

Quality:

- Virtual product descriptions that are becoming more comprehensive and more realistic (than advertisements in print, radio, or even television)
- Opportunity for mass customization – made to order products impact customer satisfaction

Speed:

- Dis-intermediation or reduced intermediation improves response time
- Availability of rich customer information allows producers to respond quickly to changing customer preferences

Along with the above values to the distribution channel, the Internet provides similar benefits to back end operations as well as the supply chain. These benefits potentially allow businesses to re-optimize value chains and provide new value added services that customers want.

Convenience is a one such new value. The premise of e-delivery is essentially – the Internet allows retailers to re-optimize their value chain and provide the convenience of home shopping and home delivery at minimal or no additional cost.

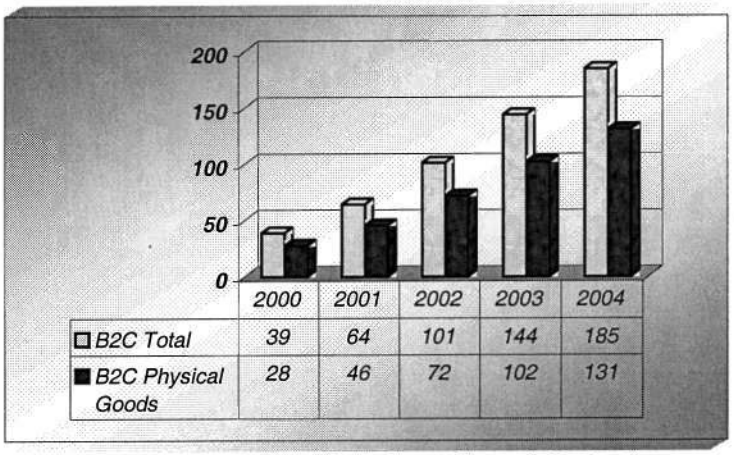
Consumer E-Commerce is Alive & Kicking, At Lease for Now

According to a recent Forrester Report [33], most online customers are not even aware of the recent financial troubles of e-commerce companies. While Internet professionals and the media keep count of failed Dot Coms, consumers go on their merry way shopping online.

More Web-sales

Amazon.com, the bellwether B2C (business to consumer) e-commerce company has a current revenue run rate of over $2.5 B per year. Ebay, the C2C (consumer to consumer) online auction giant enabled trading of over $1.4 B worth of goods in one quarter (2000 Q3). These online retail sales numbers even though relatively small compared to overall retail commerce, are already quite significant in some categories and are continuing to grow rapidly. For example, eBay expects to reach revenue of $3 B (by enabling trading of an estimated $36 B of merchandise) by 2005. Consumers are shopping online for a number of reasons including convenience, low prices, and/or unprecedented selection.

According to estimates made by Forrester Research in 1999, online retail (B2C) sales are expected to grow from $ 39 Billion in 2000 to $ 185 Billion in 2004 (see Figure 1). In comparison, the total U.S. retail spending is estimated to be $3084 B, $3176 B, $3272 B, $3370 B, and $3471 B in 2000, 2001, 2002, 2003, and 2004 respectively. With these projections, the online retail will represent 5.3% of total retail sales in 2004. Of the total B2C e-commerce in 2004, $40 B is expected to be in replenishment goods and services (groceries, food, dry cleaning, etc.).



	2000	2001	2002	2003	2004
B2C Total	39	64	101	144	185
B2C Physical Goods	28	46	72	102	131

Figure 1. E-Commerce Growth Projections

A more recent publication by Boston Consulting Group estimates that online purchases in USA will reach $60 Billion in 2000, up from $ 30 Billion in 1999 and $ 15 Billion in 1998 [1]. BCG estimates are somewhat higher than those of Forrester partly because BCG estimates include C2C revenues as well.

Though $ 60 billion B2C e-commerce revenue is just around 2 % of total retail sales in USA, the online purchases in several categories including computer hardware/software, books, and music/video are expected to cross 10% of total retail sales in those categories in 2000. Such a penetration of market by online stores is significant because even a 10% reduction in sales can adversely affect brick & mortar stores due to their high fixed costs [1].

Means More Package Deliveries

As the e-commerce retail sales are growing, the "last mile" movement of goods is undergoing changes. More and more goods are being delivered to homes and end use locations rather than retail outlets. Currently, the common carriers are doing the deliveries of most of the online purchases. In 2000, ecommerce package delivery shares of common carriers are: UPS 41%, USPS 41%, FedEx 13 %, and Airborne Express 2 %.

However, a new breed of delivery providers is emerging for last mile delivery. These new, on-demand last mile delivery ("e-delivery") providers such as WebVan and Kozmo are tightly integrating the warehousing and delivery functions to create new models of last mile delivery. A partial list of e-delivery companies includes: HomeGrocer.com, Webvan, Peapod, Groceryworks.com, Kozmo.com, UrbanFetch.com, PinkDot.com, Streamline.com, and Whyrunout.com. These e-delivery companies are operating in different target markets with different delivery/business models. It is not yet clear which of the above companies have viable business models in the long run, the industry is currently undergoing consolidations and mergers.

Regardless of which of the e-delivery models and companies survive in the long run and capture most of the growth in e-commerce package deliveries, the expected growth in package deliveries is significant - with a compound annual growth rate of approximately 22% from 1999 to 2003 according to Forrester Research.

Based on an average order value of $75, if the projected e-commerce trends are realized, over 14 million additional packages would need to be delivered to homes daily in 2004. This represents a significant addition to existing package delivery volume of the big common carriers of today as shown in Figure 2.

Company	Packages/Day	Number of Trucks	Packages/Truck/ Day
UPS	12.0 million	166,666	
FedEx	3.2 million	44,500	72
Airborne Express	1.1 million	14,988	
USPS		192,904	

Figure 2. Delivery Package Growth Due to E-Commerce

The major common carriers such as UPS have acknowledged potential growth in package deliveries due to consumer e-commerce. According to executives of UPS, consumer e-commerce is resulting in [34]:

- More and more goods are being delivered to end use location (homes as opposed to retail outlets, plants as opposed to warehouses)
- More frequent deliveries in smaller packages
- More varied packages and goods

The Cat is Out of the Bag - E-Delivery is Here to Stay

The Internet has created the concept of "immediacy" with regard to on-demand purchase and payment – but the reality of e-commerce has been "hurry up and wait" when it comes to getting the goods.

E-delivery (on-demand delivery of consumer goods purchased over the web) is really a variation on an old theme: home delivery of consumer goods and services. In olden days, it was common for small stores to deliver grocery orders. Other companies delivered milk and meat. But those and similar services faded as supermarkets subsumed smaller stores and small towns became sprawling suburbs, and personal automobiles became ubiquitous [7].

Home delivery is a recurring idea that has never quite fulfilled its promise. May be this time, though, it will stick around in the form of e-delivery. Home delivery is already on the rise. An annual survey conducted by America's Research Group, revealed that 9% of respondents were already using a home-delivery service. Estimates suggest that home delivery might eventually capture as much as 20% of the estimated $400 billion spend on groceries each year.

Who Cares About E-Delivery? Consumers!

E-delivery is likely to gain popularity due to following consumer groups [3].

Shopping avoiders, who dislike grocery shopping

People don't like shopping for commodities such as groceries - surveys reveal that among household chores, many people rate shopping for groceries only slightly less onerous than cleaning.

Necessity users, who are limited in their ability to go to the store for some reason

The population of U.S. is aging. As baby boomers are aging the older Americans continue to outnumber teenagers. Currently, almost 12% of the U.S. population is 65 or older.

Another demographic trend that is resulting in more necessity users is the rise of single parent households. Specifically, in 1998, only 25% of households were composed of married couples with their own children under 18, compared with 40% in 1970.

Time starved, who are insensitive to price and will pay extra to free up time on their schedule

There is a significant rise in dual income households in U.S. Today, women represent a growing proportion of the workforce - 60% of women over 16 years of age are in workforce in 1999 compared to only 38% in 1960 [7].

New technologists, who are typically young and comfortable with technology

Along with widespread use of the Internet along with the new wireless web enabled PDAs and other web access devices, is likely to keep technology enthusiasts interested in trying e-commerce and e-delivery services.

Who Cares About E-Delivery? E-tailers!

Shoppers prefer, and seek out, online vendors that can ship products within two or fewer days after receiving an order [10]. As consumers have embraced the Internet to buy goods, their expectations for rapid and reliable delivery of those goods have increased exponentially. No longer is it acceptable for

e-tailers to deliver in 5-7 business days. Consumers are increasingly looking for immediate satisfaction in both products and services. As a result, Internet companies are battling to control the last mile delivery to consumers and leveraging relations to sell more products and services on a regular basis. E-delivery enables e-tailers their dream of capturing the replenishment goods market and achieving repeat revenues with at cost.

Residential (last mile home) delivery is a natural monopoly. If one company establishes a network, it will be very difficult and expensive for new entrants to reproduce a similar delivery network in the same area. Whoever solves the last mile problem, delivering even perishable products, could use that distribution infrastructure to supply other household products and services.

It is estimated that 25% of all merchandise bought online is returned, with averages higher in certain categories such as apparel, at 35%. This estimate underscores the significance of this issue and hence the opportunity to reclaim costs if returns can be managed.

No one has yet claimed the market for online delivery. Incumbents – the U.S. Postal Service, FedEx, and UPS – are obvious contenders, but their networks may not be prepared to handle the volume. Delivering to residential markets requires a distribution network and set of capabilities much different from that of delivering to businesses.

In transportation and delivery industry, dominance in one segment does not equal to dominance in another. The manner in which the physical network is configured ultimately determines what types of delivery a company can and cannot perform profitably. For many courier companies, which may or may not perform residential deliveries, a lack of daily penetration into the residential markets quickly makes the opportunity unprofitable.

On a national basis, the USPS appears to have the advantage, and claims its Priority packages comprise 32% of all ecommerce deliveries. The market, however, is becoming increasingly local. With a high percentage of affluent individuals concentrated within specific geographic regions, opportunities to develop local and regional delivery mechanisms abound.

High-income households constitute 10% of 100,000 total ZIP codes. That is approximately 1.4 million affluent households, of which 85% are in the $50,000 to $100,000 annual income range. This is the segment most likely to shop online, so the concentration of buyers is leading to localized delivery solutions, from bicycles couriers to regional warehouses that merchants use as forward-stock locations.

Along with a local delivery network, e-delivery requires local stocking of the products. Therefore, a number of new entrants have emerged for e-delivery; most notable of them are e-grocers such as Webvan and Peapod. These online grocers provide next day or same day deliveries with widely differing fulfillment and delivery models.

There are also companies such as Food.com and Kozmo.com attempting to provide consumers with the ultimate in service indulgence – "e-mmediate" or within one-hour delivery services. Kozmo, focusing on large metropolitan markets, using fleets of bike messengers delivers convenience goods like videos and snack foods to consumers in an hour or less. Food.com, which purchased Takeout Taxi, America's largest restaurant delivery network, plans to leverage its online food ordering network to deliver other products such as film, dry-cleaning, and videos.

Given the appeal of e-delivery to consumers and e-tailers, it is only a matter of time before a company finds a way to deliver this service profitably.

E-Grocers - (Costly) Experiments in E-Delivery

One of the key emerging services in the e-delivery category is online grocery delivery. Online grocery as a category is behind other top consumer e-commerce product categories such as books, software, travel, and music, but it is expected to grow during the next few years.

Home delivery is an integral part of the e-grocery shopping concept. Given the complexity of grocery product lines (number of SKUs, perishable products, low value and bulky products), the contention is that if an e-delivery model can be made viable for groceries, it can be expanded to other product categories as well.

Market Opportunity

Food at home products market in U.S. is of the order of $550 billion a year. If non-food grocery products such as cleaning and personal care items ($200 billion a year) and prepared meals ($100 billion a year) are added, the market opportunity for online grocers is close to $1 trillion a year. Along with a fraction of the grocery market, if the e-delivery models of the online grocers can provide other personal services such as dry cleaning, video rentals, package shipping, etc., the potential opportunity seems very attractive.

E-Grocery Market Projections

According to Netsmart Research, the reasons shoppers would buy groceries online are shown in Figure 3.

Reason	%
Convenience	68
24-Hour Access	66
Can shop without leaving home	60
Saves time	60
Saves money	60
Prices compare favorably	47
Won't forget items	42
Better selection	41
Can find new products	39
Can shop from work	35
Hate to shop	32

Figure 3. Reasons for E-Grocery Shopping

Recent studies by Forrester Research, Andersen Consulting, Jupiter Communications, and The Yankee Capital group all point to rapid growth in the e-grocery business (see Figure 4)

Research Source	2000	2004
Andersen Consulting	$ 1B	$ 45 B
Jupiter Communications	$ 2 B	
Yankee Group	$ 6B	
Forrester	$ 1 B	$17 B
Shop.org & BCG	$ 1 B	

Figure 4. E-Grocery Market Growth Projections

Even though the projected penetration of online grocery remains small, it has the potential to impact the viability of weak conventional grocers. Since grocery business has high fixed costs and large breakeven volumes, Goldman Sachs estimates that losing 5% of sales would take more than 20% off the bottom line.

Even though the e-grocery industry is in its infancy, a number of business models have been tried/are being tried, including:

- Webvan, providing the broadest line of products using highly automated distribution centers and local delivery network
- Homegrocer and HomeRuns.com, providing a full line of groceries via a lower cost warehouse
- Firms like Netgrocer dealing only in non-perishable goods but offering a wide range of products and servicing the entire country by shipping long distances
- Firms like Peapod, which piggy backed on existing conventional grocery stores

While online grocery sales in the US have been dominated by pure plays like Webvan, in Europe traditional retailers like Waitrose, GIB, and Casino lead the way. High population density makes home delivery cheaper in Europe than in US. Forrester estimates that European online grocery sales will overtake those of $16.8 B in US by 11% in 2003.

Even though none of the e-grocery companies have made any money, in US too traditional grocery players have begun considering e-grocery concept seriously. Albertson's and Safeway have acquired e-grocery players. Kroger is carefully considering Internet retail sales and home delivery options [4].

Shades of E-Grocers – Party Colors!

Differences between retail and e-tail operations

Figure 5 shows the value chain of a generalized retail operation. One obvious difference between retail and etail business lies in the front end of the business (displaying of items, customer support, order taking, and order processing aspects of value chain) - the web-based virtual store replaces a physical store.

In addition, in a traditional retail store, the customer bears the cost of picking, packing, and transportation of the purchased goods to his/her home. In a web-based retailer, picking, packing, and delivery are additional services provided by the company. These differences potentially provide an opportunity or necessity to rethink and re-optimize the rest of the value chain for e-tail operation. Examples of changes that will add efficiencies to e-tail operation:

- E-tailers can work with producers and warehouse distributors to receive products in pallets that are already optimized for an automated fulfillment center. Lessons from warehouse clubs provide clues in this regard [35].

- Consumer Packaged Goods companies and other suppliers to retail operations can provide product information (product photos, nutrition information, etc.) in a digital format for easy upload to the e-tailer's website.

Ironically, as egrocers take on functions such as picking, packing, and delivery that were earlier performed by the customer, the traditional supermarkets are installing self-service checkout counters to increase customer self service and thereby reduce costs.

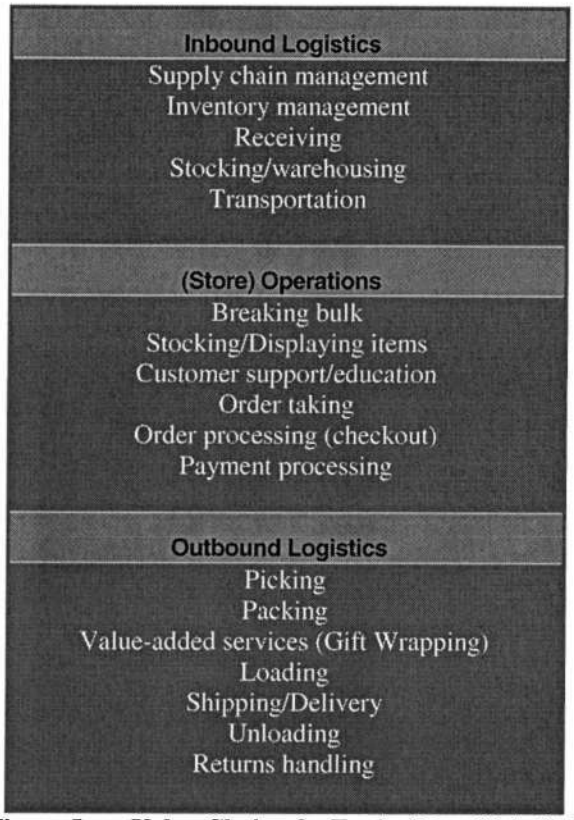


Figure 5. Value Chain of a Typical Retail/Etail Operation

Taxonomy of E-grocery Models

During a short span of a year or so, a number of e-grocery players have emerged with seemingly different models. The following classification helps to frame the various business models and provide a basis for developing an analytical model.

Store Type:

- Brick & Mortar
- Pure Play
- Click & Mortar

Fulfillment Type:

- Self Service
- Store Fulfillment
- DC Fulfillment (Semi-automated like HomeGrocer.com and HomeRuns.com or non-automated)
- Automated DC Fulfillment (e.g., Webvan)
- Source Direct (e.g., Value America which is now bankrupt)

Delivery Type:

- Self Service (pickup at the place of fulfillment)
- Delivery to customer end use location
  - Local Delivery - attended or unattended – same day or same hour
  - Box & Ship - attended or unattended
- Delivery to a pickup point (midway between fulfillment location and end use location)
  - Workplace
  - Neighborhood consolidation center (such as a dedicated NCC, Mail Boxes, Etc., gas stations, Package Net, or any other local business)

Figure 6 classifies a number of e-grocery companies using the above categories. In Figure 7, characteristics of major e-grocery business models are discussed.

Name	Description	Store Type	Fulfillment Type	Delivery Type
Albertson's	Large US grocer in Midwest and West – online only in Dallas area – delivery fee of $5.95 for orders < $60	Clicks & Mortar	Warehouse/Store	Local Delivery
AllIndiaGrocers.com	Shipping charges are proportional to $ value of the order	Clicks & Mortar	Store	Box & Ship
Basha	Chain of grocery stores with online presence – part of e-grocer.com network	Clicks & Mortar	Store	Self Service
C-mescourses.com	Large French based European grocer	Clicks & Mortar	DC	Local Delivery
e-grocer.com	Network of local grocers with common online store format	Clicks & Mortar	Store	Self Service or Local Delivery
EthnicGrocer.com	Free shipping for Namaste.com online Indian grocer	Pure Play	DC	Box & Ship
GroceryWorks.com	Dallas, Fort Worth, & Houston – 15000 SKUs – 120,000 sq. feet DC – Safeway has 50% stake	Pure Play	DC	Local Delivery
HomeGrocer.com	Merged with Webvan – in Seattle, Portland, Orange County, & Dallas – Amazon.com had 22% stake – DC size 100,000 sq.ft – Average order value $100	Pure Play	DC	Local Delivery
HomeRuns.com	Boston – 7000 SKUs both dry and perishable - $60 minimum order with no delivery charge – semi-automated DC supplied from Hannaford's warehouse complex	Pure Play	DC	Local Delivery
Kozmo.com	Delivery within an hour for convenience items – video returns at local Star Bucks – average order size of $15	Pure Play	DC	Local Delivery
Kroger	Large US grocer	Brick & Mortar	Self Service	Self Service
Netgrocer.com	Shipping charges are proportional to $ value of the order and distance from DC in NJ - $2.99 for < $50 - $6.99 to $14.99 for $60-$100 order based on distance	Pure Play	DC	Box & Ship
Peapod.com	Boston, Chicago, Dallas, Austin, TX, Columbus, Ohio, Long Island, NY, San Francisco –	Clicks & Mortar	DC or Store	Local Delivery

Name	Description	Store Type	Fulfillment Type	Delivery Type
	12,000 SKUs – Registration fee of $8-$9 per order – home delivery within 12- 18 hours of order – now acquired by Royal Ahold, the Dutch grocer with US grocery operations			
PinkDot.com	Now called PD Quick – provides attended delivery of groceries, deli & prepared foods, etc. within 30 minutes of ordering – delivery fee $2.95 for some orders	Pure Play	Store	Local Delivery
Sainsbury	UK's second largest grocer with rapidly growing e-grocery unit – 180,000 sq ft central DC	Clicks & Mortar	DC	Local Delivery
ShopLink.com	MA, CT, and NY areas – 15,000 SKUs	Pure Play	DC	Local Delivery
Streamline.com	In Boston, Washington DC, Chicago, NJ, and Minneapolis. Delivers weekly. Over 10000 SKUs – Also partners with local retailers & service providers. Provides refrigerated box for $30/month fee. Now on the verge of bankruptcy.	Pure Play	DC	Local Delivery
Telemarket	Owned by a large French retailer.	Clicks & Mortar	DC	Local Delivery
Tesco	Largest British grocer provides next day attended delivery for 5 BPS.	Clicks & Mortar	Store	Local Delivery
Value America	Now bankrupt.	Pure Play	Source Direct	Box & Ship
Webvan	Same day delivery from highly automated local DC	Pure Play	Automated DC	Local Delivery
YourGrocer.com	NY area – online bulk grocer – 750 SKUs - $50 minimum order – home delivery within 2 days of order	Pure Play	DC	Local Delivery

Figure 6. Taxonomy of E-Grocers

Model	Advantages	Disadvantages
Kroger **Brick & Mortar Store + Self-service Fulfillment + Self-serve Delivery**	• Traditional tried and tested • Trustworthiness • Instant gratification • Expert advice • Good for high value and specialty items • Good for perishable items	• Narrowest geographic scope • Limited products • Cost of inventory • Cost of maintaining a physical store
Tesco **Click & Mortar Store + Store Fulfillment + Local Delivery**	• Trustworthiness • Good for high value and specialty items • Good for perishable items • Leverages existing infrastructure	• Fulfillment and delivery is an added cost that is not offset by savings in other parts of value chain • Narrowest geographic scope • Limited products • Cost of inventory • Cost of maintaining a physical store
Webvan **Web Store + Automated DC Fulfillment + Local Delivery**	• Virtual store front rather than brick & mortar store – one distribution center is equivalent to multiple traditional storefronts • Higher inventory turnover than storefront model • Lower cost of inventory (lower inventory due to aggregation of demand) • Lower cost of stocking/displaying items than storefront • Good for replenishment items • Good for perishable, time sensitive, special handle, fragile items • On demand delivery • Good economies of scale for delivery (delivery costs decrease with order size and volume)	• High cost of building new distribution centers • Narrow geographic scope – geographic expansion is capital intensive • Cost of local delivery (to customers) • Lower SKUs than Box & Ship model • Higher cost of inventory
Netgrocer **Web Store + DC Fulfillment + Box & Ship Delivery**	• Large number of SKUs in large, centralized distribution centers • Good for specialty, high price, non-perishable, small items • Broad geographic scope • Example: Netgrocer.com	• Poor economies of scale for shipping (shipping costs increase with order size and volume except may be for some volume discounts from common carriers) • Not suitable for time sensitive, fragile, special handle, or perishable items • Takes several days for delivery
Value America **Web Store + Source Direct Fulfillment + Box & Ship Delivery**	• Ship directly from source to end use location • Very high level of dis-intermediation • Largest number of SKUs • Good for exotic, specialty, and limited demand items • Zero inventory • Broadest geographic scope	• Manufacturers and warehouse distributors are not designed to ship individual items • Quality assurance, tracking, and branding issues • Lowest economies of shipping (each item ships separately) • Slowest delivery

Figure 7. Major E-Grocery Models

Party Is Over - Is Anyone in Black Yet?

At the time of this study, based on publicly available information, none of the pure play e-grocery businesses is making money. However, most of these businesses are in initial phases of proving their business models. Due to a number factors including initial capital expenditures, marketing costs, un-ramped volumes, and negative sentiment in the capital markets, their current status is not necessarily an indication of future success of such business models. Therefore, more interesting question than "are they making money?" is "can they make money?" To help answer this question, this study attempted to develop a cost model of e-grocery operations and study the effect of various conditions on the eventual profitability of different e-grocery business models.

The objective of the model is to be able to study the viability of various e-grocery business models described in the previous section for a variety of conditions, such as:

- Market conditions (interest rates, worker wages, real estate costs, population density, etc.)
- Business conditions (order volume, order value, marketing costs, etc.)
- Product related parameters (gross margins, bulkiness, etc.)

The model can then be used to not only theorize on what e-grocery business models make sense for various scenarios, but also explain if and why the current e-grocery businesses are deviating from the theoretical scenarios.

The Model

The model is a MS Excel spreadsheet that uses macros and Visual Basic programming. A snapshot of the model is shown in Figure 8. As shown in this figure, the model allows one to select a target market (such as USA – Suburban, USA – Rural, USA – City, etc.) and a product line (e.g., groceries, ethnic groceries, flowers, etc.).

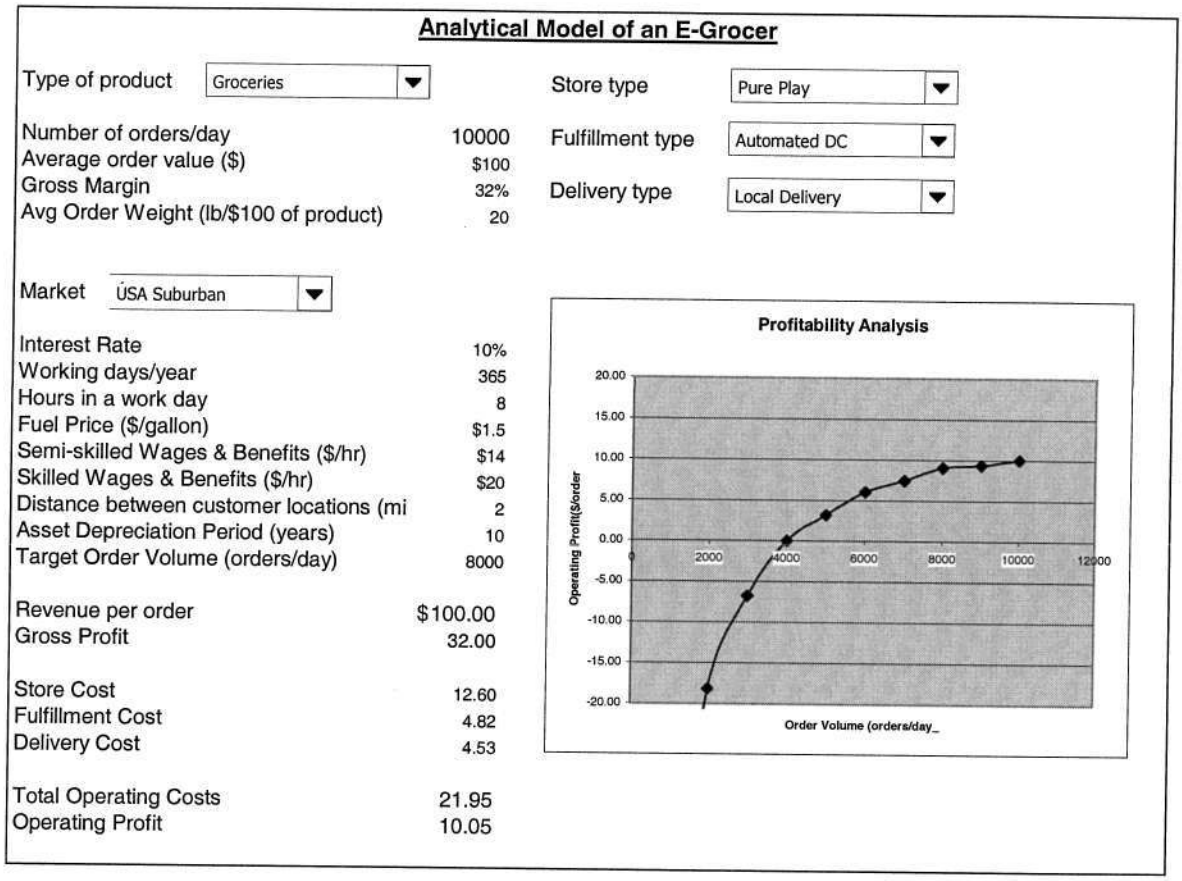


Figure 8. Analytical Model of An E-Grocer

Along the lines of the classification of e-grocery business models described in the previous section, the model is based on dividing the costs of business among store, fulfillment, and delivery costs. The following tables show the cost items considered for each of the above categories.

The model allows one to perform various what-if analyses by varying store type (brick & mortar, web store, click & mortar), fulfillment type (automated dc, semi-automated dc, store, and self-service), and delivery type (box & ship, local delivery, and self-service).

In this model, a key parameter that can be varied is the order volume, i.e., number of order per day.

Output of the model is an estimate of store, fulfillment, and delivery costs, as well as operating profit for the business model chosen. Further, profitability curves can be generated by continuously varying the order volume. This is accomplished by pressing "Profitability Analysis" button in the work sheet, which activates a background Visual Basic program.

In developing the model, an effort has been made to preserve generality so that further development of the model to account for more varied scenarios can be done.

The Data

This section explains the data that was used for the model. This data has been gathered from a number of sources including company reports, SEC filings, industry sources, security analyst reports, and other news sources. In some cases, the data was inferred or estimated based on informal consultations with people knowledgeable about e-grocery industry (the author and his colleagues at Ford Motor Company had visited a number of e-grocery companies). The model can be updated as more accurate data becomes available.

Gross Margins

According to Food Marketing Institute Website (http://www.fmi.org/keyfacts/grocery.html), gross margin of a typical supermarket is around 26%. This is similar to the gross margin of 27% reported in the latest annual report of Kroger. However, this gross margin is after taking in to account not only COGS, but also advertising, warehousing, and transportation expenses. If only COGS are considered for gross margin and the other expenses (6 to 8%) are accounted in distribution center and G&A costs, the gross margin of a typical supermarket would be around 32%.

Webvan's gross margins continually improved and were 28% of sales in 2000 Q2. Like Webvan, any e-grocer attains scale; its gross margins will approach those of supermarket industry. Therefore, for analysis purpose, we took gross margins of 32% for grocery business.

Store Costs

A snapshot of store costs worksheet is shown in Figure 9.

Store Costs Worksheet

Number of orders per day	10000
Average order value ($)	$ 100

Costs Per Day

Store Type	Equivalent # of Stores	Warehouse & Transportation	General & Administrative	Inventory Cost	Rent	Advertising	Amortized Website Development	Website Maintenance	Online Customer Support
Brick & Mortar	25	$ 60,000	$ 170,000	$ 6,667	$ 20,000	$ 20,000	$ -	$ -	$ -
Pure Play	1	$ -	$ 85,000	$ 4,167	$ -	$ 20,000	$ 2,198	$ 9,022	$ 5,652
Click & Mortar	1	$ 60,000	$ 170,000	$ 6,667	$ 20,000	$ 20,000	$ 2,198	$ 9,022	$ 5,652

Costs Per Order

Store Type	Equivalent # of Stores	Warehouse & Transportation	General & Administrative	Inventory Cost	Rent	Advertising	Amortized Website Development	Website Maintenance	Online Customer Support
Brick & Mortar	25	$ 6.00	$ 17.00	$ 0.67	$ 2.00	$ 2.00	$ -	$ -	$ -
Pure Play	1	$ -	$ 8.50	$ 0.42	$ -	$ 2.00	$ 0.22	$ 0.90	$ 0.57
Click & Mortar	1	$ 6.00	$ 17.00	$ 0.67	$ 2.00	$ 2.00	$ 0.22	$ 0.90	$ 0.57

Figure 9. Snapshot of Store Costs Worksheet

Brick & Mortar Store Costs

Equivalent Number of Stores:

The model uses the costs of a typical grocery supermarket in USA as shown in Figure 10. The data for typical grocery store has been adapted from Food Marketing Institute Website, Kroger company data, and other sources. Based on the order volume in the E-grocery model, an equivalent number of brick & mortar stores is estimated and their costs are calculated.

Data for Average Grocery Store (Supermarket) in USA

			%
Revenue per store per day ($)	40,000	Revenue	100%
Store Size (sq. ft.)	40,000	Gross Margin	32%
Number of employees/store	100	Warehouse & Transportation	6%
Rent per store per year ($)	200,000	General & Administration	17%
		Employee Salary & Wages	12%
Inventory turns per year	15	Information technology costs	2%
Value of inventory in store	973,333	Allocation for headquarters	3%
Inventory carrying cost per day ($)	267	Inventory Carrying Cost	1%
		Rent	2%
		Advertising	2%
		Operating Margin	4%

Warehouse & Transportation costs refer to the cost of a chain's central warehouse, whose function is to take delivery of goods from manufacturers and truck them to multiple stores in a region.

Source: Adapted from Food Marketing Institute Website, http://www.fmi.org/keyfacts/grocery.html, E*Offering Analysis, and Kroger company data.

Figure 10. Data for a Typical Grocery Store (Supermarket) in USA

Warehouse & Transportation Costs

For a brick & mortar, warehouse & transportation costs refer to the cost of a chain's central warehouse, and transportation of products to retail outlets. Typically, these costs are lumped along with the COGS and reported as "merchandising costs". By subtracting COGS from merchandising costs, warehouse and transportation costs were estimated to be 6%.

General & Administrative

G & A costs include employee salary & wages, information technology costs, and allocation of headquarters costs. These costs account for day to day store maintenance costs.

Compared to e-grocers, in conventional grocery stores, store maintenance costs are high due to high stock display costs (large displays of produce have to be kept cool by refrigerators that pumped cold air straight through the produce and into the store) and spoilage (some stock gets spoiled due to open display and handling by customers).

Inventory Carrying Costs

Traditional supermarkets turn inventory 15 times a year. The need to display items reduces the opportunity to adopt just in time processes. Segregation of demand among several retail outlets in a chain lowers the ability to consolidate demand and reduce overall inventory levels. Based on the published inventory turnover ratio, inventory-carrying cost of a typical grocery store was estimated to be 1%.

Rent

Traditional grocery store would normally be located in a desirable retail district close to its customers. These retail locations (with sufficient store size and parking space) typically command high property taxes and premium rents. The actual real estate costs will vary based on general location – for example, in bay area, store rent costs run as high as 4 to 5% of retail sales [18]. For the model, an average rent cost of 2% of sales was used for the brick & mortars.

Advertising Costs

Advertising costs for typical grocery store were taken as 2%.

For brick & mortar stores, web-site development and maintenance costs are assumed to be non-existent or negligible (unlike competitive e-commerce web-sites, simple corporate presence type web-sites do not cost much money). Also, online customer support costs are not present for brick & mortar stores. In store customer service costs are accounted in store general and administrative expenses.

Pure Play Store Costs

Warehouse & Transportation Costs

For pure play stores, there is no transportation cost similar to warehouse to retail outlet transportation cost of brick & mortar stores. The warehouse costs of pure play stores are accounted as part of fulfillment costs.

General & Administrative

Due to centralized warehousing and no retail outlets, pure play store does not need as many employees as equivalent brick & mortar stores. For example, Web Van's fully functioning distribution center needs 900 employees and has capacity to serve the order volume of 18 supermarkets that would have 18*100 = 1800 employees. Therefore, general & administrative costs of pure play store are taken as 50% of those of equivalent brick & mortar stores.

Inventory Carrying Costs

Traditional supermarkets turn inventory 15 times a year, whereas a pure play can achieve higher inventory turn ratio due to aggregation of demand. Webvan expects to achieve inventory turns per year of 24. The model uses inventory turnover ratio of 24 to compute the inventory carrying cost of pure play.

Rent

Since pure play store has no physical retail outlet, there is no store related rent expense.

Advertising Cost

Currently, the advertising costs of egrocers are very high due to the fact that they are breaking in to new markets with new brand names. E-grocery companies are finding that, because ordering groceries online is such a drastic change in behavior, it demands that customers completely change a certain aspect of way of life. Therefore, ordering groceries over the web has required a deep sell with high customer acquisition costs. Some of the reasons for the deep sell mentioned by e-grocers are:

- Customers are reluctant to transmit credit card information over the net
- General perception that groceries purchased online are not as fresh as groceries picked up at a store
- Customers actually crave for the shopping experience and that a virtual shop precluded the enjoyable impulsive, inspirational purchases made at a conventional grocery store.

According to a Shop.org and BCG study [1], customer acquisition cost for pure play retailers is $82

(119% of revenue), for catalog-based multi-channels it is $11 (6% of revenue), and for store-based multi-channels it is $31 (36% of revenue).

However, in future, as customers become more familiar with online store brands and the ease of order placement improves, the advertising costs of pure plays could converge to the industry average. Therefore, the model uses advertising costs for pure plays as equal to that of typical grocery store.

Website Development Cost

Website development costs are estimated based on a survey done by Forrester Research [11]. According to Forrester, website development costs of e-commerce sites vary based on intended order volume as shown in Figure 11. For e-grocer websites the transaction volumes are typically in 1000 to 10000 orders per day range. For the model, web-store costs were taken as those for a typical 1000 orders/day ecommerce website. In the model, marketing and customer support costs were considered separately and not as part of the website costs. According to [18], initial website of Webvan cost over 50 person years to develop. Therefore, initial website development of Webvan was 50 programmers * $120,000 per programmer/year = $6,000,000. According to [5], Webvan spent $12 million in 1999 for software development. Therefore the website development cost of around $8,000,000 used in the model is in the range typical for e-commerce sites. Also, in the model the initial website development costs were amortized and not expensed as is done for accounting purposes.

Web Store Development Costs ($K)

Site Type	Transactions / day	Core Commerce (Hardware + Software)	Content	Guided Selling	Marketing	Customer Service	Total
Basic	250	841	359	175	305	107	1787
Competitive	1000	2793	3124	2105	2127	423	10572
Leading Edge	10000	6870	10916	9945	3569	9246	40546

Figure 11. Web Store Development Costs ($K)

Website Maintenance Cost

Website maintenance costs are estimated based on a survey done by Forrester Research [11]. According to Forrester, website maintenance costs of e-commerce sites vary based on intended order volume as shown in Figure 12. For e-grocer websites the transaction volumes are typically in 1000 to 10000 orders per day range. For the model, web-store costs were taken as those for a typical 1000 orders/day ecommerce website. In the model, marketing and customer support costs were considered separately and not as part of the website costs.

Web Store Maintenance Costs ($K)

Site Type	Transactions / day	Core Commerce (Hardware / Software)	Content	Guided Selling	Marketing	Customer Service	Total
Basic	250	528	72	24	1037	284	1945
Competitive	1000	1463	935	895	8917	2063	14273
Leading Edge	10000	3555	3021	2617	18870	20762	48825

Figure 12. Web Store Development Costs ($K)

Customer Support Costs

Customer support costs for online stores was obtained from [11].

Click & Mortar Store Costs

Click & Mortar stores leverage the existing retail stores and provide online order placement and processing. They require web-based store similar to Pure Play stores. Therefore, website development and maintenance, and online customer support costs of Click & Mortar are similar to those of Pure Play stores. However, since they piggy back on existing stores for backend functions, their backend costs are arguably lower, particularly if the online sales are incremental to their Brick & Mortar counterpart. In the model, online sales are considered incremental to Brick & Mortar stores when order volumes are low (compared to target order volume in that market) and then as the order volumes increase, they are considered to gradually cannibalize the corresponding Brick & Mortar store sales. The following formula was used to estimate the store related costs of Click & Mortar stores:

Store related costs of Click & Mortars = Store related costs of Brick & Mortar Store * (Order Volume/Target Order Volume) for Order Volume < Target Order Volume

Store related costs of Click & Mortars = Store related costs of Brick & Mortar Store for Order Volume >= Target Order Volume

Fulfillment Cost:

Warehouse and fulfillment operations are at the heart of the online fulfillment process. As such, they represent the most complex and expensive investment component of the process. Decisions made here influence the order-to-receipt cycle a business may achieve, the number of SKUs it can represent online, the speed at which it can make inventory changes, and the packaging and other value-added services (such as gift wrapping) it can offer to customers.

Even organizations such as Wal-Mart have realized that established expertise in the movement of goods in bulk is not entirely transferable to the nature of single-order pick, pack, and ship. In this case, Wal-Mart chose to use Fingerhut Business Services to solve is online order fulfillment requirements. According to an executive of Wal-mart.com, the online division of the company chose to shut down its website and revamp its operations to prepare better for the online purchase fulfillment process. She also admitted that achieving sizeable order volume (such as $1 B quarterly sales of Amazon.com) takes careful and gradual ramping up of backend operations.

Figure 13 gives a snapshot of Fulfillment Costs Worksheet that is used in E-Grocer Model.

Fulfillment Costs Worksheet

Number of orders per day		10000
Average order value ($)	$	100

Costs Per Order

Fulfillment Type	Automation Factor	CAPEX	Fulfillment Person Hours/Order	Fulfillment Labor Cost	DC Capital Cost	DC Depreciation Expense
Automated DC	4	$ 40,000,000	0.19	$ 2.63	$ 1.10	$ 1.10
DC (Semi-auto)	2	$ 20,000,000	0.38	$ 5.25	$ 0.55	$ 0.55
Store	1	$ -	0.75	$ 10.50	$ -	
Self-Serve	1	$ -	0.00	$ -	$ -	$ -

Figure 13. Snapshot of Fulfillment Costs Worksheet

Self-Serve Fulfillment

If customers pick and pack their own order as in a conventional grocery store, there is no cost to the store.

Store Based Fulfillment Cost

Fulfilling orders from store lets a Brick & Mortar get to online market quickly, but it may have to change the model quickly, as the stores are not designed for picking. Peapod, which began its business using store-based fulfillment, realized that the cost of sending a shopper to fulfill a grocery list does not allow for enough profit margin to sustain the business. In addition, in Peapod's case, too often the local grocer did not have the customer's request.

Stores are not optimized for fulfillment. In fact, they are designed such a way that customers spend maximum amount of time in the store finding the items they want so that they also spend money on impulse purchases. By one estimate, the average time for a grocery customer to select and pick his/her order is 45 minutes.

Orders filled per hour per person = 60/45 = 4/3 = 1.3

"Orders filled per hour per person" determines the fulfillment cost for store-based fulfillment and also serves as the baseline metric for estimating the cost of other fulfillment approaches.

Automated DC Based Fulfillment Costs

Order fulfillment is a challenge for home delivery grocery business. Workers must sort through a dozens of similar but different food items, distinguishing one canned soup from the next in seconds. Automation helps improve the productivity of the fulfillment personnel.

Per Webvan, a hub worker could assemble 450 grocery items per hour, nearly 20 times the productivity of a store shopper. However, as Webvan offers a variety of products many of which are not filled at automated carousals, the overall productivity of DC is much lower than 20 times the average store shopper.

Webvan requires an estimated 900 people to fill and deliver 8000 orders per day. If the DC employees are roughly split equally among stocking, maintenance & support, fulfillment, and delivery,

> Orders filled/person = 8000/200 = 40/day = 5 orders/hour (representing an automation factor of about 4 with respect to store fulfillment)

According to Telemarket, a French e-grocer, it takes 20 minutes to pack an order in their current warehouse that is semi-automated. This time will be reduced to 10 minutes when a new more automated warehouse is completed.

Based on the above reasoning and data, the model considers Automated DC fulfillment to be four times more productive than Store Based Fulfillment. In other words, for Automated DC, the following metric could be defined:

> Automation Factor = (Number of orders/hour/person for DC fulfillment)/(Number of orders/hour/person for Store fulfillment) = 5/1.3 ~= 4

Cost of WebVan's fully automated DC is around $40 M. They are large (330,000 sq. ft) and could handle more SKUs (over 25,000 SKUs) than less automated and smaller DCs.

(Semi-automated) Distribution Center Fulfillment

Semi-automated DCs are similar to warehouses of HomeRuns.com and HomeGrocer.com. The order picking personnel wear wrist computers and go around the aisles that have lights indicating the item to be picked up for different order totes.

Orders filled/person at semi-automated DC will be higher than store fulfillment, but lower than fully automated DC such as WebVan's.

Therefore, orders filled/person/hour = 2 to 3 (representing an automation factor of around 2)

Cost of HomeGrocer.com DC (around $10 to $20M) is expected to be lower than fully automated DC of WebVan. They are also smaller 120,000 sq. ft and handle fewer SKUs (around 12,000 SKUs)

In the model, the automation factor for Semi-automated Distribution Center is a parameter that can be changed to determine the investment cost of Distribution Center and the fulfillment cost per order.

Delivery Cost:

Figure 14 shows a snapshot of Delivery Cost Worksheet used in E-grocer Model.

Delivery Cost Worksheet

Number of orders per day		10000
Average order value ($)	$	100
Average order weight (lb)	$	20

Costs Per Order

Delivery Type	Deliver Cost Per Order	
Local Delivery	$	4.53
Box & Ship	$	9.20
Self-Serve	$	-

Figure 14. Snapshot of Delivery Cost Worksheet

Self-Service

If customers carry their own orders, there is no cost to the store for delivery.

Box & Ship

Box & Ship precludes perishable items. If an online grocer does not carry all the items that potential customer needs, the appeal of online grocery store is potentially limited, but stores such as NetGrocer.com are using this model.

Today, common carriers like UPS, Airborne, and RPS/FedEx lose money on almost every residential delivery [28] due to insufficient home delivery volume density. However, for the Box & Ship model, we used the UPS shipping rates as shown in Figure 15.

UPS RESIDENTIAL GROUND RATES ($)
EFFECTIVE FEBRUARY 7, 2000

Weight Not To Exceed (lb)	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7	Zone 8	Average
1	4.02	4.12	4.35	4.4	4.59	4.63	4.73	4.41
2	4.08	4.28	4.61	4.71	5	5.09	5.35	4.73
3	4.17	4.43	4.81	4.97	5.26	5.4	5.81	4.98
4	4.29	4.58	5.02	5.23	5.52	5.66	6.12	5.20
5	4.42	4.71	5.2	5.43	5.72	5.92	6.43	5.40
6	4.57	4.84	5.35	5.64	5.93	6.18	6.69	5.60
7	4.71	4.96	5.45	5.79	6.13	6.38	6.95	5.77
8	4.85	5.08	5.56	5.9	6.29	6.64	7.36	5.95
9	4.98	5.21	5.66	6	6.44	6.95	7.77	6.14
10	5.11	5.32	5.76	6.16	6.65	7.36	8.24	6.37
11	5.25	5.44	5.87	6.31	6.91	7.83	8.75	6.62
12	5.38	5.58	5.97	6.46	7.17	8.29	9.32	6.88
13	5.51	5.72	6.06	6.57	7.47	8.75	9.89	7.14
14	5.62	5.87	6.16	6.67	7.84	9.22	10.45	7.40
15	5.72	6.02	6.25	6.83	8.2	9.68	11.02	7.67
16	5.81	6.19	6.4	7.03	8.57	10.14	11.59	7.96
17	5.9	6.36	6.56	7.29	8.95	10.61	12.16	8.26
18	5.99	6.55	6.76	7.6	9.33	11.07	12.72	8.57
19	6.09	6.73	6.97	7.91	9.71	11.54	13.29	8.89
20	6.21	6.92	7.18	8.22	10.09	11.95	13.86	9.20
21	6.33	7.1	7.39	8.53	10.47	12.36	14.42	9.51
22	6.46	7.29	7.61	8.84	10.86	12.77	14.99	9.83
23	6.6	7.47	7.83	9.09	11.24	13.24	15.56	10.15
24	6.73	7.65	8.04	9.35	11.62	13.7	16.12	10.46
25	6.87	7.81	8.26	9.61	12	14.17	16.69	10.77
26	7	7.97	8.47	9.87	12.38	14.58	17.21	11.07
27	7.13	8.12	8.7	10.13	12.76	14.99	17.72	11.36
28	7.27	8.28	8.93	10.4	13.15	15.4	18.29	11.67
29	7.4	8.44	9.16	10.68	13.53	15.87	18.86	11.99
30	7.54	8.62	9.37	10.96	13.91	16.33	19.42	12.31
31	7.67	8.79	9.6	11.24	14.29	16.79	19.99	12.62
32	7.8	8.97	9.83	11.53	14.67	17.26	20.56	12.95
33	7.94	9.14	10.04	11.82	15.04	17.72	21.13	13.26
34	8.06	9.32	10.27	12.1	15.41	18.19	21.68	13.58
35	8.19	9.5	10.49	12.39	15.78	18.65	22.24	13.89
36	8.31	9.67	10.7	12.67	16.15	19.11	22.79	14.20
37	8.43	9.85	10.93	12.95	16.51	19.58	23.33	14.51
38	8.56	10.02	11.16	13.23	16.86	20.04	23.87	14.82
39	8.67	10.2	11.37	13.51	17.2	20.51	24.4	15.12
40	8.78	10.37	11.59	13.78	17.53	20.97	24.93	15.42
41	8.9	10.55	11.8	14.06	17.86	21.43	25.46	15.72
42	9.01	10.72	12.02	14.34	18.19	21.9	25.97	16.02
43	9.12	10.9	12.23	14.62	18.51	22.36	26.49	16.32
44	9.23	11.07	12.43	14.9	18.82	22.83	27	16.61
45	9.32	11.25	12.63	15.18	19.11	23.24	27.52	16.89
46	9.4	11.41	12.83	15.45	19.4	23.65	28.03	17.17
47	9.49	11.57	13.01	15.72	19.68	24.06	28.55	17.44
48	9.57	11.71	13.2	15.98	19.95	24.48	29.01	17.70
49	9.65	11.85	13.37	16.23	20.21	24.89	29.42	17.95
50	9.73	11.97	13.55	16.47	20.45	25.25	29.79	18.17
51	9.82	12.08	13.71	16.69	20.69	25.61	30.15	18.39
52	9.9	12.19	13.88	16.9	20.93	25.92	30.51	18.60
53	9.98	12.29	14.03	17.1	21.17	26.18	30.82	18.80
54	10.06	12.39	14.19	17.31	21.4	26.38	31.07	18.97
55	10.14	12.5	14.33	17.52	21.64	26.54	31.33	19.14
56	10.23	12.6	14.48	17.72	21.88	26.69	31.54	19.31
57	10.31	12.7	14.61	17.93	22.1	26.85	31.74	19.46
58	10.39	12.8	14.74	18.08	22.32	27	31.95	19.61
59	10.47	12.91	14.87	18.24	22.53	27.16	32.16	19.76
60	10.56	13	14.99	18.39	22.72	27.31	32.36	19.90
61	10.64	13.09	15.1	18.5	22.91	27.47	32.57	20.04
62	10.72	13.19	15.22	18.6	23.08	27.62	32.78	20.17
63	10.8	13.28	15.33	18.7	23.25	27.78	32.98	20.30
64	10.89	13.37	15.43	18.81	23.4	27.93	33.19	20.43
65	10.97	13.46	15.54	18.91	23.55	28.08	33.39	20.56
66	11.05	13.56	15.63	19.02	23.68	28.24	33.6	20.68

Figure 15. UPS Domestic Shipping Rates

Local Delivery Cost

Local delivery of groceries requires a fleet of temperature controlled delivery vehicles. To achieve optimal delivery fleet efficiency, the vehicles must be supported by telematics and dynamic route scheduling software. The delivery fleet operating software must be properly integrated with other enterprise systems such as DC and customer support systems for optimal performance. Figure 16 shows a snapshot of Delivery Cost Model that was used to calculate local delivery costs in E-grocer Model.

Vehicle Specifications	Medium Duty Truck Based
Cost ($)	70,000
Useful Life (years)	15
Fuel Economy (miles/gallon)	10
Insurance Cost ($/year)	3,500
Maintenance Cost ($/year)	5,250
Volume Capacity (cubic feet)	1,200
Payload Capacity (lb)	10,000
Driver Productivity Factor (base Low Efficier	0.9

Market Data	
Driver Wages ($/hr)	14
Fuel Price ($/gallon)	1.5
Interest Rate (%)	10%
Fleet Manager Wages ($/hr)	20
Work Hours per shift (hr)	8
Number of working days/year	365

Product Data Groceries	
Gross Margin (%)	32%
Average Order Size ($)	100
Average Order Volume (cubic feet)	8.00
Average Order Weight (lb)	20.00

Avg Dist. Between Destinations (miles)	2
Avg Speed of Vehicle (mph)	35
Average Loading Time at DC (hr)	1.00
Avg Time at Each Delivery Location (hr)	0.13
Avg Travel Time Btwn Destinations (hr)	0.06
Avg time btwn two deliveries (hr)	0.21
Number of Delivery Shifts per vehicle per day (#)	1.00
Number of Vehicles per Fleet Manager (#)	10

Max Volume Capacity Utilization	17.05%
Max Payload Capacity Utilization	5.11%
Vehicle Cost as % of Revenue (% $/hr)	1.56%

Labor Cost as % of Revenue (% $/hr)	4.38%

Max Number of Orders per Hour (#/hr)	4.87
Realized Number of Orders per Hour (#/hr)	3.65
Maximum Number of Orders/vehicle/day (#)	25.57345
Delivery Cost as % of Revenue (% $/hr)	5.94%

Delivery Cost Analysis (per hour)

Revenue Generated		365.34
Delivery Costs		21.71
Driver Wages and Benefits		14.00
Fleet Manager Wages		2.00
Vehicle Cost		5.71
Fuel Cost		1.10
Insurance Cost		1.20
Maintenance Cost		1.80
Depreciation Cost		1.60
Financing Cost		0.02
Delivery Cost Per Order	$	5.94

Figure 16. Delivery Cost Model

The Delivery Cost Model accounts for a number of vehicle, market, and product related factors to estimate the number of deliveries per hour and the cost of delivery per hour. For a given delivery region such as Suburban USA, the model takes into account distance between two customer locations and the average delivery time at each location to compute the maximum deliveries possible per hour. The model also accounts for the fact that due to limited market demand, maximum order delivery capacity may not be realized. The model therefore computes realized order deliveries per hour per vehicle as a fraction of maximum order deliveries per hour per vehicle based on orders per day/target order volume in that market.

Model Verification

To check the reasonableness of the model, a number of sanity checks have been performed, such as the following:

- Figure 17 shows the operating profit of a brick & mortar store as predicted by the model. The model "opens" a new brick & mortar grocery store of the size of Kroger supermarket for every 400 orders/day incremental volume. As new stores are open the operating margin dips as the new store volume ramps up to the design volume (400 orders/day). As the order volume increases, the model predicts that the operating margin of the chain of supermarkets approaches 4.33%, which is very similar to the operating margin of a brick & mortar grocery store chain such as Kroger.

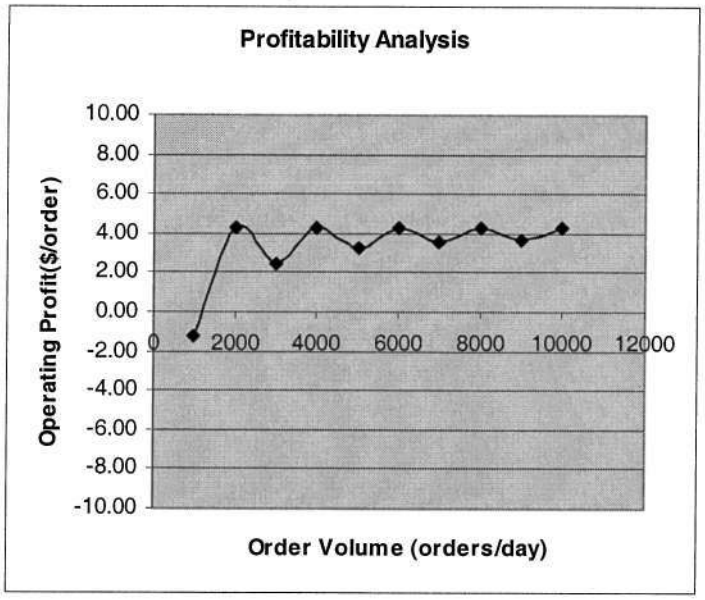


Figure 17. Operating Profit of a Brick & Mortar Grocer ($100 average order)

- Figure 18 shows the profitability analysis of a Pure Play Grocery Store with Automated DC and Local Delivery model such as WebVan's. The model predicts that WebVan type e-grocer will have a break-even volume of around 4000 orders/day with average order size of $100. This breakeven volume is similar to the numbers suggested by WebVan [5] and security analysts who follow WebVan [18]. Also, TheStreet.com's Katie Hobson reported in October 2000 that for Webvan to break even in the San Francisco Bay market, home to its prototype facility, the company would have had to record between 3,300 and 3,500 orders a day at an average of $110 an order.

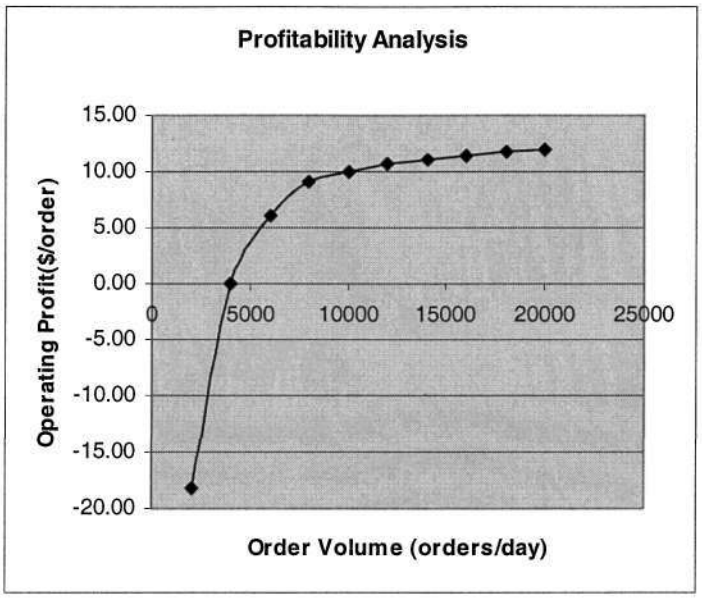


Figure 18. Profitability Analysis of WebVan type business model ($100 average order)

- According to Shop.org/BCG [1], fulfillment costs per order are $18.10 for store-based multi-channels. According to the model, a Click & Mortar grocery store with store based fulfillment and box & ship delivery will have fulfillment & delivery cost of around $19.

The Results

The E-Grocer model was used to study the profitability of major e-grocery business models. For these analyses the following product and market data were used:

Product Data for Groceries

Average order value ($)	$100
Gross Margin	32%
Average Order Weight (lb/$100 of product)	20
Average Order Volume (cu.ft/$100 of product)	8

Market Data for USA Suburban

Interest Rate	10%
Working days/year	365
Hours in a work day	8
Fuel Price ($/gallon)	$1.5
Semi-skilled Wages & Benefits ($/hr)	$14
Skilled Wages & Benefits ($/hr)	$20
Distance between customer locations (mi)	2
Asset Depreciation Period (years)	10
Target Order Volume (orders/day)	8000

For all of the analyses, revenue did not include any shipping and delivery charges.

WebVan Model

Webvan is a Pure Play e-grocer with automated DC fulfillment and local delivery. As shown in Figure 19, all of its operating costs (store, fulfillment, and delivery) costs decline as order volume increases. This model breaks even at 4150 orders/day and has a potential achieve 10% operating margin.

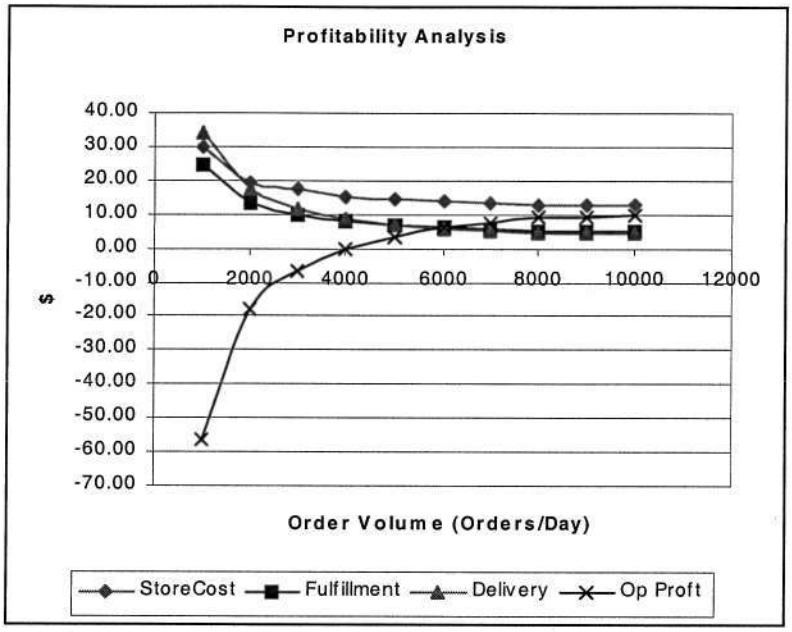


Figure 19. Profitability Analysis of WebVan type E-Grocer

HomeGrocer.com Model

HomeGrocer.com is a Pure Play e-grocer with semi-automated DC fulfillment and local delivery. As shown in Figure 20, all of its operating costs (store, fulfillment, and delivery) costs decline as order volume increases. This model breaks even at 4140 orders/day and has a potential achieve 8.5% operating margin. It is interesting to note that the breakeven volume of both WebVan and HomeGrocer.com models turn out to be about the same even though their distribution centers are of different types (in the model Webvan's DC has twice the productivity of HomeGrocer.com's DC, but also costs twice as much to build).

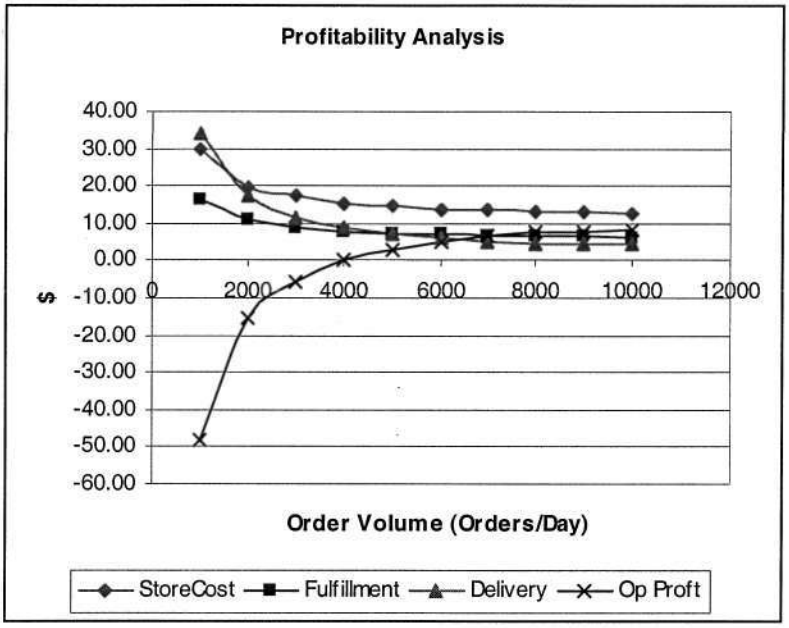


Figure 20. Profitability Analysis of HomeGrocer.com type E-Grocer

NetGrocer.com Model

NetGrocer.com is a Pure Play e-grocer with semi-automated DC fulfillment and box and ship delivery. As shown in Figure 21, all of its operating costs (store, fulfillment, and delivery) costs decline as order volume increases. This model breaks even at 4820 orders/day and has a potential achieve 3.9% operating margin. It is interesting to note that NetGrocer.com model will achieve the same operating margin as a traditional supermarket without charging for shipping and handling.

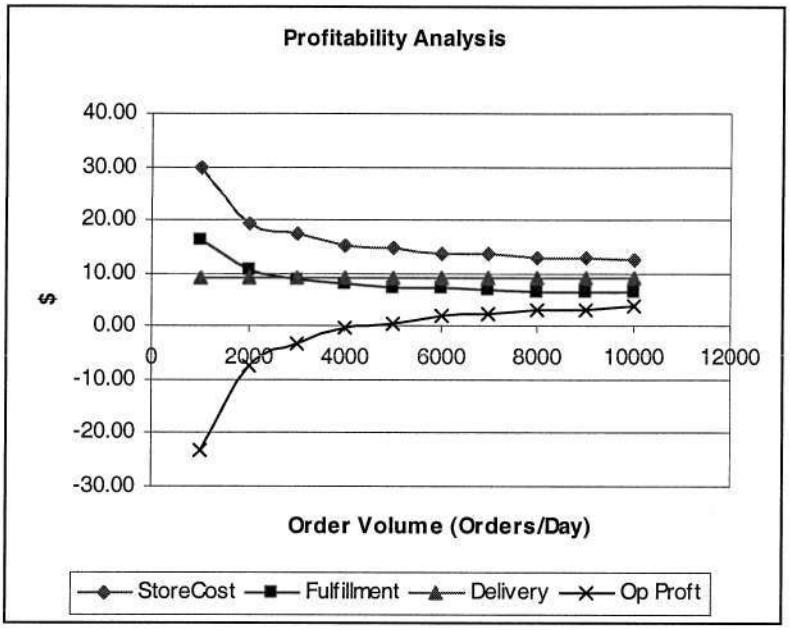


Figure 21. Profitability Analysis of NetGrocer.com type E-Grocer

Tesco Model

Tesco is a Click & Mortar e-grocer with store based fulfillment and local delivery. As shown in Figure 22, its store costs actually go up as order volumes pick up based on the assumption that as online order volume increases, there would be cannibalization of physical store sales and hence more of the store costs would have to be allocated to its online store. Tesco's fulfillment costs are $10.50/order and they do not change with order volume as store based fulfillment can enjoy little scale economics. Tesco's delivery costs drop with increasing order volume to reach $4.53 per order as local delivery costs go down with increased delivery density.

This model does not break even without handling and delivery charges. At $10 per order delivery charge, the model will be profitable in 2000 - 6000 orders/day range. It is interesting to note that Tesco model is not profitable at very low or at very high volumes even with a $10 per order delivery charge.

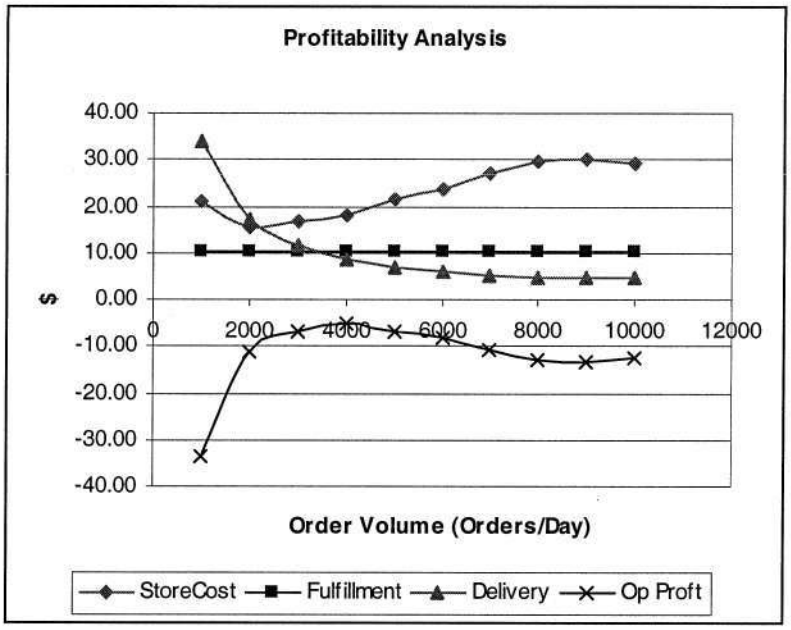


Figure 22. Profitability Analysis of Tesco type E-Grocer

Basha's Model

Basha's is a Click & Mortar e-grocer with store based fulfillment and self-service delivery. As shown in Figure 23, its store costs actually go up as order volumes pick up based on the assumption that at low volumes online sales are incremental to its store sales and hence store costs are not allocated to them, but as online order volume increases, there would be cannibalization of physical store sales and hence more of the store costs would have to be allocated to its online store. Basha's fulfillment costs are $10.50/order and they do not change with order volume as store based fulfillment can enjoy little scale economics.

This model breaks even at less than 1000 orders per day and remains profitable through 5000 orders/day without handling and delivery charges.

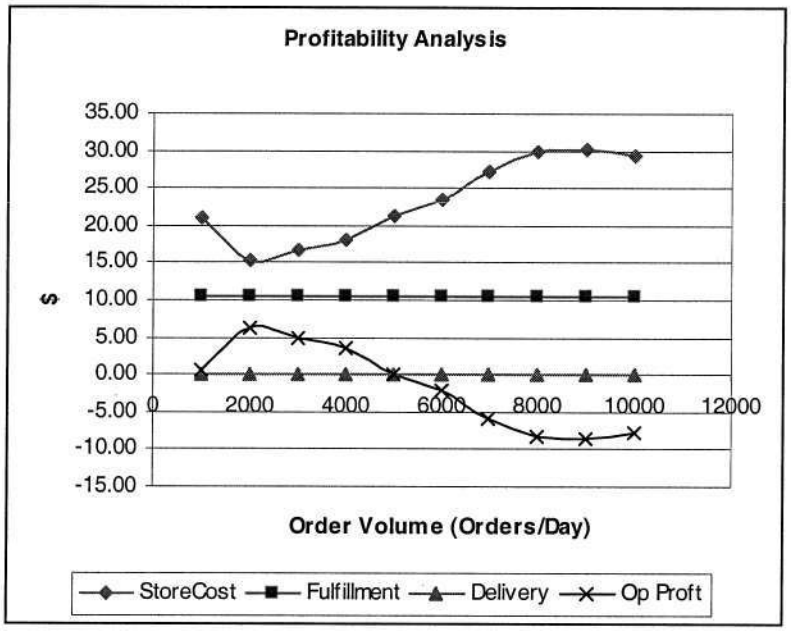


Figure 23. Profitability Analysis of Basha's type E-Grocer

Bring Out the Crystal Ball

Conclusions

In this project, we developed an analytical model that allowed us to study various e-grocery business models. We used publicly available data to populate the model and then analyzed the profitability of different e-grocer models under various conditions.

Figure 24 summarizes the operating profit curves of major e-grocery business models studied. This analysis was done without including handling and delivery charges and for the following product and market data:

Product Data for Groceries

Average order value ($)	$100
Gross Margin	32%
Average Order Weight (lb/$100 of product)	20
Average Order Volume (cu.ft/$100 of product)	8

Market Data for USA Suburban

Interest Rate	10%
Working days/year	365
Hours in a work day	8
Fuel Price ($/gallon)	$1.5
Semi-skilled Wages & Benefits ($/hr)	$14
Skilled Wages & Benefits ($/hr)	$20
Distance between customer locations (mi)	2
Asset Depreciation Period (years)	10
Target Order Volume (orders/day)	8000

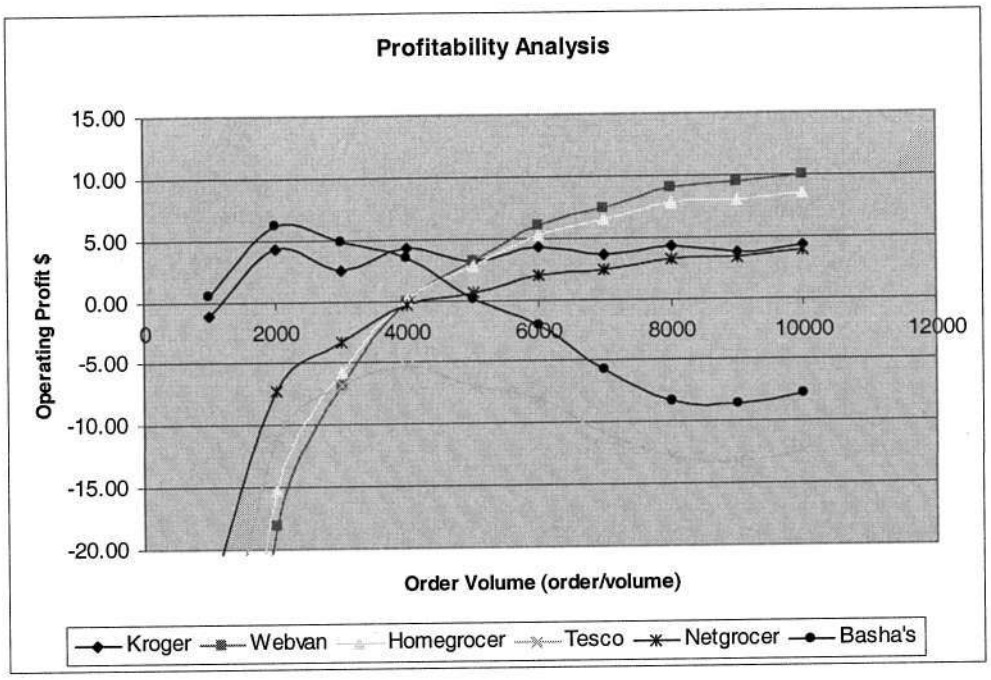


Figure 24. E-Grocery Model Profitability Analyses Summary

As shown in Figure 25, a Click & Mortar model with store-based fulfillment and self-service delivery (e.g., Basha's) can be profitable even at low volumes (< 1000 orders/day) if online sales are considered to be incremental to existing store sales.

If local delivery is added to such a Click & Mortar store (e.g., Tesco), the store needs to charge for handling and delivery, to be profitable. Even then, the profitability declines as the order volume picks up and physical store sales are cannibalized by online store.

Netgrocer.com model (pure play with DC based fulfillment and box & ship delivery) has the potential to achieve operating margins similar to that of a traditional grocery store even without charging for shipping and handling.

HomeGrocer.com (pure play with DC based fulfillment and local delivery) and Webvan.com models (pure play with automated DC fulfillment and local delivery) have the potential to achieve significantly higher operating margins than that of traditional supermarket.

Our model predicts that e-grocery business can achieve profitability at sufficiently high order volumes. In reality, the following deviations seem to be occurring:

- E-grocers with new business models such as WebVan have the dual problems of creating demand while debugging their systems to handle the designed capacity.

- Marketing costs for pure play groceries have been significantly higher than industry norm. For example, even though they have been declining from year to year, WebVan's marketing and sales costs were 35% of sales in 2000. In comparison, a traditional supermarket chain like Kroger spends less than 2% of sales in marketing costs. One reason for high customer acquisition costs seems to be the fact that ordering groceries online is a deep sell even though it is supposed to be a more convenient alternative for the customers. Difficulties such as low

speed Internet connections, long waits for deliveries to arrive, and inaccurate deliveries as the e-grocers debug their systems seem to be limiting speedy growth of online grocery customers.

- Due to intolerance of capital markets for non-profitable ecommerce companies, many e-grocery businesses are folding up or are being acquired before reaching break-even order volume and sustainable business conditions. For example, distressed Peapod has been acquired by Royal Ahold. Similarly, the stock of now combined WebVan and HomeGrocer.com is at a level that precludes additional capital availability and hence the company faces financial distress if the existing investments cannot be made profitable within several quarters.

As a result, Brick & Mortar grocery stores with online initiatives seem to be in a vantage position to capture the customer base that is now educated about the benefits of online grocery shopping, thanks to the initiatives of pure play grocery businesses.

On the other hand, Brick & Mortar stores without existing or planned online initiatives are likely to face tough new rules as e-grocery models that eventually prove sustainable provide additional value added services such as home delivery competitively.

Recommendations

To e-grocers:

- Adapt a fulfillment/delivery model that is appropriate for the market conditions and do not necessarily use a cookie cutter approach. Balance growth with profitability – expect to scale gradually and limit marketing & customer acquisition costs as well as capital expenditures.
- Explore all revenue sources – banner advertisements, advertisements on delivery vehicles, affiliate marketing (one to one marketing and coupon delivery), and subscription fees.
- Early customers are likely to be those for whom home delivery is valuable, therefore, charge delivery fees.

To traditional grocers:

- If e-grocery models prove sustainable, they have the potential rewrite the rules of grocery retailing by offering value added services such as home delivery at very competitive prices. Therefore, traditional grocers should definitely explore the online channel.
- Store based fulfillment and delivery may allow traditional grocers a quick entry in to online channel. However, as order volume ramps up, they should look for more efficient means of handling fulfillment and delivery.

To government/policy makers:

Policy makers should encourage e-delivery:

- E-delivery is likely to have society-wide benefits. Average American family spends more than 200 hours each year doing errands [36] – if some of that time is saved – could it increase the quality of life and result in social benefits? What if moms could stay home and spend time teaching kids while waiting for groceries to arrive?
- If e-delivery is widely accepted, one delivery vehicle trip will replace several trips by consumers to stores. As a result, there will be net fuel and emissions savings.

E-tailing and e-delivery could have other societal impacts as well:

- There could be downward pressure on commercial retail prices as traditional brick & mortar retail business comes under pressure due to growth in online retail.
- At least theoretically, e-grocery as well as other e-tail models are more efficient than brick & mortar counterparts as measured by revenue generated per employee. This could affect the employment levels in retail industry.

Predictions

The growth in online grocers seems to be slow currently, but it will eventually pick up and become a significant portion of the retail grocery market for the following reasons:

- Tedious order entry is limiting home shopping growth [37] - especially for groceries as the customer needs to dial up to ISP, go to e-grocer web-site, find and select products, then place the order. However, this will change as more sophisticated websites that make order entry easier by keeping customer's lists, etc. and smart scanning appliances such as those from High Point Systems come in to use.
- Currently customers prefer tactile interaction with food items and do not trust ordering food over the web. This will change with even more realistic presentations of product descriptions on the web – eventually even including aroma and touch and feel! Also, as customers try online grocers, they are likely to discover that the quality of groceries delivered to homes is indeed good.
- Eventually, a paradigm shift will occur in grocery retailing as well as in other retailing categories due to e-delivery:

  Current paradigm: Home delivery is a luxury and you pay premium for the convenience

  New paradigm: Brick & mortar retail shopping provides values such as physical touch and feel of products, entertainment, and instant gratification that are not found in e-tail shopping. Therefore, you pay premium for brick and mortar shopping. Home delivery is the cheaper alternative!

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