A STRATEGIC ANALYSIS OF ONLINE GROCERY AND ITS FUTURE OUTLOOK

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Submitted to the Engineering Systems Division in partial fulfillment of the requirements for the degree of

Master of Engineering in Logistics

At the

Massachusetts Institute of Technology

June 2004

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BARKER

To my parents,
and to Dao

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Submitted to the Engineering Systems Division on May 5, 2000 in partial fulfillment of the requirement for the degree of Master of Engineering in Logistics

ABSTRACT

The e-commerce boom has led to a major shift in business paradigm from the traditional brick-and-mortar store to the direct sale click-and-mortar model across the business world. Amazon and Dell pioneered the direct sale concept and fundamentally changed the way of doing business in their industries. Since then, many traditional industries have experienced similar transformations. Online grocery business, for example, has seen many failed endeavors to emulate Amazon and Dell's success in the past few years. The most famous one was Webvan - a 7.8 billion dollar roller coaster ride that in two years burned through all its cash reserve and produced zero profits. Webvan epitomized one of the classic mistakes during the dotcom era - the "Get-big-fast" doctrine that infatuated the e-commerce world at that time.

On the other hand, other online store such as Tesco and Peapod cautiously laid out their operations that strategically aligned with their original vision of the online grocery business – not as a revolutionary new business model but as a value-added convenience service provider that exists on top of the existing structure. That strategy not only helped them survive the turmoil of e-commerce downturn but also turned them into successful players in the markets they are serving.

This thesis will analyze these three online grocers' business models and explore the underlying reasons that contributed to their failure and success, respectively. A recent trend in online grocery business is to positions online grocery store as a premium food and service provider that delivers high quality food products to the upper-income group. A representative case – FreshDirect is analyzed to bring insights to this new niche market. From these findings, a list of recommendations are suggested to help future online grocers avoid the mistakes made by the earlier attempt, align their business strategy with the growing consumer interest in specialty foods and wellness services and find the niche market that is best for their business.

Finally, a vision of future online grocery store is conceptualized based upon the latest Semantic web technologies and a successful supply chain management practice in the retail industry – Vendor Managed Inventory (VMI).

ACKNOWLEDGEMENTS

I would like to express my deepest appreciation to my thesis advisor, Dr. Joseph Coughlin, for his support and valuable advice during the thesis writing. Without his patient guidance and input, the thesis would not have been finished.

I am also grateful to the faculty members at MIT, especially to Professor Simi-chi Levi, who have enlightened me with their advice and teaching.

I would also like to thank my fellow MLOG classmates for giving me a great opportunity to learn from them and making my time at the program an enjoyable one.

Finally, I would also like to acknowledge myself for enduring this grueling process.

Kang Xie
Cambridge, MA, May 7, 2004

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Introduction

The Internet has completely transformed business world during the past few year and created a new business paradigm – consumer-direct e-commerce. Consumers no longer have to go through an intermediary to purchase the products. The web has given them the means to purchase products directly from the vendors. The disintermediation led to an explosive growth of e-commerce during the dotcom era. Amazon.com and Dell Computer were the frontrunners who pioneered the concept of direct sale in the book and PC markets and have achieved phenomenal successes. Their models created a trend in the New Economy – a shift from brick-and-mortar shops to consumer-direct virtual stores. Many traditional industries have experienced the travails of this transformation in recent years.

The grocery business, for example, has seen many e-commerce startups trying to change traditional grocery shopping behavior. Although their approaches were varied, their objective was the same: to provide convenient and cheap grocery-delivery service to consumers using Internet technologies. However, their meteoric rise can only be shadowed by their sudden downfall. The rise-and-fall of on-line grocery stores has marked one of the most dramatic chapters in the dotcom era. An interesting question to answer is that what contributed to their demises and more importantly what are the improvements that have been made over the past few years in technologies and supply chain management that can help online grocers overcome those hurdles and make on-line grocery a viable and competitive business.

Three on-line grocery businesses: Webvan, Peapod and Tesco in United Kingdom were dissected to understand the dynamics of the on-line grocery business and the challenges they faced. Their business models, strategies and operations were analyzed and compared with each other to determine what the underlying factors to their failure and success are. Webvan epitomized the on-line grocery business during the dotcom era and provided a classic case study to understand the operational and strategic challenges that foundered most of the on-line grocers. Tesco, on the other hand, stood in stark contrast with Webvan since it has not only survived the e-commerce bust but achieved great success in the online grocery market in UK. The comparison of these two

companies can give us a comprehensive account of what makes an on-line grocery business successful. In addition, a current online grocer in the US market – Peapod was also discussed to illustrate the proven strategy of using existing infrastructure to save upfront cost in facilities. Their examples can give future online grocers important lessons of the operational challenges they will face in this industry and insights on how they may avoid those pitfalls in their business.

A vision of a future online grocery model that builds on top of the latest developments in web technologies and household appliance is conceptualized to show that how technologies can help online grocers overcome some of the inherent weaknesses in the system. Many studies and real-life cases have shown that online grocery business was not born out a false promise but was brought down by a series of strategic mistakes. The focus of this thesis is to identify those oversights and what the future online grocers can do to avoid the fate of their predecessors and turn online grocery into a sustainable business. Moreover, this thesis will argue that convenience provided by online order and home delivery is a necessary but not sufficient condition for the online grocer to sustain their business. They must create new value-added services to differentiate themselves from the traditional stores to gain competitive edge. For example, the aging population in the US produced a new niche market for wellness and heath service. Online grocer stores could use its superiority in technology to the traditional grocery store to explore business opportunities in those hidden markets.

1 Promise and Potential of Online Order and Home delivery

The online grocery business grew out of the two simple assumptions about the viability of this model: 1) Consumer behavior changes driven by the proliferation of online shopping provide a basis of acceptance 2) Existing technology can make this business model work.

Consumer Behavior

From the consumer perspective, on-line grocery shopping has loomed large like a potential winner in the Internet sweepstakes, with its promise of an escape from the drudgery of grocery shopping. For many modern professionals, grocery shopping is considered a hassle and a chore. A seemingly short trip to the local store can usually take longer than expected due the traffic and long check out line during peak time. On-line grocery shopping was therefore born under the assumption that today's time-starved professionals are willing to pay a small service fee in exchange for the convenience home delivery service can provide.

According to a research conducted by Peapod, 67% of urban population is interested in or is considering using on-line service to order their groceries [Peapod, 9-502-050, HBS, 2002]. Two researchers at Helsinki University of Technology in Finland have found out using computer simulation models that e-grocery home delivery service can actually be as much as 43 per cent cheaper than the costs of customers visiting the store with their cars and time. There is also a strong argument in favor of the forecast showing rapid growth of the e-grocery market. According the Forrester Research Inc., a market-research firm in Cambridge, Mass., estimates that Americans will spend $27.1 billion to buy food, household and beauty supplies online by 2004, up from $1.1 billion in 1999. Similar opinions also were shared in Europe and other developed countries. The average household spends $4,000 per year on groceries. The latest Nielsen/NetRatings,

statistics have shown that there are over 272 millions people are now subscribed to the Internet, that accounts for 74.9% of the population in the USA.

These statistics shows that the online market is enormous and fast growing and it is full of business opportunities for e-commerce such as on-line grocers to explore.

Technology Development

Internet technology provides the vehicle that bridges the consumers with the suppliers. In the past the customer did not have the means to search a wide range of vendors for the cheapest price or buy products directly from the suppliers. Internet gives them the ability to search the best price, compare products and make purchases directly from the web. Business applications that can offer many functions and database technologies that can store large amount of data has given e-commerce the necessary tools it needs to run the business. The cost for computer hardware such as CPU, server, and hard disks has come down significant during the past few years but their qualities and capacities have made huge improvement. In addition, the global network of Internet has undergone significant revamping. Fiber optics have been deployed to provide fast and large-volume data exchanges that can transmit data at gig bytes per second. The broadband explosion led by the growing adoption of cable and DSL has elevated the online experience to a new level. The proliferation of wireless technologies such as the wi-fi technology, PDA and cell phone has made going online as easy and as ubiquitous as ever. Consumer now can access the internet anytime, anywhere with a handheld device or cell phone. Most of these technologies were either non-existent or at earlier stage during the dot-com era. But now they have been improved to meet the challenges of on line shopping.

1.1 Tale of Three Business Models: Webvan and Peapod and Tesco

1.1.1 Overview: the rise and fall of Webvan

The story of Webvan represented a classic chapter in the dotcom boom-and-bust drama. Webvan was conceived by Louis Borders, one of the founders of the Borders Group Inc. bookstore chain. It roared into existence in 1999 with heavy fanfare and a blue-chip roster of backers that included venture capitalists Benchmark Capital and Sequoia Capital and Softbank America Inc. Combining deep pocket with experience, it recruited senior executives from major companies such as the head of Accenture, senior vice president from FedEx and UPS to join the management team. At the height of its boom, the company had a market cap of 7.8 billion dollars and had about $805 million in cash. As an e-commerce analyst with New York consultant Booz-Allen & Hamilton put it, "If someone is going to make online grocery delivery work, it will be them". Embodying the Web-era saying, "get big fast or go home," Webvan poured much of that money into building high-technology warehouse facilities and a 26-city expansion plan. As a result, it quickly burned through its $1.2 billion cash reserve in a period of two years without making a single profit.

1.1.1.1 Webvan's business Model

Webvan offered same-day delivery of consumer products through an innovative proprietary business design that integrates Webstores, distribution center and delivery system. Its principle product offerings are focused on food both perishable and non-perishable, non-prescription drug products and general merchandise including house wares, pet supplies and books.

Technologies:

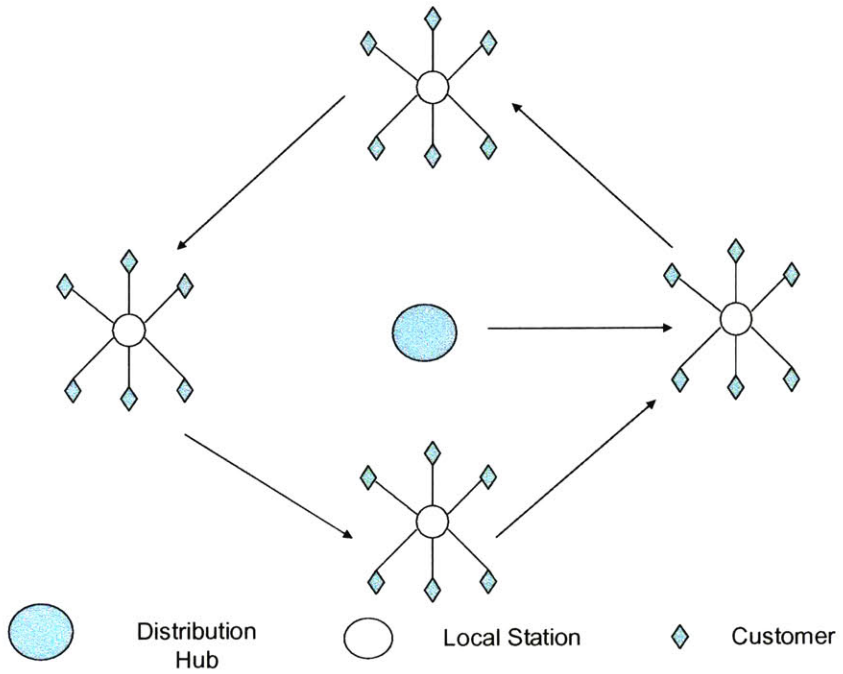
Webvan's primary interface with the users is its Webstore – a presumably user-friendly and personalized web site which enables users to quickly and easily choose from a wide selection of items. Each item on the site has an image and many grocery products have nutritional information attached. The website can also allow user to personalize their shopping experience: Multiple lists can be saved for weekly shopping, specific events or special occasions. [Webvan, 9 – 500- 502, HBS, 2003]

Webvan devoted a total of $18 million dollars from 1997-1999 in software development. It designed and built an advanced systems platform, which integrates its entire business process from front-end to back-end from ground up. It has built an array of proprietary advanced inventory management, warehouse management, route management and material handling systems and software to manage the entire customer and ordering and delivery flow process. For example, its proprietary automated materials handling controller communicates with the Webstore at the front-end and with the warehouse management system in the back-end and issues instructions to the various mechanized areas of the distribution center to ensure the proper fulfillment of orders. The vertical integration of different stages of operations creates a tight and seamless operational flow that minimizes human errors and ensures high productivity. The system is designed to utilize automated conveyors and carousels to transport items to centrally located employees. As a result, the system is scalable and allows Webvan to increase volume without a proportionate increase in human resource. The state-of-the-art inventory-tracking system was designed by its founder Mr. Borders in 1970s. He incorporated Webvan in order to build an elaborate mechanized warehouse based on his original 1970 model. The result was Webvan's 330,000-sqaure-foot distribution center, in Oakland, Calif. The wiring alone cost $3 million. [Webvan, 9 – 500- 502, HBS, 2003]

Delivery Operations

Webvan employed a hub-and–spoke delivery system. See Diagram below. Orders are collected from the Webstore, routed and managed by the distribution center, transferred to stations and delivered from the stations to customers' homes. The two-tiered model gave Webvan the flexibility to take advantage of centralized order fulfillment with decentralized delivery methods. The highly automated distribution center

allowed Webvan to assemble the order for the consumer in one twentieth of time used by the consumer – or three minutes. Deliveries can be made from 7:00am to 10:00pm every day of the week from its Oakland facility. The customers must be at home to accept delivery of perishable or frozen items or regulated products such as alcohol and tobacco. Non-perishable items may be delivered when the customer is not home.



Webvan's two-tier delivery system

The total cost of order fulfillment and delivery is estimated to $15 per order. [TQM, 2003]

Suppliers and Vendors

Webvan sources grocery products from a network of food and drug manufacturers, wholesalers and distributors. Because it covers a wide geographical area and service high volumes from a single point of distribution, it had a simple supply network for its suppliers and thus enjoyed a discounted pricing for its grocery products.

Competitors

Webvan's principal competitive factors that affect its business are location, breadth of product selection, quality, service, convenience, price and consumer loyalty to

traditional and online grocery and non-grocery retailers. Some of the Webvan's competitors include Streamline, Homegrocer, Albertson's, and NetGrocer. [Webvan, 9 – 500- 502, HBS, 2003]

Peapod

Peapod was Webvan's main competitor. Peapod was the on-line grocer with the longest track record. However, from its inception until 1998, Peapod had operated exclusively in partnership with grocery stores, which differentiate itself from the rest of on-line grocers' business model. In addition, Peapod charges its customers a membership to use its service and that membership accounts for almost 12% of Peapod's revenue in 1999. Webvan did not charge membership fee and waived delivery fee over $50. Peapod went public in June 1997 but failed to capture the investing public's imagination. It had a market capitalization of $204 million in 1999.

1.1.2 An analysis of Webvan's downfall

Webvan's downfall, along with many other e-commerce, has proven that the Internet-era strategy of "getting big fast" was fundamentally untenable. The definition of the get-big-fast strategy includes three criteria: massive up-front investment in customer acquisition and infrastructure-building, products and services that are often free or deeply discounted, and abundant funding provided by the exuberant capital markets The get-big-fast strategists believed that the winner-take-all dynamics apply in the Internet game and rapid expansion can capture enough market shares to turn the business into profit. However, many of them did not fully assess the challenges accompanied with rapid growth and underestimated the difficulties for a fledging business to expand its operations. Webvan's business strategy was representative of the imbalanced thinking prevalent during the e-commerce Boom and it meets all three criteria mentioned above. Its debacle proves again that future e-business must carefully evaluate its business strategy to get the model right and then use technology only as an enabler to fulfill its strategic design.

1.1.2.1 Profligate Spending with a conflicting low-cost strategy:

As soon as Webvan launched into existence, it immediately rolled out a 26-city expansion plan that locked itself into a billion dollar construction contract to build 26 high-tech distribution centers at $30 million a pop. Two factors underlay Webvan's aggressive drive for growth. The first was the threat of emerging competition. Peapod had a head start over Webvan in the online grocery market, though it was losing money. A greater challenge stemmed from HomeGrocer, a Seattle-based online grocery company. Around the same time that Webvan launched its operations, Amazon.com announced it had bought a stake in HomeGrocer. The Amazon-HomeGrocer combination could have affected Webvan's prospects significantly. For Webvan, the only way to head off that threat seemed to be to make a run for dominance [Wharton, 2001].

Webvan executives believed the threat of competition made the company's drive for market dominance necessary. The second factor--easy availability of capital--made that drive possible.

In 1999 capital was flowing in tidal waves towards technology and Internet companies, especially those backed by leading Silicon Valley venture capitalists such as Benchmark Capital and Sequoia Capital--both of which were solidly in Webvan's corner. That year venture-capital investments reached an all-time high of $48.3 billion, an increase of more than 150 percent over 1998's total, according to the NVCA and Venture Economics. More than 90 percent of that capital went to high-tech and Web-based companies. Under this circumstance, even if someone at Webvan had wanted to try its online grocery model in one city, improve upon it, and then expand to other cities, the financial climate of those times would have had little patience with that approach [Wharton, 2001].

In addition to these two factors, Webvan was born with notion that it would have to do everything from scratch, and that a new type of company would be required to do it. As a result, Webvan invested heavily at the startup in construction of high-tech distribution center. Each hub would cost between $25 million to $35 millions to construct and equip. And it entered into a $1 billion contract with the construction company Bectel to build 26 warehouses [Webvan, WSJ, 2000].

In retrospect, the highly automated distribution center would offer efficiencies only if fully utilized. But investing in infrastructure heavily during the start-up phase carries huge potential risk – particularly when there is uncertainty about the utilization level and demand. The fact is that Webvan never attracted enough demand to utilize any of their distribution centers above 20-30%. Therefore, the 30 million dollar distribution center was an expensive waste. Peapod and Tesco, on the other hand, used existing facilities to lower the infrastructure cost. They also relied more on manual picking rather than on automatic processes. It may seem inefficient on the surface but for a limited size market it achieves the objective of minimizing facility expenditures while sacrificing some degree of order picking efficiency. [TQM, 2003]

Webvan spent enormous sums trying to build a brand name and a customer base while overlooking the basics of the grocery industry. "We made the assumption that capital was endless, and demand was endless," new CEO Robert Swan said in a June interview. [WSJ, 2000]. In its short life, Webvan's exorbitant expending coupled with unscrupulous expansion plan put the company on fast track to bankruptcy.

When Webvan merged with rival HomeGrocer.com, its spare-no-expense approach stood in stark contrast to HomeGrocer's more conservative strategy. Webvan shelled out more than $25 million for each of its massive facilities vs. HomeGrocer's $5 million or so for smaller, lower-tech operations. Webvan's warehouses needed some 1,000 servers and 16 employees to run the back end, but HomeGrocer's got by with just 100 servers and two employees. And while Webvan needed about 4,000 orders a day to break even per facility, HomeGrocer required just 1,500. "Webvan took an extreme position," says Evie Black Dykema of Forrester Research Inc. "They opted to automate the entire business and that dug a very big hole." [WSJ, 2000]

However, many of Webvan's managers were so steeple in the company's original vision that the cost-cutting measures it did finally take were steps that grocery veterans would have known to avoid. For instance, Webvan switched to lower-quality produce suppliers in California, turned off many customers. "We slipped," conceded CEO Swan. "We had started to think of the customer as a statistic or number instead of as a Tom and a Sally."[WSJ, 2000]

1.1.2.2 Order Density

Another problem Webvan had to cope with is the "Order density" dilemma. It makes more money when the homes it delivers to during a specific time period are clustered near one another. But Webvan's half-hour delivery windows are filled on a first-come, first-served basis, and Webvan can't bet that neighbors will collude to have their groceries delivered at the same time. So it has devised a system to let customer know when Webvan will be in their area, leaving a potential route to profitability in the hands of its customers. The high transportation costs for this scattered system was a major hurdle that Webvan failed to overcome on its way to profitability. It is estimated that Webvan lost more than $130 per order. [Wharton, 2003]

In fact, many on-line grocery stores committed themselves to a very tight delivery window that was too short to accumulate enough density in demand. The scattered distribution made it hard to keep the transportation cost down - a major factor that drove most on-line grocers out of business.

So does Webvan's failure mean that online grocers' prospects are the same as the perishable good they are delivering? Not necessarily. Some believe it can still be a solid business, though one that will likely mature more slowly than anything Webvan anticipated. A soon-to-be-released study from IBM's consulting arm predicts that by 2004, enough demand will exist in some metropolitan areas to support at least three profitable grocers in those markets. "There is demand, and there are profitable ways of servicing these markets," says IBM's Ming Tsai. The examples of Peapod and Tesco may illustrate this point well.

1.2 The Business models of Peapod and Tesco

Several old-fashioned grocery chains claim that they are already making profit in on-line grocery business. Royal Ahold, the Dutch-based chain that now controls online grocer Peapod Inc., says its Net business is profitable in Chicago and Massachusetts. Safeway Inc. is revamping its online unit, GroceryWorks.com, by employing a profitable business model developed by Tesco PLC, the large British-based grocery chain. What is

the difference between the Webvan's business model and those of Peapod and Tesco? In short, both Peapod and Tesco carefully selected their positions in online grocery business. Rather than trying to conquer new market, they see online shopping simply as one more channel to serve existing customers. For now, that looks like the most likely path to online grocery profitability.

1.2.1 Peapod

Founded in 1989, Peapod by 1998 was serving 10,000 consumers in seven markets (Boston, Chicago, San Francisco, Long Island, Dallas, Houston, Austin, and Columbus). Peapod's ordering process was similar for consumers using other on-line service. One difference that sets Peapod from other on-line grocery stores is upon completion of the orders entry process, customer can choose either to pick up completed orders themselves at nearby Stop & Shop stores or to receive home-delivery the next day within a three-hour time window designated by the customer. All orders were processed by employees who either physically combed the aisles of Stop & Shop stores or gathered products from centralized warehouse facilities. Another major difference is that Peapod's alliance with local supermarket chain in developing grocery business.

Ahold, International supermarket operator, based in The Netherlands, purchased a 42% of the Peapod. The alliance with Ahold protected Peapod from the turbulence experienced by most e-commerce companies when the Internet bubble burst in 1999. It may be one of the reasons that it could outlast Webvan and other on-line competitors. Not only does Peapod have Ahold's $65 billion in purchasing power behind it and the strength of several leading grocery chains with which it co-branded, but also it has access to Ahold's supply chain and stores. More importantly, Peapod chose a different approach to on-line grocery than Webvan. Peapod handles order fulfillment with a hybrid operational model that utilizes both stand-alone distribution centers and bricks-and-mortar supermarkets. A similar fulfillment model has been used by Tesco to achieve great success in Britain. In the Chicago and Washington markets, Peapod fulfills orders from lightly automated centralized distribution centers. In its other delivery areas, orders are fulfilled from a network of smaller "quick pick" centers adjacent to Ahold supermarkets. Such a fulfillment method is more efficient and scalable than the method

Peapod had before Ahold. - picking items from the shelves of local stores with which Peapod was partnered. Despite van fielder (Ahold's CEO)'s faith in the future of e-grocery, he believes that on-line supermarkets are not a replacement for the real thing. Peapod charges customers a delivery fee of $9.95 for orders up to $75, and $4.95 for larger orders. In some markets, delivery is free for orders over $100. The company also instituted a minimum order size of $50, a change from its earlier policy that saw the company lose money on delivery of smaller orders. Peapod's pricing structure prods customers to purchase more: The average basket size is more than $130.[Peapod, 9-502-050,HBS,2002] The effective use of pricing structure and minimum order requirement reduced the delivery costs and selected the customers Peapod wants to service. "Customers tend to shop with us for large grocery purchases, especially if they are pressed for time or have children to take care of at home. Our goal is to give the customer a grocery shopping alternative when it isn't convenient for her to go to the supermarket." says one of the Peapod employees.

1.2.2 Tesco's business model

Tesco, the leading online grocer in UK, is said to have nearly one million registered users and 840,000 orders a year, and is expanding into new categories such as baby products and cases of wine. Tesco.com claims to be "the largest and most successful Internet based grocery home shopping service in the world". [Wharton, 2001]

What contributed to Tesco's phenomenal success is that it took a very different approach to online grocery than Webvan. Although both of them wanted to harness the power of the Internet to deliver groceries to shoppers, Webvan made huge bets on the Internet's ability to change shopper's behaviors but Tesco made only small ones.

1.2.2.1 Strategic Positioning

From the start, Tesco positioned its online business as a service-provider rather than a low-cost substitute to the local store. The online business unit is just one more channel through which it reaches it existing customers as well as new ones. It tried to provide a multi-channel experience to customers it had already attracted. Hence, it was

marketing online groceries as a convenience, not as a low price option. Based on this principle, it charges customers a delivery fee in addition to the retail cost of groceries. The entry fee may seem to be a "turnoff" to average consumer but in fact it works to differentiate the customers into different segments: those who are serious about using online service as a convenience measure or those who are occasional bargain hunters just looking for a deal. Customer selection retains those customers that tend to order on a regular basis and in large quantities. The order pattern for repeat order is much more manageable than that of random orders. It provides a better model for forecasting and optimization and thus reduces the overall transportation and inventory costs.

1.2.2.2 Operations

Tesco, like Peapod, has kept the operations of grocery delivery relatively simple by using existing assets rather than building high-tech warehouses. Tesco used the industry's infrastructure to keep costs low and took advantage of its existing brand and customers to drive it online business. Online orders are filled by Tesco employees at the nearest Tesco store, then picked up and delivered via van. This approach may not be as efficient as Webvan's in terms of picking time, but it is likely to be more efficient than consumer for three reasons: 1) The pickers work more efficiently due to learning. 2) one picker can be assigned to pick multiple orders simultaneously. 3) routing algorithm can direct the pickers to walk down the aisles.

This approach works much better for lower volumes of business, albeit at a high cost per order, than Webvan's high fixed investment on facilities, low variable cost approach. As stated before, that approach is only viable with a very high volume of orders. The net result is that Tesco had sales of £356 million ($520 million) in the fiscal year ending February 23, 2002, with profit of £400,000($600,000). (E. Logistics, 2002; Reinhardt, 2001; Hall, 2001).

By employing this simple strategy and its level-headed approach to online grocery, Tesco is now the world's largest online grocery.

1.3 Summary - Lessons Learned from those Businesses

One stream of research on operation strategy has focused on the strategic process, i.e. how strategies are developed and refined (Leong et al, .1990). It is possible to explain Webvan's failure and Tesco's relative success in term of strategic process. The operation strategy process is most often modeled as a hierarchical one in which functional strategies such as operations, logistics, marketing and finance are driven by the higher level business strategy (Skinner, 1969; Fine and Hex, 1985). Webvan chose a business strategy of rapid growth to prove that it was a model "new economy" company. In doing so, it violated several fundamental strategic principles, including the need to align supply chain operations with marketing. Peapod and Tesco, on the other hand, picked a more realistic approach of building new business on top of existing proven principles. A Recent research explained some of the reasons behind the spectacular successes and failures in the online grocery industry. Initial findings of this three-year, ongoing study, "Internet Disintermediation of Food Delivery: Spanning the Last Mile;" conclude that some of the industry's early endeavors such as Webvan, Streamline and Home Grocer failed as operating business models because they did not understand the on-line grocery business and failed to implement operational strategies that sustain today's successful online groceries. [Boyer, MSU, 2004]

The study reveals general principles that can be useful for any companies that market and sell through the Internet. For example, the survey evidence clearly shows that successful online retailers strike a balance between their range of offerings and the ease of fulfillment and synchronize their marketing and supply chain strategies. For instance, a root cause of Webvan's failure was its promise to deliver groceries at the same price as in-store service, which it was unable to do profitably. Customers in the study uniformly rated the importance of convenience much higher than price, indicating they were aware of, and prepared to pay for, increased costs associated with convenient pickup and delivery. In general, online customers clearly appear to be conscious of the tradeoffs they make between product assortment, price and reliable delivery.

Another lesson from the study, say the authors, is that learning curves are critical for both the seller and the customer. The failure of Webvan and the success of

Tesco, among other online grocers in Britain, illustrate the need for sellers to carefully educate customers about new services and coach them in how to get the most benefit from the service. For example, the study shows that customers ordering groceries online have substantially higher satisfaction levels after having completed four or more orders. Moreover, the time it takes to place an order quickly drops from 60 to 80 minutes for the first order to 25 to 35 minutes by the fifth. The data shows the importance of working with online customers to develop their comfort level with a new technology. In addition, many failed online retailers concentrated too much of their marketing efforts on attracting a broad range of customer and too little on retaining target customer. Since repeat orders represent a large part of business for most retailers, the loss was a significant drain of revenue from return customers.

Another important lesson learned is that e-retailer must pay attention to market segmentation and cultural differences.

In Britain, where the grocery market is homogeneous, the stores make more efficient use of space than those in the United States, and denser populations make for easier delivery to local areas. Because of this grocery services carefully positioned themselves not as a revolutionary technology, but as an evolutionary channel that simplifies customers' lives. By contrast, many of the first-generation U.S. online grocers felt the pressure to grow rapidly and were reluctant to discriminate in the markets they served. As a result, they rapidly spread their resource on a broad range of customers over a wide geographical region. The lack of focus approach did not help them to retain enough business to sustain their operations. Webvan, was the classical case in the slew of flyers.

The newer, more successful online groceries are better at addressing their core target market: dense urban areas with a high concentration of families having two working spouses - busy people. The relatively greater success of online groceries in Britain (Tesco, for example, had sales of more than $550 million in the most recent fiscal year) underscores the study's fourth lesson for e-businesses. Unlike Webvan and other cautionary examples, the British company and Peapod carefully thought through how to efficiently coordinate its IT processes, marketing approaches and supply-chain

strategies. For example, these companies pick up customer orders from existing stores rather than building new distribution centers, thereby assuring a lower fixed cost.

These potentially beneficial strategies were not clearly understood in the early days of U.S online retailing but they represent the kinds of approaches that today's online grocers, and e-retailers in general, should be employing.

1.4 What are the Operational strategies online grocery business should consider?

The examples of Webvan and Tesco suggest that future endeavors in a competitive and razor-thin profit margin market like the grocery business must choose their business strategy carefully to align their marketing and operation with the strategy. They must understand clearly what the underlying market forces are and the customer segment they want to target. Then they can evaluate different operational approaches that fit their business models under the circumstances. The lessons learned from Webvan and Tesco cases suggest the following operational strategies that the future online grocers should consider.

1.4.1 Delivery Window

For most on-line grocery stores, high transportation cost and razor-thin profit were a lethal combination that overwhelmed their efforts to profitability. In order to keep transportation cost down and profit margin up, online grocers need to consider what the proper order-fulfillment model should be. For Webvan, its delivery window was set to be half an hour. The short lead time not only puts burden on the suppliers to carry enough safety stock to buffer the fluctuations in demand but also increase the transportation cost because of the unoptimized delivery routes. An extended delivery window up to 90 minutes or even a one day will give the orders enough time to accumulate. Accumulated orders can then be aggregated according to regions and categories for optimal shipment sizes. Most households shop for groceries on a weekly basis. The postponement strategy can pool different orders from various households and make a collective delivery due to

their geographical proximity. The benefits of using a longer delivery window is order aggregation and better demand forecasting. The aggregation of orders can not only save delivery trips but also leads to shorter delivery routes and lower the transportation cost. Aggregate forecasting is always more accurate than point forecasting. The company can use better forecast data to plan their inventory level and reduce safety stock. The optimal delivery window can be determined based on several parameters such as the order density, order quantity, distance from the distribution center and the fleet size. Optimization methods such as computer simulations could be used to pick the best delivery window that can maximize the expected profit.

1.4.2 Service Charge

The Tesco and Peapod example seems to suggest that a service charge can be used as an effective operating method to compensate the high delivery and transportation costs associated with home delivery. Online grocers uses service charge as a way to generate revenue rather than forego it to attract customers. Many customers who are using Peapod find $5 service charge a bargain for the time and trouble home delivery has saved for them. Tesco customers have the same view. Other than recouping the transportation expense, a service charge can also help the online grocer select customers. Service charge can actually create customer loyalty and retain their business because the customers who pay a service charge tend to value the service more than if they could use the service for free. In a competitive business that is characterized by paper-thin profit, the profitability of the business depends on a loyal customer base and a flow repeat orders. Service charge is therefore an effective tool to differentiate serious customers from bargain hunters.

1.4.3 Product Substitution

One of the biggest challenges to all home delivery grocers is getting right orders. A 99% service level many sound high for an on-line grocer but that is not the way how

the consumer perceives the service. Typically, the out of stock rate in grocery store is fairly high – 3 percent and 8 percent. The big difference between home delivery and in-store shopping is the shift of responsibility. Customers may intuitively make their own substitution while shopping in store. However, when the grocery company is making the delivery, the customer now is more likely to blame the store for the shortage of items. Thus, it is very important for the home delivery grocers to limit the number of substitutions as much as possible and educate the customers to accept the inherent limitation of the system involved.

1.4.4 Proper alignment between marketing and operations strategies

The comparison between Webvan and Tesco has demonstrated that Tesco has chosen a proper operational model that properly aligns with its business strategy. Indeed, Peapod, Tesco, and Albertson's all view online ordering and home delivery as value-added services. Therefore, they market these services as time-saving convenience and charge customers who in need of such services accordingly. In contrast, Webvan marketed itself as a substitute for the traditional grocery stores and offer same prices on home delivery. Webvan's marketing strategy was based on the apparent false premise that the operational efficiencies would more than make up for the additional costs incurred by the infrastructure cost and transportation costs associated with home delivery. However, their operational efficiency could not deliver what their marketing efforts had promised and it is estimated that the total cost of order fulfillment and delivery is around $15 per order.[TQM, 2003] The high delivery cost was the main stumbling block that tripped Webvan's business. The future online grocers must contemplate their marketing strategy and make sure it closely aligns with their operational capabilities. The misalignment will create not only operational challenges but wreak havoc for the business.

In addition to these operation methods, online grocer should consider using existing facilities and manual labor to minimize the initial capital investment in infrastructure and equipment building. Webvan spent $30 million dollar to build its highly automated

distribution center and plan to build 26 similar ones. The spare-no-expense approach did not carry the business very far. Peapod and Tesco, on the other hand, utilized existing facility and relied on manual picking to avoid the initial investment. That strategy seemed to work well in online grocery business

1.5 Value-Added rather than "just another milk-man"

New market conditions sharpen competition. The internet offers the consumers a platform that they can compare different prices and services across a wide range of companies easily and painlessly. Particularly in the grocery business, since the "core competency" – the commodities differ little from company to company, it becomes imperative for those online grocers to look at innovative ways to enhance their competitive edges. [Wagner, 1997] cites a study by the Gartner group Inc. and notes that suppliers no longer remain competitive by way of lowest prices, but must offer the customer additional services and information. [Rayport/Sviokla, 1996] introduced the term "Virtual Value-added Chain": successful customer relations require a virtual value-added chain in addition to the physical value-added chain. The supplier must be guided by the specific requirements of customer and offer innovative market service. The goal of such additional service(e.g. groceries portfolio that is compiled based on individual needs of diabetes patients, heart patient and weight losers) is to promote customer loyalty and build relationship with the customer. In the sense, they must expand their service boundary to include more services that can support customers in the most comprehensive way during all phases of the customer relationship.

On-line grocers should consider creative ways to add value to the grocery business and develop competitive edge over the traditional grocery store besides simple delivery of groceries. As Netgrocer president and CEO Lisa Kent agrees that e-grocers have a spot alongside, not in place of, traditional supermarkets. Reflecting that belief is Netgrocer's product selection - an emphasis is placed on hard-to-find niche items, particularly in categories such as breakfast cereals, beverages and snack foods. "Customers will always go to the supermarket for their daily staples, so we'd better offer something extra," Kent says.

1.5.1 FreshDirect – A new model

A successful example of this value-focused business model is Freshdirect.com – a new online grocery startup that offers high-quality food preparation and delivery service in New York – Manhattan area. It delivers fresh meat, fish, cheese, fresh-baked breads, produce, and other foods to Manhattanites at prices about 25% below what most New York grocers charge. [Kirkpatrick, Fortune, 2002]

FreshDirect delivers specialty-store-quality fresh food and prepared food at strikingly low prices. Though it has a limited selection of dry goods, it concentrates on impeccably fresh perishable foods because that's what consumers want, says Fedele – its CEO.

Americans have shifted their food buying dramatically over the past 30 years. In the 1970s about 70% of food was purchased in packaged form, vs. 30% fresh. Today, following dramatic growth in prepared and specialty foods and even farmers' markets, the percentages for East Coast urbanites have roughly reversed. [Kirkpatrick, Fortune, 2002]

Yet supermarkets were literally built around the old product mix. Says retail analyst Adler: "Most supermarkets don't even think of themselves as perishables retailers."

FreshDirect aims to create a new standard in the processing and handling of fresh foods. The entire building is a refrigerator. From the moment foods enter, they are kept at 36 F or below-all the way through production, packing, and shipping. Only when the delivery person removes an order from the truck is the food exposed to warmer air. The insulation guarantee the freshness of its produces. [Kirkpatrick, Fortune, 2002]

Why should FreshDirect do any better than Webvan? Fedele and co-founder Jason Ackerman insist Webvan was merely a distribution company that missed the point. According to Fedele, FreshDirect is a company based on food people, not dotcom people. As a result, FreshDirect choose a prudent spending business model with cautious expansion plan. It delivers in only in New York, mostly in Manhattan and adds new ones slowly as it fine-tunes its systems. Where Webvan invested heavily in state-of-the-art automated warehouses to handle 500,000 different products with little human intervention, FreshDirect's points of differentiation are cooks, butchers and the like who

personally prepare fresh meat, deli and seafood orders for customers. There is automation at FreshDirect's single distribution center, but only in the background.

Where Webvan relied heavily on developing its own software and systems to deliver "competitive advantage," Fresh- Direct has not. The company's strategy is to buy applications off the shelf where it can, customize where it has to and scrimp on areas that don't have a direct impact on its business, as the founders insist that efficiency, not technology, is the point. To provide high-quality product at low price, FreshDirect formed a "unique" partnership with the manufacturers and sourced directly from growers or producers that normally sell through distributors. FreshDirect provides suppliers with invaluable market research based on its direct contact with consumers, and to encourage them to put their own brands on what are normally commodity items-things like beef, fish, and vegetables. It also pays suppliers in three or four days, vs. the 35 days or so typical for the industry.[Kirkpatrick, Fortune, 2002]

For all these reasons, Fedele claims, suppliers charge FreshDirect significantly lower prices than they charge supermarkets.

The focus on freshness, quality and specialty-food plus its customer relationship-building strategy worked well in FreshDirect's case and helped it find the niche market in the vast New York Food market: The company turned profitable in just sixteen months after its initial launch in September 2002 and on its way to capture more market share in the NY food market.

The growing awareness of health and wellness among the public has led a wave of call for hormone-free. farm-fresh natural products. FreshDirect's success seems to correspond to this development. Moreover, the strong growth of organic products and opening of a slew of food chain that provides fresh farm produces seems to indicate that there is a trend among consumer to return to the old value. Organic products are no longer found only on the shelves of healthfood stores, but have expanded into widely accepted brands carried in national supermarkets. The January/February 2003 issue of National Grocery Buyer estimates that organic dairy sales in mainstream stores will increase by 24% a year through 2004. Sales in the yogurt market advanced in all segments during the period from 1997-2002. [Retail World. Rozelle: Oct 27-Nov 7, 2003. Vol. 56, Iss. 21; pg. 33]

The strong demand for organic and natural food creates a new niche market. For online grocers that want to differentiate themselves from the traditional supermarket or other online services, it presents a good opportunities for them to explore.

2 Is online grocery a promising business in the future?

2.1 A viable business despite its past

A recent study conducted by Professor Kenneth Boyer at Michigan State University has identified five key elements of on-line groceries business model that make it a viable business despite all the past failures. The paper titled "ITR: Internet Disintermediation of Food Delivery – Spanning the Last Mile" report those five key findings are:

1. **Service quality**

Customers rate the Service quality for online ordering much higher than for in-store shopping. Customers generally feel that employees are more responsive, courteous and understanding of their needs in an online/home delivery setting than in traditional stores. The traditional supermarket has more or less degenerated into a large warehouse with few staffs on hand. Shopping experience is more and more being pushed toward self-service. This setting alienates the customers from the service provider. The online grocery companies use home delivery or store pickup as a means to offer customers a service that is valued and feels much more personal than in-store shopping.

2. **Time Savings**. For most customers, the average time to place an order online is less than twenty minutes except the first time(66 minutes). The average time The average time for placing the first order online is 66 minutes. For customers that have placed 7 or more orders, the average order time is 25.9 minutes. Customers that make frequent use of saved lists of past purchases often place orders in less than 20 minutes. For today's busy customers, this can represent a significant time savings. Time saving is one of the main advantages of on-line shopping.

3. **Convenience.** Customers in the online channel rate convenience as the dominant reason they choose to order online. In contrast, price is rated as more important for in-

store customers. Many customers have small children, are disabled and have difficulty getting to the store, and/or are two career couples. On-line grocery shopping releases those customers from the burden of going to store and that is representative of all e-commerce customers.

4. **Online Customers give more of their business to their online grocery store**. There was very little difference in the online and in-store customer responses to the question "I would classify myself as a loyal customer of Grocer X". However, when asked what percentage of grocery shopping they did with Grocer X, the mean response for online customers was 81.43% versus 76.26% for in-store customers. This is important in the grocery industry, which operates in an environment that is especially challenging with exceptionally low profit margins of 1-2%. Incremental gains in sales at an existing store often result in large gains in profits.

5. **Groceries from Distribution Centers are fresher**. Contrary to popular belief that groceries picked by others are not as good as self-picked, customers who order online from grocers who pick customer orders from a distribution center, rather than picking customer orders from their retail grocery outlets, report that they believe the groceries are fresher. However, there is an initial hurdle that companies must overcome to establish their reputation in the minds of customers. The more orders these customers place more orders, the higher they perceive the quality of the goods they receive to be. Companies that delivery groceries from a central distribution center include Grocery Gateway (Toronto), Ocado (London) and FreshDirect (New York) and customers of each of these grocers rate the fresh produce and meats they receive as significantly better than from traditional grocers.[Boyer, 2004]

These findings suggest that online grocery still holds promise as a viable business model despite its past failures. Contrary to public perception, online grocery shopping is still alive and fast growing. Companies such as Tesco, Albertsons, Grocery Gateway, Lowes Foods, Peapod, Safeway, Ocado and FreshDirect all have learned lessons from earlier efforts and modified their business models accordingly. After decades of price competition at the mammoth supermarkets, these home delivery grocers are offering customers a return to an old concept: grocery shopping where the retailer offers valuable service and not just a commodity product values. Most importantly, customers are treated

as individuals rather than faceless parts of the mass market. Service and care therefore become the differentiating factor that sets the on-line grocery stores apart from their traditional counterparts.

Although Tesco, Peapod and other stores have achieved limited success in the on-line grocery business, their total sale volumes only account for a marginal percentage of the entire grocery purchases. For example, Tesco, the world's No. 1 online grocer sells $450 millions, but this represents only approximately 1.5 percent of the total grocery sales. FreshDirect now only gets 5% market share of the New York food market. Therefore, the room for growth is still enormous for the online groceries. In addition, Tesco, FreshDirect and other store indicate that new market success may be in aligning the supply chain to provide values to customers. These values may include using technology to access high quality products and services that gear specifically towards the needs of special groups, for example, the high-income families.

During the past four years, e-commerce has seen significant changes in term of consumer behavior, internet technologies and logistics that may underline the notion that on-line grocery may have a strong comeback.

2.2 Consumer Behavior Change

Consumer shopping behaviors have experienced fundamental changes for the past few years. More and more people are now connected to the internet thanks to the rapid development in web technologies. If four years ago, Internet was still considered a novelty for the XYZ generation, now people from all age groups have accepted Internet as a life necessity and that on-line shopping a way of living.

According to Nielsen/NetRatings, statistics has shown that there are over 272 millions people are now subscribed to the Internet, that accounts for 74.9% of the population in the USA. What's more interesting that, women are more likely to get on on-line than men. In the age group of between 35 and 54, there are 34.6 million women on the internet compared to only 32.4 million men. In another age group between 25 to 34, 77% of women are now on-line, man is 75.6%. Analyst contributes this discrepancy

to the fact that women usually do the shopping in the household. The statistics seems to imply that there are more and more people have turned to online shopping.

In the e-commerce sector, there is certainly a steady growing trend in e-commerce sales despite its early crash in 1999 and the ensuing long-term stagnancy on the stock market. Retail e-commerce sales in fourth quarter 2003 were 17.2 billion, up 25.1 percent from fourth quarter 2002, census bureau reports. These statistics have shown that e-commerce is still growing strong. Both consumers and retailers have reached a consensus that e-commerce is the way to go and it has enormous room to expand given its current fractional role in the total retail industry.

At the same time, demographic changes in the US population may hold huge potential business opportunity for the e-commerce in the near future. It is estimated that 22 percent of the population is the US is now 65 and above, however, they possess almost 40% of the purchasing power in the US. More interestingly, 22% of Americans 65 and older are now online. The percent of seniors who go online has jumped by 47% between 2000 and 2004. That translates to about 8 million Americans age 65 or older who the use the internet. By contrast, 58% of Americans age 50-64, 75% of 30-49 year-olds, and 77% of 18-29 year-olds currently go online. A detailed breakdown reveals more interesting trend among this group who have a lot of leisure time and case on hand:

- 66% of wired seniors had looked for health or medical information online at some point in their online life by the end of 2003. That is a 13-point jump since 2000, and a growth rate of 25%.
- 66% wired seniors had done product research online by the end of 2003. That is an 18-point jump since 2000, and a growth rate of 38%.
- 47% of online seniors had bought something on the Internet by the end of 2003. That is an 11-point increase since 2000 and a growth rate of 31%

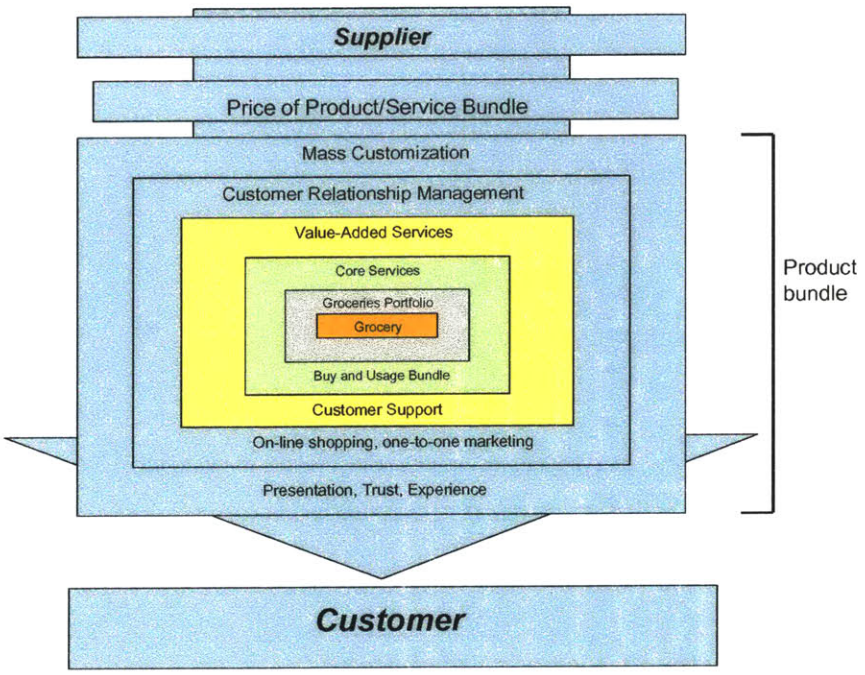
[Fox, 2004]

The large increase in online senior population and their tremendous purchasing power create a huge market and ample business opportunities. This customer segment was almost nonexistent five years ago. For many older Americans, grocery shopping is a physically challenging task. For millions of seniors in the US, on-line grocery service may be a great help for them to overcome the physical challenge of grocery shopping.

As the Baby Boomers are beginning to enter the retirement age, many new businesses will need to be created to provide service to this large retired population.

On-line grocery business that can offer home delivery service plus additional personalized service such as individual health and wellness solutions will find great appeal in the senior citizen group. On-line grocers need to go beyond simple grocery deliveries to leverage technologies and supply chain strategies to provide diet or health solution packages that can be customized and modified based on customer needs. On the consumer side, this "bundling" integrates service and delivery together to give them an one-stop-shop that saves time and money. On the supplier side, these add-on services will attract new business opportunities that not only stimulate groceries sale but also help build better customer relationship. This "bundling" strategy is enabled by the recent developments in technology such as standardization, Broadband Internet connection, wireless technologies and semantic web.

Product Bundling



2.3 Technology as Enabler and Promoter of New Business Solutions.

Technological improvements in Information Technology, particularly in the area of web technologies, database system and artificial intelligence provide solutions to many challenges that clobbered the earlier e-commerce and they may also produce new business opportunities.

2.3.1 Standardization

One of the main technological challenges brought down many e-commerce companies was a lack of compatibility between various technologies. Since then, many standards have been developed to overcome that bottleneck.

- Commonly recognized interfaces and specifications facilitate joint management of process tasks(e.g. XML, OBI) and the free exchange of information objects between supplier and customer.
- The implementation of standards for transaction management, payment management, identification of business partners, generation of customer profiles.

By simplifying business transactions, standardization contributes to an increase in the acceptance of online offers. E-commerce including online grocery business will gain tremendous benefits from the evolving standardization efforts.

2.3.2 Broadband Internet Connection

The newly revamped Internet Backbone – fiber optical network that can transmit data up to 10 gig bytes per second (MCI's UUNET) plus the fierce competitions in the broad-band internet market(e.g. Verizon and Comcast) has led to a wide spread of high-speed internet service in the form of DSL(Digital Subscribe Line) or cable network and has greatly enhanced the overall quality of online experience. Survey results show that Internet users at home with broadband access rose to an estimated 11.32 million in December, exceeding the ten-million mark for the first time and commanding a 42% share of home users. The 215% year-on-year increase far surpasses the 59% growth in

America during the same period, as reported by NetRatings Inc. of the U.S. on January 15. By contrast, narrowband users began to decline last summer, dropping approximately 15% over the year (see Tables 1 & 2)

Table 1. Trends in user numbers by broadband/narrowband environment
(December 2001–December 2002, access from home PCs)

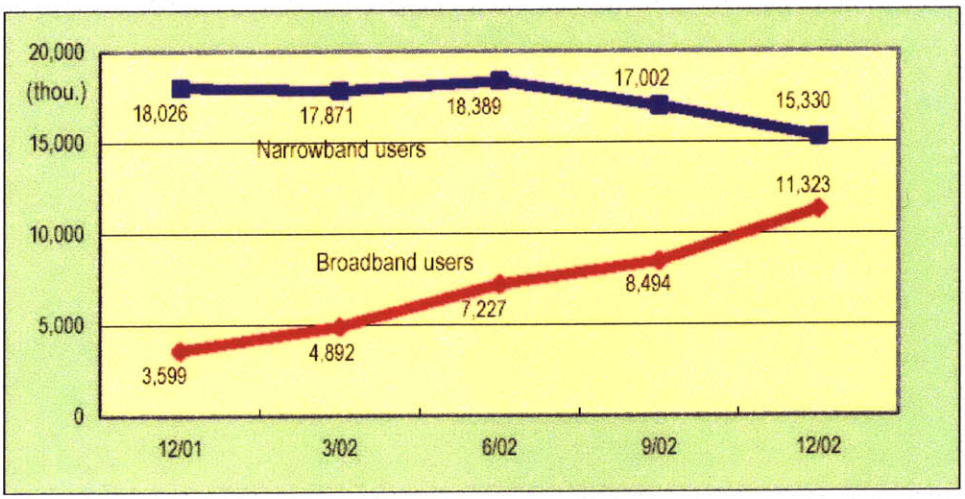


Table 2. Comparison of U.S. and Japan user numbers by access environment
(December 2002, access from home PCs)

	Japan		U.S.	
	Users (proportion of total)	YoY change	Users (proportion of total)	YoY change
Broadband users	11.32 million (42%)	215%	33.60 million (31%)	59%
Narrowband users	15.33 million (58%)	–15%	74.40 million (69%)	–10%

Note: U.S. data are taken from a report released by U.S. NetRatings Inc. on January 15, 2003 (http://www.Nielsen-netratings.com/pr/pr_030115.pdf). Yearly changes in user numbers for both the U.S. and Japan are determined compared with December 2001 figures.

Internet users earning upper-level incomes have a higher concentration of broadband adopters. Broadband surfers made up 69 percent of the total audience for those with incomes of $150K and above, as compared to 31 percent accessing via dial-up (see Table 2).

Table 2: Broadband vs. Narrowband by Household Income March 2004 (U.S., Home)

Income Level	Narrowband	Broadband
$ 150,000+	31%	69%
$ 100,000 - 149,999	39%	61%
$ 75,000 - 99,999	50%	50%
$ 50,000 - 74,999	54%	46%
$ 25,000 - 49,999	64%	36%
$ 0 - 24,999	75%	25%

Source: Nielsen//NetRatings, March 2004

For E-commerce and online grocery business, the growing adoption of broadband technology among the rich may imply that the real online business opportunity may reside in the upper income sector rather than in the general public. The higher income household with broadband internet connection is the customer segment that online business should consider focusing their business on.

2.3.3 Wireless Technologies & Internet everywhere

The proliferation of wireless technology on mobile phone, laptops and PDAs in recent years makes Internet presence universal. Online is no longer restricted to home or office. 17% of internet users in the U.S have logged on using a wireless device according to the Pew Internet & American Life Project. The results in the report are based on data from telephone interviews conducted by Princeton Survey Research Associates between February 3 to March 1, 2004, among a sample of 2,204 adults, 18 and older. The wireless technology enables user to access the net anywhere at anytime with either a cell phone or PDA. A user can use her cell phone to make a purchase online and put the charge on her monthly cell phone bill. The ubiquitous internet presence and increasingly convenient service will greatly stimulate the growth of e-commerce and may expand the scope of the service.

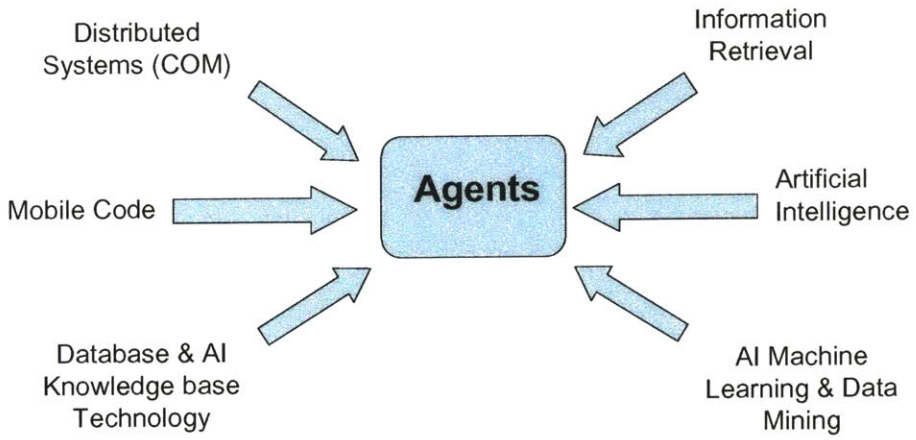
These major improvements in technologies over the past few years, along with new business concepts, have paved the way for e-commerce to make a comeback. Online grocery, led by earlier successes like Peapod and Tesco, may see new business opportunities created by the latest technologies.

2.4 Emerging New Technologies & E-commerce in the near future.

2.4.1 Agent is coming to a web store near you

In recent years, the Web and its data infrastructure is undergoing a sea change from its embryonic HTML format to the new XML(eXtensible Mark-up language) paradigm.. The XML provides generic vocabularies for conducting transactions over the web and enables machine-to-machine communication such as agent talk. It is estimated that the entire World Wide Web will soon be all XML. One major benefit of using XML technologies is that XML will help data interchange over the semantic Web. The Semantic Web is an "agent-enabled" resource which makes a huge amount of information available in machine-readable form. It will revolutionize business applications and e-commerce through the means of "agent" communication at a Web-Web scale.

Semantic Web Agent – the " SoftBot "



Agents are Web services that can be cross-fertilized with Artificial Intelligence technology. These Intelligent "softbots" can perform sophisticate tasks such as

knowledge gathering, reasoning, and to some extent, economic optimization via the Semantic Web. Soon, billions or even trillions of agents will be created to roam the web and act as human buyer, sellers and brokers for us.

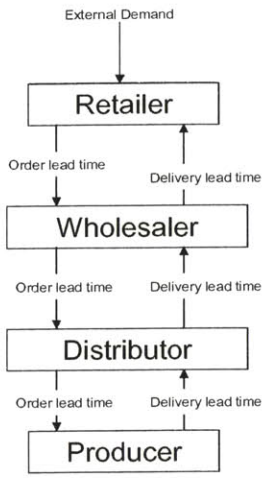
These new technologies could transform e-commerce from an online order-delivery business model represented by the first generation e-commerce represented by Amazon and Webvan towards a new service–oriented business model.

Agent-enabled Semantic Web may also revolutionize interactivity in the e-marketplaces. Machine-to-Machine communication can not only minimize human efforts and errors and but also can perform tasks that is beyond human capability such as scanning thousands of machines to collect and analyze information. Using this technology, online grocer may be able to overcome an inherent issue in grocery delivery-uncertainties in demand that cause fluctuations in the supply chain. Based upon semantic web technologies and other innovation, it is now possible to build a VMI(Vendor-managed inventory) system at home for the future online grocery stores.

2.4.2 Vendor-Managed Inventory(VMI)@home

In a *vendor-managed* inventory(VMI) system, sometimes called a vendor-managed replenishment system, the suppliers received customer's inventory data and use this data to prepare shipments at previously agreed-upon intervals to maintain specific inventory level for the end retailers. In the initial stages, vendor suggestions must be approved by the retailers, but eventually the goal of many VMI programs is to eliminate the retailers' oversight on specific order. The type of relationship is best represented by Wal-Mart and Procter & Gamble, whose partnership, begun in 1985, has dramatically improved P&G's on-time deliveries to Wal-Mart while increasing inventory turns.[Simchi-Levi,2004] One of the promised benefits of using the VMI system is to tame the Bullwhip Effect.

The Bullwhip effect is defined as the increase in variability as order variability travels up in the supply chain. See diagram below.



The supply chain

Source: David Simichi-Levi, Designing & Managing Supply Chain

The retailer observes customer demand and places the orders to the wholesalers. The wholesaler receives orders from the retailer and places orders to his supplier, the distributor. To determine these order quantities, the wholesaler must forecast the retailer's demand. If the wholesaler does not have customer's demand data, it must use the order data from the retailers to forecast future demand. This behavior is propagated down to the producer/factory level. If the retailer/vendor does not have a good forecast of the customer demand, the variability will travel downstream and augment, resulting in higher inventory levels down at each level and higher costs at these facilities[Simi-chi Levi,2004].

To reduce the harmful bullwhip, one often-suggested technique is to centralize demand information within a supply chain and provide each stage of the supply chain with up-to-date information on customer demand [Simi-chi Levi, 2004]. If the demand information is centralized, each stage of the supply chain can use the actual customer information to create more accurate forecasts, rather than relying on the orders received from the previous stage, which can vary significantly more than the actual customer demand. VMI down at household level can serve exactly that purpose: to know customer demand ahead of time so to improve forecasting and reduce the bullwhip effect.

At present time, VMI system is primarily used for B2B transaction such as in the Wal-mart and P & G case. However, with the advent of Semantic Web, Intelligent Agent and Smart Appliance, it becomes possible in future to deploy the VMI system in average consumer household and manage inventory of groceries and other commodities such as drug for individual consumers. In order to make it work, the VMI@home system requires an innovation in household appliance- a smart storage unit that can automatically monitor and record the inventory level of goods inside and is connected to the Internet.

2.4.2.1 Smart Appliance

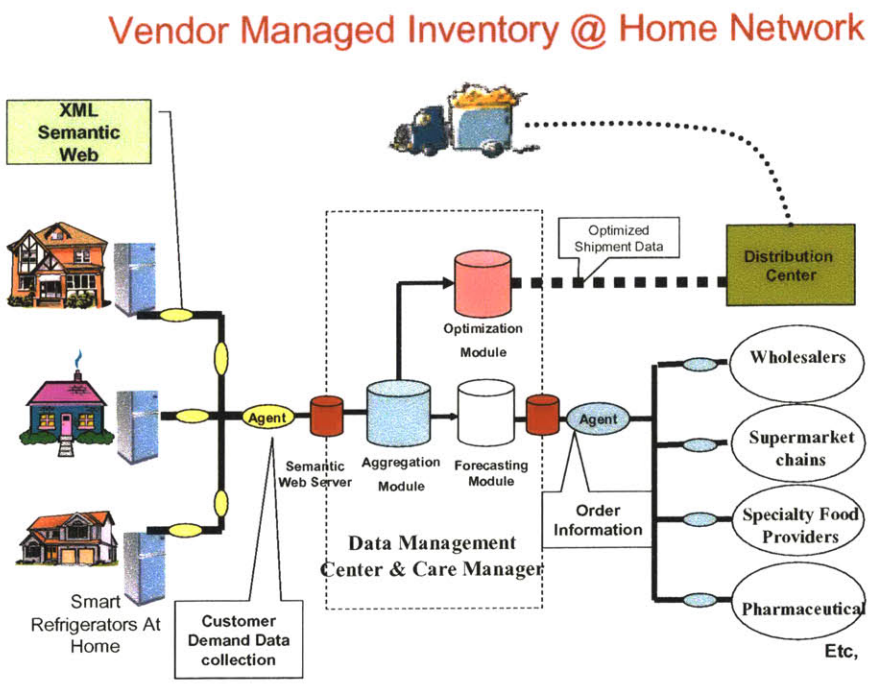
According to a CNN report in 1998, a Japanese company was able to combine computer and refrigerator to develop a refrigerator smart enough to keep track of what's inside, store recipes and make the grocery list. [CNN, Sept 30, 1998 "Japanese company combines computer and refrigerator"] The company unveiled its "Internet Refrigerator" at the opening of the PC World Expo in Makuhari, east of Tokyo. With a speedy Pentium II microprocessor and huge hard drive, it has separate compartments for fruits and vegetables. The refrigerator is controlled with a touch panel monitor in the door or verbally through a built-in microphone. Smart Refrigerator will make it possible to retrieve real-time knowledge about grocery inventory level in customer's home.

2.4.2.2 Data Management, Optimization and Demand Forecasting

The primary advantage of using VMI@home system is that online grocer can monitor the inventory level on household level and thus accurately predict when the stockout and reorder will occur.

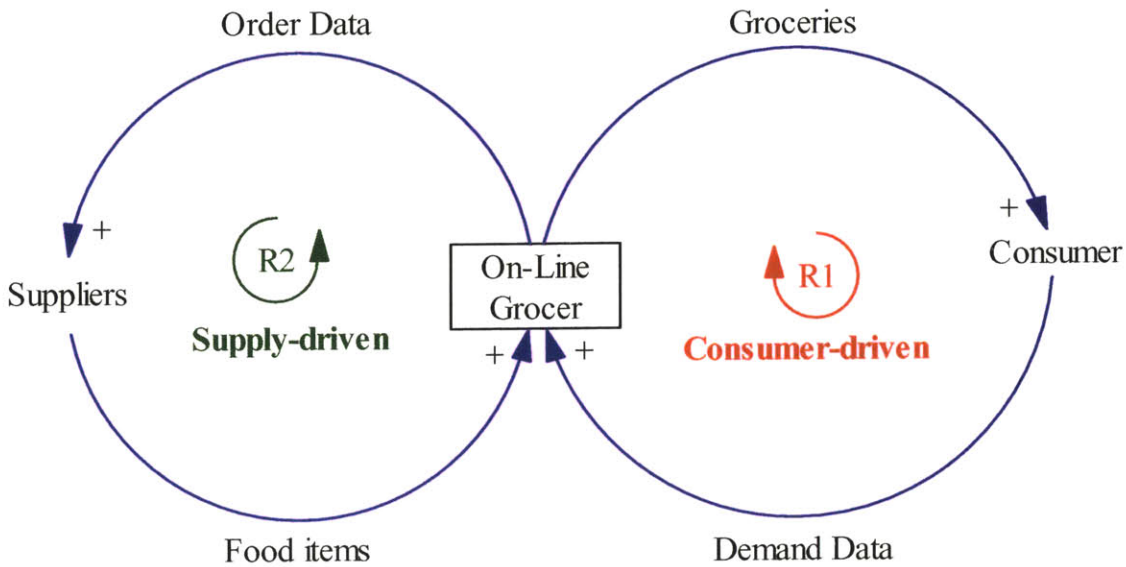
At the core of the system is a data management center.(See the diagram) The data center consists of three modules – the aggregation, forecasting and optimization modules with two semantic web servers on both ends. The front semantic web service will send out numerous "agent" to scan all the smart refrigerators in the field. Since these softbots can not only collect data but also reason and perform calculations, they can communicate with the appliance to calculate when the stockout will occur based upon consumption rate and even warn the user for reordering. Once the orders are approved by the owners, the agents will take the order data back and load it into the aggregation

module. The aggregation module will take all the data carried back by the agents and sum it up according to regions, product categories and delivery schedules. Once the data is assorted and aggregated, it can be transmitted to two other modules. First is the optimization module that can perform economic optimization that calculates the best shipping size, delivery schedule and trucking routes. The optimized shipment information is sent to the distribution center for shipment dispatch. The Forecasting module uses statistical analysis to project what the future demand will be based upon the aggregated order data. Once the projected demand information is calculated, it can be sent out as order data via agents. The agents will take the order data and roam the web to discover and negotiate with agents from the suppliers' systems to find the best deal for the online grocers and then place the order automatically.



The benefit of the system is obvious: it creates an automatic and continuous loop from front to end. There is minimal human intervention and thus little chance for mistake and waste to occur. The groceries can flow continuously and smoothly from the supplier end to the customer with speed and accuracy. Since the online grocery store knows exactly what the demand will be, it can use that information to optimize its operations

and reduce the total inventory and transportation cost. The cost and time saved on the supplier's side will be reflected as cheaper and fresher groceries down to the consumer level. It is a win-win situation for both supplier and customers (See System Dynamics Diagram)



A similar real world example may illustrate the benefits of vendor-managed inventory for both suppliers and customers. Nalco Chemical, a specialty chemical maker whose water treatment chemicals were becoming a commodity. Nalco installed sensors on the customers' chemical tanks. Nalco could monitor them as customers drew down the chemicals. This led to big cost savings for Nalco in routing the replenishment trucks, sometimes replenishing a tank even before the reorder point if a truck was passing by, and even led to cost reductions in manufacturing due to better production scheduling.[Jonathan Brynes, 2004]

2.4.3 Supply Chain Global Optimization

The other benefit of centralization of customer demand information using VMI@home system is that it can move the whole supply chain toward a global optimization model rather than local optimization. Local optimization achieve only

limited performance objective because it can only account for a few componential processes. Global optimization, on the other hand, will coordinate supply chain activities collectively so as to reduce system-wide cost while maximizing supply chain performance. Since customer demand is the "head" of the snake that drives the whole chain, visibility of customer demand makes global optimization obtainable and tractable. The information obtained via VMI@home system can be used to implement Supply Chain Master Planning. Supply chain master planning can be defined as the process of *coordinate production, distribution strategies, and storage requirements to efficiently allocate supply chain resources to maximize profit or minimize system wide cost. Supply chain master planning allows companies to plan ahead for seasonality, promotions, and tight capacities.*[Simchi-levi, 2004].

In addition to this type of strategic supply chain planning tool, other tactical software can be used to optimize daily delivery routes to minimize the transportation cost. UPS, for example, uses such technology on a day-to-day operation basis to save millions of dollars each year. However, the effectiveness of all these optimizations fundamentally hinges upon an accurate forecasting of customer demand information. Therefore, VMI@home system will provide these systems with ammunitions to fully exercise their functions and maximize the value for the whole supply chain network for the on-line grocery business.

2.4.4 Challenges and Benefits for VMI@home

The challenges for setting up a Vendor-managed inventory on a household level can be daunting but the rewards will be tremendous as stated above.

2.4.4.1 Hardware Requirement

To make the system work, it requires a deployment of smart appliance that can be connected to the internet as the one described above. The cost for installing the smart refrigerator can be prohibitive to the average consumer. The current price has come down to $7,000 from $10,000 – a high price item for most of people. But it is essential for the system to work. The initial acceptance is expected to be limited to the affluent households or restaurant business which are willing to pay a high price to get the quality

service or to those old people who are willing to adopt new technology that can help them overcome physical challenges. Once the system is in place and enough customers have been converted to the system, it will generate economy of scale that will drive down the unit cost for the hardware and service charge. VMI@home can bring tremendous benefits and convenience to consumers and suppliers but it is expensive at the beginning and therefore is it not for everyone. A small pilot program needs to be set up to test the concept in the right customer segment. Once enough is learned about the system and the unit cost goes down, then it is possible to promote this service model to other groups.

2.4.4.2 Privacy and Ownership

Another challenge that will emerge is the trust issue. In order to make full benefits of the system, the consumers have to release their control over grocery shopping and let the vendor manage the replenishment of inventory for them. That raises a question that whether consumers are willing to expose what's inside their refrigerators to the vendors. The users of VMI@home may also expect to relinquish some control over their inventory replenishment but not totally. That may also raise the issue of who owns the grocery inventory at home. For some consumers, an automatic inventory replenishing system is a blessing since it can save them time and trouble. For others, it is an issue of personal privacy. Therefore, it is important to work out those terms in the contractual agreement and incentivise users to subscribe to the system.

2.4.4.3 Delivery

One challenge faced by the earlier online grocers was the delivery of goods. Many customers did not adhere to the delivery schedule they choose on the web. With an automatic system, this will become even more problematic since the delivery of groceries can be up to the vendor not the consumer. Since groceries are highly perishable items, a missed delivery can increase the chance of spoilage and reduced quality. One solution is to impose a redelivery charge to force the consumer adhere to the delivery window. How effective that strategy will be is hard to say.

2.4.4.4 Integration

The VMI@home system has three integration points: front-end integration with consumer appliance, back-end integration with suppliers' systems and intermodular integration with all three modules. How to make these two subsystems work seamless together will be technically challenging. The data must flow from one system to another smoothly for the automation to work. Hence, the engine that can take data from one system and transmit it into another is critical to the integrity of the system and must be carefully researched and designed.

Finally, whether VMI@home can deliver its perceived value to both consumer and suppliers largely depends on the collaboration between the consumer, the online grocer and the suppliers. For a centralized system to work properly, a trust relationship must be built first so each component of the system will not hold back and impede the operation. How to build that trust largely depends on the good wills between the two sides and a strong adherence to promise. The vendor should educate the user about the benefits of the system and deliver that it promises. The consumer should trust the vendor to take care of the inventory for her and understand that it is actually in her best interest to do so.

3 On-line grocers as a service provider

For many e-retailers, the focus today should be on customer retention, not acquisition. One primary advantage of on-line grocer over its traditional brick-and-mortar counterparts is the ability to use latest development in Artificial Intelligence (AI) and web technologies to provide one-on-one service oriented towards each individual need. This direct marketing initiative or the so-called mass customization concept was proposed in the book "Mass Customization" by Joseph Pine in 1992. In the book Joseph envisioned that the manufacturing in future (which is now) would shift from mass production to mass customization. Here is a comparison of these two paradigms:

The Old ways Contrasted with the New	
The old ways of Mass Production	The New ways of Mass Customization
Low-cost, consistent quality, standardized products	Affordable, high-quality, customized products
Homogeneous markets	Heterogeneous markets and segments of one
Stable demand	Demand fragmentation
Economies of Scale	Economies of scale and economies of scope
Long runs	Lot size of one
High overhead	Low overhead
High inventory: build to plan	No inventories: make to order
Blanket Marketing and Sales campaign	One-on-one Marketing and Sales services
Separation of innovation and production	Integration of innovation and production
Poor supplier relations	Supplier interdependence
Disregard for many customer needs and wants	Accommodate to customer desires
Short-term managerial decisions	Sound long- and short-term decision by managers and workers.

Increasingly, personalization is taking a leading role in e-retailing, both in the online shopping experience and in marketing campaigns. More e-retailers are turning attention to customer retention rather than to acquire new customers. That is the emphasis Lauren Freedman, president of Chicago-based consulting firm the e-tailing group, wants to see take a bigger part in direct-marketing initiatives. A recent survey conducted by the e-retailing group asked industry executives what five features in order of importance they would most like to add to their Web site, assuming resources were not an issue. More respondents listed personalization as either their first or second answer. Freedman says e-retailers still are not using the Internet to its fullest potential, for either personalization or branding. However, the current development in Artificial Intelligence can enable e-

retailers such as the on-line grocers to use the Internet to offer not only a personalized shopping service and but also many other customized services to consumers.

3.1 The Technology for Customization

AI technologies have been used very extensively in operations, finances and medicine to facilitate decision-making and marketing process. One form of AI is called "Machine Learning". Machine Learning is a computing algorithm that can "learn" customers' preference based upon their past purchasing behaviors and shopping lists. One direct application of "Machine Learning" technology is "one-on-one marketing" that can precisely target customers with the items that interest them most. This model may eventually replace the current practice of blanketing a huge audience with spams, pop-ups and banners to get minimal responses.

Another AI technologies e-commerce company use to promote their sales is called Recommendation Algorithm: Recommendation algorithms provide an effective way of precision marketing by creating a personalized shopping experience based upon each customer's preference. The Recommendation algorithms used at Amazon.com is called item-to-item collaborative filtering match. This algorithm is able to react immediately to changes in a user's data and makes compelling recommendations for all users regardless of the number of purchases and ratings.

In addition, data mining of customer consumption data can lead to unexpected "discovery" of new business opportunity. Data mining is a type of statistical analysis that looks for "hidden" patterns, trends and relationships in the data. Data mining, for example, produced the marketing gem that men purchase beer and diapers on Friday afternoon, suggesting to retailers that these two items should be displayed close to each other in the store. On-line grocers could effectively take advantage of these tool and technology to create additional services so they can differentiate themselves from the traditional brick-and-mortar grocery store.

All these technologies can be user collaboratively to provide personalized marketing and service. Personalize marketing is much more effective way of selling products than traditional marketing methods. In the May 2000 issue of 1to1 Magazine, Cisco is mentioned as a company that has "virtually" reinvented itself around customer

needs. According to Cisco, it is pursuing a "personalized, dynamic, customer-driven content model." Besides sales and marketing, artificial Intelligence can also aid in a growing part of Internet-based marketing – customer self –service.

Customer self-service can range from technical support to individualized special service, for example, dieting and health. According to a CNN report, Internet dieting has exploded in the last few years, attracting people who lack the time to attend face-to-face meetings or those too embarrassed to get on a scale in front of strangers. About two-thirds of American adults are overweight or obese. Since cyberdieting generally reaches a wider audience and is significantly cheaper than weigh-in meetings with a counselor, it is not surprising that more and more people flocking to internet looking of diet help.

A 2001 study by researchers at Brown University found that people who enrolled in a structured online dieting program lost three times more weight in six months than those who casually surfed the Internet for diet information. But the study published in the Journal of the American Medical Association did not compare virtual weight-loss programs with traditional counseling. Last month, researchers at the University of Vermont suggested that the Internet appears to work as well as offline programs in maintaining long-term weight loss.[CNN, 2004]

These studies and statistics all suggest that online grocers should capture this booming trend in consumer behavior and offer new service to assist customer to reach their goals through self-service. Artificial Intelligence called Expert system can realize that service concept.

Expert System:

An expert system is a knowledge-based computer program that can reason and make deductions using human logic. A computer implemented expert system can work continually (24hrs a day) can be duplicated (thus creating many experts), never dies (taking knowledge with it), learns indefinitely (so long as new information is added to the system), always operates at peak performance, and does not suffer from personality incompatibilities. One type of Expert system is called ***Instruction system*** that provides individualized training or instruction in a particular field, including monitoring of performance, correction of errors and pacing to suit the individual. On-line grocery store

can the assistance online to its customers who are seeking dieting and health maintenance program. Traditional stores do not have the technological capability to provide individualized programs to their customers. On the other hand, new websites that can provide individualized programs using AI and web technologies do not have the ability to sell actual products. Customers have to manually link these two together which cost them extra time and money.

On-line grocery stores, therefore, are in a unique position to combines these two separate services and create a combo model that can provide customers with an integrated solution package of individualized program and home delivery. For example, senior citizen with health problem, for example, high blood pressure, can log on to the on-line grocer website to create a medical profile and seek for medical help. The "Medical expert system" on the website analyzes the user profile and medical history to design a portfolio of food and drug for him. The package will then be scheduled to deliver to the consumer's house according to the desired interval. The integrated service model can bring many benefits to both the suppliers and the consumer. The supplier can generate more business by providing additional services that can stimulate grocery and drug sales. The consumers can save the time and money of using two services and doing the shopping themselves.

In a highly competitive commodity market with narrow profit margin, the online grocery store will have to come up with innovative approaches to sell groceries online. The online grocery stores should look beyond simple grocery business and develop unique services that can add value and attract customers to visit their websites.

4 Conclusion

Online grocery, despite its bumpy start, still holds great future in the era of on line retailing. The success of Amazon and Dell in the midst of e-commerce downturn suggests that on-retailing has deep root in today's Internet-permeating society but online grocers must take great care to align their strategic planning with their actual operations. The analysis of now defunct on-line grocer Webvan and the more fortunate Peapod and Tesco has demonstrated that on-line grocer must choose their business strategy carefully and align its operations with it. Webvan and other failed on-line grocers were carried away by the "Get big fast" mind-set epitomized the dotcom era and plunged themselves into a risky gamble of overexpansion and price-matching. However, their excessive spending on technology and infrastructure building failed to generate enough return in a market characterized by razor-thin profit to sustain their business. The heavy weight of operating an extensive distribution network under uncertain demand conditions eventually crushed their fragile business structure.

On the other hand, Peapod and Tesco shied away from the "quantum leap" approach and took more cautious steps to enter the market with a prudent business model. They positioned themselves as convenience service-providers rather than competitors with local supermarket on prices. That strategy has a three-prong approaches: partner with local store and utilize existing facility and manual labor to save the upfront expense on distribution centers; charge service fee to recover delivery cost and customer relationship building. These steps helped them save on initial cost on infrastructure building and successfully find those customers who are willing to pay for the service.

The more recent example of FreshDirect has offered an important observation in the grocery business. There is a growing trend among the upper-income group that demands premium food and high-quality service. Future online grocers should consider how to position their business in this changing market to find the niche and carefully lay out their operations aligning with their overall objective. Moreover, online grocery store should keep an eye on the latest development in web and consumer technology for inspiration of new business idea.

The Internet has become the norm of life and significantly changed consumer behavior. The new movement toward a semantic web based on XML technology and the innovation in consumer appliance enable future online grocer to develop a Vendor Managed Inventory supply network on household level. The VMI@home system can not only save cost and time for suppliers and consumers but also add value to the whole supply chain. Moreover, the newest development in AI(Artificial Intelligence) can create new business opportunity for online grocer by offering customers with individualized programs and special service online that can address the ever growing trend of online servicing. Online grocer should leverage the technology to compete with the local stores on value-added service not grocery delivery.

Internet is evolving so is the online business that comes with it. Online grocers who stumbled in the past provided us with valuable lessons on what on-line grocery business is about. These evidences seem to suggest that the online grocer such as Webvan was ahead of their time and failed to capture the right customer segment. Online grocers in the future or present need to identify those niche markets so that they can differentiate themselves in term of specialized service they can provide. More importantly, they need to utilize technologies effectively and align supply chain strategies and operations with evolving opportunities characterized by changing consumer demands.

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