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Application of POM to e-business: B2C e-shopping

Application of
POM to
e-business

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Abstract Can operations management impact significantly the profitability of consumer-based businesses on the Internet (called B2C)? During the past two years, Internet retailers have not provided satisfactory financial results. Whereas, leading in-store retailers have been profitable using traditional modes for selling and delivering goods to customers. The research underlying this paper focused on analyzing the costs of doing business which are affected by operations management decisions. We wanted to determine if the criteria for best practice normally used by operations managers applied to firms engaged in e-tailing (Internet B2C). To do this we singled out a well-known dot.com retail failure, Webvan. Cost data were studied from startup (1998) to bankruptcy (2001). It was found that operating costs were way out of line with (even) good practice. Under in-store retailing circumstances, the inability to reach breakeven would not have been tolerated. While concentrating on Webvan, this paper uses information about other firms to provide additional insights.

Avoidable failures?

Toward the end of the 1990-decade, great Internet investments, supported by heavy publication-hype, were viewed as capitalizing a revolution in business methods. Doubt and uncertainty grew rapidly about the status of traditional retailers. The use of stores was labeled the "old economy" in a pejorative way. Selling via the Internet was part of the "new economy" which was best characterized by an astonishing inflationary effect on stock prices and ready access to venture capital.

Then, about March of 2000, the "new economy" bubble burst (Tenner, 1996). Negative opinions about doing business via the Internet were as extreme as previously, the positive opinions had been. An increasing number of articles appeared describing e-business as a transient phenomenon that would never replace traditional modes of selling goods. The Internet business model for retail dot.coms was said to be inherently flawed. But this was surmise, since no analytic studies served as the basis for the claim.

To exemplify, on Tuesday, 10 July, 2001, *The New York Times* had a front page headline that read, "An ambitious Internet grocer is out of both cash and ideas". This article stated that Internet-grocer Webvan had spent US\$1.2 billion of investors' money. When Webvan declared bankruptcy there were no more investors in sight.

What had gone wrong? Were Webvan's problems unavoidable? Was its business model permanently and fatally flawed? Was Webvan's effort too extensive? Did the firm try to do business in many places in too short a time? Would Webvan have fared better if it had stuck to groceries alone?[1] Was its



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product line too extensive? Could traditional operations management thinking have helped this firm adjust its plans to promote survival?

Research objectives

No one in academia believes that there are clear and unambiguous answers to questions such as those in the paragraph immediately above. However, academics consider the possibility that rational explanations can be found, even when a dilemma seems to exist about the causes of failure (Christensen, 1997). Thus, analysis of Webvan data indicates weaknesses in the prevailing Internet business model that could be corrected. Perhaps these corrections could have changed failure to success. Results of such an analysis can be tested against dot.com firms in other industries. A lot might be learned by comparing B2C companies that are still functioning with those that have closed their doors.

It will be interesting to observe, as a possible by-product of such study, whether Webvan is a unique case, or can serve as a prototype for e-tailing in groceries. Perhaps general rules will emerge that apply to even more generic representations of B2C business systems (Cohan, 2000). For example, consider the range of possible applications shown in Table I.

Our primary research objective was to determine if the application of sound operations management thinking and techniques could have helped to prevent Webvan's business failure. To understand what the Internet B2C situation entails, we undertook examination of the costs and revenues that led Webvan into bankruptcy.

A parallel research objective that is an outgrowth of the primary research objective was to identify those factors that must be in place for e-tailing to be profitable. This second research objective encompasses management systems that include market considerations as well as those of operations. Among these are product pricing strategies, shipping and handling charges, order receipt to delivery intervals, and alternative competitive issues that arise when customers have access to stores for returning merchandise.

Design of the study

Data were collected from annual reports of Webvan for the years 1998, 1999, 2000, as well as the first quarter of 2001, see Table II. To our knowledge, no further data were published by Webvan since it declared bankruptcy in July, 2001.

Five-person MBA student teams used online resources and library research to obtain information about various other Internet companies that sell groceries, pharmaceuticals, pets supplies, books, and travelers' accommodations. Some of these were pure Internet companies, meaning that they had no in-store partners or associates. Others were mixed-Internet and in-store retail systems. At the inception of this study, it was not recognized that this distinction would emerge as a significant competitive factor.

The 12 MBA team-based surveys were guided by an experienced academic advisor. There has been increasing attention to the quality of work

Company name	Present status
Amazon.com ^a	Books, electronics, music, computers, tools, etc., available at: www.amazon.com
drugstore.com ^a	Fill your prescription or buy cosmetics, nutrition bars, etc., available at: www.drugstore.com
eBay.com ^a	The most continuously successful dot.com firm is not the only auction site but the major one, available at: www.ebay.com
Fandango.com ^a	You can still buy your movie tickets online, available at: www.fandango.com
Orbitz.com ^a	Flights, hotels, cars, cruises, etc., available at: www.orbitz.com
Peapod.com ^a	Seven locations including Boston and Chicago, available at: www.peapod.com
Pets.com ^a	Click on: www.pets.com and you reach: www.PETsMART.com
Priceline.com ^a	Flights, hotels, cars, cruises, buy cars too, but no more groceries, available at: www.priceline.com – team A
Priceline.com ^a	Same description as the row above – team B
Razorfish ^a	Smaller than in its heyday, with Web portal design, content management, strategy and planning, available at: www.razorfish.com
Tupperware.com ^a	Part of Tupperware, one can now buy storage containers on the Web, available at: www.tupperware.com
Webvan.com	Bankruptcy and dissolution starting July, 2001. There is no longer a: www.webvan.com

Note: ^a Still in business

Table I.
Range of business
applications

accomplished by student teams, with mutual advantage to both the firms studied and the students (Ahire, 2001)[2].

Although this paper focuses on one of those reports, namely, Webvan, a great deal was learned about the perils and the benefits of e-tailing from the other studies. The firms covered by the 12 teams are listed in alphabetical order in Table I. Except for Razorfish, references are made at appropriate points to all of these companies. The 12 project teams analyzed data that included profit and loss and cash flow statements (quarterly and annually, over several years), balance sheets, and breakeven analyses.

This paper concludes with two discussions that relate Webvan's situation with other than food Internet retailers, namely, PETsMART.com and drugstore.com. Considerable attention is also paid to the evolution of Amazon.com over time. Amazon has striking similarities with Webvan, but the differences are generic (food spoils; books do not).

Relevant literature

The objectives that are listed in the section on "design of the study" are very specific and a review of the literature was undertaken to find antecedent

	2000	1999	1998	1st quarter
Net sales	178,456	13,305	0	77,200
Cost of goods sold	131,239	11,289	0	55,600
Gross profit (GP)	47,217	2,016	0	21,600
Sales and marketing expenses	49,120	11,746	0	54,000
Development and engineering expenses	25,516	15,237	3,010	6,600
General and administrative expenses	292,335	92,406	8,825	105,400
Amortization of good will and intangibles	63,394	0	0	57,000
Amortization of deferred compensation	55,233	36,520	1,060	0
Restructuring charges	40,810	0	0	73,900
Total expenses (TE)	526,408	155,909	12,895	296,900
Loss from operations (GP-TE = LFO)	(479,191)	(153,893)	(12,895)	(275,300)
Interest income	27,550	11,480	923	4,100
Interest expense	(1,648)	(2,156)	(32)	(1,400)
Net interest income	25,902	9,324	891	2,700
Net loss (LFO - net interest income)	(453,289)	(144,569)	(12,004)	(272,600)
Unrealized gain (loss) on securities	1,942	(729)	4	0
Comprehensive income (loss)	(451,347)	(145,298)	(12,000)	(272,600)
Basic and diluted net loss per share	(1.21)	(1.43)	(0.31)	(0.57)
Number shares used for line above	374,124	101,044	39,344	481,650

Notes: As of 31 December 2000 Webvan's accumulated deficit was \$612.7 million; as of 31 March 2001 Webvan's accumulated deficit was \$829.7 million

Table II.
Webvan Group, Inc.
and subsidiaries
consolidated statements
of operations and
comprehensive income
(loss) (in thousands,
except per share
amounts - each year
ended 31 December)

writings on the subject of B2C. Many useful articles about e-tailing appear in the operations management literature and in its journals. These articles are only of general relevance for topics that are covered in this paper. Thus, a taxonomic analysis of B2C food retailers (Heim and Sinha, 2002) provides an important and well-organized classification for the structure of grocery shopping on the Internet. Another article (Heim and Sinha, 2001) creates a product-process matrix for categorizing B2C-customer satisfaction. The Marketing Science Institute published a report on interactive home shopping (Alba *et al.*, 1997). All of these are useful because they provide a generalized structure and overview of the electronic retailing field. They do not however address the cost components of B2C business models.

In a fascinating way, the issue of customer's costs in determining where to shop (Bell *et al.*, 1998) lay clever groundwork for customer's store choice behavior. Here, shoppers rather than the stores experience the fixed and variable costs. Customers are likely to select actions associated with the lowest total costs. Another paper examines consumers' choice of "retail format" based on economizing their shopping time (Messinger and Narasimhan, 1997). Such decision rules may offer meaningful insights concerning how to satisfy Internet customers. Alternatively, if the buying process is complex and takes time, that is sure to drive the customers away. Efficient use of time may be a critical reason for some customers to prefer using the Internet. However, all of this

stands in contrast to the purpose of this paper, which applies fixed and variable costs to the firms' balance sheets and profit and loss (P&L) statements.

Explanations of consumer behavior can help e-tailers improve their performance. Thus, the literature to date is valuable for understanding consumer buying behavior, which includes causes of loyalty and customer satisfaction. However, this paper is written from the viewpoint of firms selling to customers via the Internet. These firms must decide on purchasing and pricing, warehouse capacities, and investments in IT technologies to support demand levels. Literature found in journals about these topics, with specific reference to the Internet, was not abundant.

Elements of Webvan's failure

Webvan entered the grocery business with managers who had no previous supermarket experience (Webvan, 2001). Their expertise was technology and they viewed their company's future business success in the supermarket field as a function of technology. Toward that end, Webvan's fixed costs (FC) for general and administrative expenses (G&A) increased from \$8.825 million in 1998 to \$92.406 million in 1999. Further, G&A costs increased by \$200 million to \$292.335 million in 2000 as Webvan expanded geographic coverage and invested in the highest level warehouse technologies. This latter increase is more than 200 per cent and may have crossed the threshold of sustainable growth. See data in Table II.

Projections for the year 2001 are shown in Table III. These estimates indicate that in 2001 G&A may reach \$421.6 million. This 44 per cent increase is relatively small in comparison to the prior year's increase of 200 per cent. It may reflect an attempt by Webvan to scale back on excessive technological investments and capacity additions. Webvan's year 2000 Annual Report notes three new distribution centers, as well as HomeGrocer locations obtained by merger. Together, they account for 60 per cent of the year 2000 G&A costs (Webvan, 2000).

After subtracting the cost of goods sold (COGS) from net sales, the gross profit (GP) in the year 2000 was only \$47.217 million. Sales and marketing expenses of \$49.12 million exceeded the GP. In 1999, GP was \$2.016 million, which is too small to be relevant (related to start-up timing). Note that for the year 2000, G&A costs were six times larger than gross profit.

	Year 2001	3 quarters	2 quarters	1st quarter
Net sales	308,800	231,600	154,400	77,200
Cost of goods sold	222,400	166,800	111,200	55,600
Gross profit (GP)	86,400	64,800	43,200	21,600
Sales and marketing expenses	216,000	162,000	108,000	54,000
General and administrative expenses	421,600	316,200	210,800	105,400
Total expenses (TE)	1,187,600	890,700	593,800	296,900
Loss from operations (GP-TE)	(1,101,200)	(825,900)	(550,600)	(275,300)

Table III.
WEBVAN Group, Inc.
and subsidiaries
(extrapolation based on
1st quarter of 2001)

Table III is a quarter-by-quarter linear extrapolation based on the first quarter data of 2001. Projecting data in this way provides less reliable information than actual measured data. Linear projections do not reflect change of plans such as initiating cost cutting programs or deciding to accelerate of expenditures. Nevertheless, it is the last set of data to work with that was derived from Webvan information.

Table III's projections for the year 2001 show that G&A costs are nearly five times larger than gross profit. By any operational criteria, this is an unacceptable ratio. It is identified with the situation in which there is considerable over-capacity. As confirmation, many trade journals, during this period, were reporting that Webvan's warehouse systems were operating significantly below their designed capacity. The same conclusion is reached by comparing the amount of Webvan's G&A with the revenue the firm generated.

The enterprise architecture for the logistics component of the supply chain was out of kilter. Technology without a carefully designed resource management system would produce transaction costs far greater than those associated with traditional retail methods. The selling-chain system has many components that need to be honed to a fine balance (Kalakota and Robinson, 1999). Such modeling does not occur as a result of adopting advanced technology. However, the consequences of not modeling the logistics system can impose severe penalties.

Sales and marketing costs increased from \$11,746,000 in 1999 to \$49,120,000 in 2000. While this represents an increase of 4.2 times, net sales increased by 13.4 times (going from \$13,305,000 to \$178,456,000). Year 2001 sales and marketing costs were estimated to increase from \$49,120,000 (2000) to \$216,000,000 which is 4.4 times, while net sales were estimated to increase from \$178,456,000 to \$308,800,000 which is only 1.7 times.

The picture for 2001 does not reflect a healthy situation. With under-utilized warehouse capacity, Webvan's market strategy and budget were not creating enough demand to match the warehouse capacities that had been created. One conclusion that can be drawn is that the cost of switching customers from conventional, in-store shopping to Internet shopping was much higher than had been imagined. Some of the possible reasons for this are discussed in the sections that follow.

Analysis of Webvan's operational situation

It is reasonable to assume that maximum warehouse throughput capability has been designed to be well above the theoretical breakeven point (BEP) so that substantial profits can be realized when everything is going as planned. Therefore, it is useful to estimate this BEP for Webvan's two years of factual data. Then, we can compare actual sales volume (V_{act}) to the theoretical breakeven volume (V_{bep}) for each of the two years. After this, the estimated data for the year 2001 can be examined for the trends that were in place at the time of Webvan's bankruptcy.

The expectation for a properly functioning system is that (V_{act}) will be larger than (V_{bep}). During startup, the reverse may be true, but it is hoped that two V s will be close to being equal (i.e. at breakeven) in a reasonably short period of time. If this is not the case, then the market performance (demand generated) is not keeping pace with investment plans in technology, software, and system's capacity.

Data for the following variables are available:

- NS, which is net annual sales;
- COGS, which is the cost of goods sold per year;
- \bar{S} , which is the average dollar value of a purchase;
- FC, which is the annualized fixed costs; and
- M, which is the margin ratio, defined below.

Employing these terms, net sales (NS) in 2000 were \$178,456,000. COGS in 2000 were \$131,239,000 (Webvan, 1999, 2000). Thus, COGS, which is a large part of the variable cost component of total costs, accounted for 73.54 per cent of net sales. Accordingly, $(COGS)/(NS) = 0.7354$ and the margin ratio (M) is estimated to be $1 - (COGS)/(NS) = 0.2646$. When M is multiplied by NS, the product is equivalent to margin contribution.

Actual sales volume (V_{act} = number of purchases per year) is calculated by dividing NS by \bar{S} . Breakeven sales volume (V_{bep}) = number of purchases per year to achieve the BEP) is calculated by dividing FC by $(M \times \bar{S})$. In the equation below, R designates the ratio of actual volume to the BEP volume:

$$R = \frac{V_{act}}{V_{bep}} = 100 \left(\frac{NS \times \bar{S} \times M}{FC \times \bar{S}} \right) = 100 \left(\frac{NS \times M}{FC} \right)$$

\bar{S} , in both the numerator and denominator, cancels out. The reduced equation (on the right hand side) is an easy way to compare actual volume with breakeven volume. The business model goal is to achieve a value for R that is equal to or greater than one.

For the year 2000, using the reported value for G&A as the FC, the ratio is calculated to be 16.153 per cent. For comparison, the year 1999 yields $M = 0.1515$ and $R = 2.181$ per cent. The year 2000 value of R is a distinct improvement from that of 1999 but it is not enough to proclaim any light at the end of the tunnel for Webvan.

For the estimated values of 2001, $M = 0.2798$ and $R = 20.494$ per cent. This is based on the three values: $NS = \$308,800,000$; $COGS = \$222,400,000$; and $FC = \$421,600,000$, as found in Table III. R has increased from 16.2 per cent to 20.5 per cent, which is not enough to warrant optimism about the future success of Webvan. Breakeven produces an $R = 100$ per cent. These data indicate that the investment in operational capacity is too great. Evidently, the venture capital investment community also found these numbers discouraging.

Hope had dissipated that within a few years Webvan's operating system would reach and surpass breakeven.

How long would it take for the ratio of V_{act} to V_{bep} to become greater than one, so that profit can be made? If the firm had continued in the present fashion, it would have taken many years (if ever) for Webvan to reach breakeven. Had successful changes been introduced, they might have included increasing the demand volume and/or decreasing the breakeven point. In terms of the equation, this would mean increasing NS, increasing M; decreasing FC; and/or all of the above.

The situation is worse than pictured above. In its consolidated statement for 2000[5], Webvan listed total expenses of \$526.408 million, which is 11.15 times greater than gross profit. About \$160 million of the total fixed expenses can be ignored because they are related to accounting for amortization of goodwill, intangibles, and restructuring costs. However, that still leaves tangible fixed costs of \$367 million (including sales and marketing expenses) to create net loss of \$320 million. That is, \$367 million less \$47 million of gross profit. With the estimate of \$367 million in fixed costs, $R = 12.866$ per cent. This indicates that actual sales volume is 12.866 per cent of the breakeven volume in the year 2000, which is 20 per cent lower than the prior R of 16.153 per cent.

Because our estimates are based on annual reports, business journals and facts gleaned by the project teams, one cannot be sure of the "true" position of the breakeven point, or the "real" value of the ratio, R . Nevertheless, there is consistency among these data to show that Webvan's business model and operating strategy are debilitated by high fixed costs and low margins. The effort to gain greater market share, while entirely correct in theory, only exacerbates the situation because each additional share point is gained at too high a cost. Further complicating the matter are additional variable and fixed costs, which have not yet been included in the analysis. This omission is addressed in the next section.

Inventory carrying costs

Webvan's high BEP is a tough a hurdle to surmount. At least in part, this is owing to the high fixed costs of running the distribution centers. On the other hand, one of the largest related variable expenses of distribution is the inventory carrying costs. This opportunity cost of holding items in stock instead of doing something else with the freed-up money is not reflected in the costs that have previously been introduced. Balance sheets, profit and loss statements and cash flow analysis do not include opportunity costs.

A major component of carrying costs is money that is tied up (say, in inventory). Under bankruptcy laws, that money cannot be used in other more profitable ways. Operations managers factor carrying costs into inventory policies that determine the order size, which affects the days of inventory, carried and inventory turns. The number of turns is a function of the sales and that is related to the marketing effectiveness and the cost of creating sufficient demand. These are, at best, indirectly included in breakeven analyses.

What can be done to reduce inventory levels and, thereby, carrying costs? One often-used method is to employ drop-shipments. They are a means of avoiding or reducing carrying costs, but dropshipments are not suitable for most grocery items. Perishable items need special attention. Dropshipments increase the time-length of the supply chain as well as the span of control. Returns are costly in both the physical sense and the damage they do to customer loyalty. Mail order firms will affirm, that even for books, CDs, appliances, electronics, and other non-perishable items, dropshipments take oversight control away from the seller. Delivery delays may not be recognized and customer dissatisfaction may not be noticed until too late in the process.

Purchase and delivery options with mixed-model configurations

Webvan could not use dropshipments to lower holding costs without compromising the quality of its delivered produce. Instead, Webvan opted to build the finest, state-of-the-art warehouses, using the latest technology for sorting, picking, and packing that could be found. The cost of carrying inventory in such high-tech warehouses is very large.

The idea was that Webvan would be able to out-class all other pure-Internet retail grocery providers. To a large extent they did this. Webvan's technology was intended to build a significant competitive advantage by creating a barrier to entry. However, there were, as usual, unintended consequences of the new technology. Customers began to appreciate the advantages of stores after their new technology shopping experiences. Competitive modifications of the in-store business model to include ordering using the Internet as an alternative appealed to the marketplace. The mixed-model for e-tailing allowed the customer to choose where to purchase and where to return unsatisfactory items. The way in which this scenario plays out is not yet certain, but for the moment it appears that the mixed-mode has achieved an end-run around the pure Webvan model.

The flaw in reasoning which now seems evident is that Webvan's cost of doing business was too high. A large enough segment in the marketplace did not perceive the benefits of purchasing most of its groceries from this Internet grocery leader. Webvan's assumption that large numbers of grocery shoppers would prefer to do all aspects of their purchasing via the Internet has so far proved incorrect.

However, as Bell *et al.* (1998) and Messinger and Narasimhan (1997) have shown, customers will choose purchasing strategies that minimize their total costs and/or time needed to shop. In line with this finding, the 12 study teams reported that a relatively small percentage of customers were unequivocally committed to Internet purchasing on principle. The team studying Webvan found drop-outs occurred, even among those who started out fully loyal, after one or more bad experiences (Webvan, 2001). For apparent reasons, the probability of a "bad experience" is larger with home delivery than with in-store buying.

Given the opportunity, a majority of consumers preferred to see some of the items (such as greens for salads) that they were buying. With other items (such

as canned goods) they would prefer delivery. As a result, depending upon time pressures and other situational factors, customers choose to mix and match in-store and Internet shopping (Webvan, 2001; Peapod.com, 2001).

The options that have been set by the established supermarkets vary. An apparent success in utilizing the mixed mode has been developed in the UK by Sainsbury.com whose attractive Web page combines a store locator for pick-ups with an on-line order capability.

PublixDirect is a growing online service in Florida. Their Web page states that tipping delivery personnel is not permitted and returns to stores are totally acceptable. Safeway's acquisition of GroceryWorks.com has facilitated expanding the range of "clicks mixed with bricks". Click on: www.groceryworks.com and you get: www.safeway.com with a delivery charge of \$9.95, no matter the size of the order. The Safeway.com return policy is not specified except the assurance that customer satisfaction is of the utmost import. The connection with the entire Safeway family of stores (Vons, Pavilions, Carrs, etc.) is promoted and vaunted.

Peapod.com operates ten fulfillment centers, reaching about seven million households, which is approximately 6 per cent of US households[8]. The minimum order size is \$75 and there is a charge of \$9.95 for deliveries. Shared cost benefits (for purchasing and inventory) result from their (Ahold) association with "Stop & Shop" and "Giant" supermarkets. Peapod does not allow returns to either "Stop & Shop" or "Giant" stores. However, private label brands of each chain are made available through Peapod in the appropriate regions.

Just over a year ago, April 2000, Peapod was close to following Webvan's recent path of bankruptcy, but with funding from Royal Ahold (www.aholdusa.com) and new markets abandoned by out-of-cash competitors like Homeruns, Webvan, Shoplink.com, Streamline.com (newly acquired by Peapod[3]), and HomeGrocer.com, the company has managed, for the second time, to stay afloat and in this case meet financial analyst expectations (Scher and Murphy, 2000).

From the URL listed above:

The company (viz. Royal Ahold) has over 7,000 supermarkets, hypermarkets and other store formats in 23 countries and serves 30 million customers every week.

Compatibility between "clicks and bricks" can take many forms. When purchase, return, and replacement are interchangeable between in-store and the Internet, there is less stress and more flexibility for customers. There is also an added sense of security when the two (store and Web) are linked together in customers' minds. This raises the issue of synergy or, at least, compatibility. Synergy means that total benefits derived from the combined retail system are greater than the sum of the benefits derived by individual retail methods.

Compatibility produces results that are less than synergistic. Total benefits derived from the combined retail system are equal to the sum of the benefits derived by individual retail methods. Incompatibility deteriorates performance. Total benefits derived from the combined retail system are less than the sum of

the benefits derived by individual retail methods. It is even likely that synergy is created by appropriate differentiation between Web and store. Consider the quote (Hayes, 2002, p. 26): "Compatibility is often as important to a company's success as differentiation". A mixed-model for supermarkets could assure that corporate brands (e.g. Giant, Publix, Safeway, Albertson) carry both compatibility and differential value to their B2C-Internet grocery business.

Comparing Webvan's distribution centers to those of Amazon continues to provide useful insights. This is the case because new information has become available during 2001 about Amazon's warehouse system, and changes that it has made in its business model. If Webvan had survived, it would likely have followed the same path as Amazon, which has engaged in major efforts to decrease the total costs of operations during 2001. As a result, Amazon has increased its operational productivity significantly.

Amazon, trying to placate irate investors, as its stock value plunged, made no secret of the fact that operations were going to take center-stage in a cost-cutting drive. During the 2001 Christmas season, Amazon concentrated on improving its production functions and operations management. That effort has continued during the first quarter of 2002 with striking results. Amazon reported profitable quarters for the first time in 2002 as a result of improved productivity and lower fixed costs.

In a January 2002 article in the *New York Times*, it was estimated "... that order fulfillment costs absorbed 11 percent of Amazon's sales (i.e. dollars of revenue) in the fourth quarter (of 2001), down from 13.5 per cent a year earlier".

The analyst estimated: "those costs need to fall below 9 per cent for the company to thrive" (*New York Times*, 2002a). Perhaps, 9 per cent accomplishes the goal of allowing actual volume to significantly exceed breakeven volume and achieving profitability. It is noteworthy that in 2000, order fulfillment costs (variable plus annual fixed costs) constituted 87 per cent of Amazon.com's total revenues (Amazon, 2001).

With a variety of service improvements, demand is increasing as Amazon continues to drive fixed costs down while stabilizing variable costs[4]. Webvan would have tried to develop the same kind of scenario, but it never got the chance to try that out. Webvan warehousing and distribution centers were highly automated and very much like the five gigantic warehouses which Amazon built in 1999. However, Webvan would have had additional problems to cope with, since food is highly perishable and much of it carries expiration dates. As a result, there are added costs for refrigeration in both storage and delivery, which books, CDs, and DVDs do not require.

Shipping and handling costs (S&H)

Another variable cost to consider in terms of prices and services offered to customers is the shipping cost per order. These logistic (delivery) costs are of major consequence to all B2C companies. How much does delivery cost the customer and how long does it take to deliver the goods? Webvan

experimented with different shipping and handling (S&H) charge schemes, but as 2001 began there was no final resolution (Webvan, 2000).

All of the Internet retailers of goods that have been studied by the project teams have reported that customers are not consistent in what they consider to be acceptable S&H charges. The variability can be traced to many factors, including the latest competitive practices, changes in shipping charges (which occur frequently), costs of the item(s) being shipped, the bundling together of several items in one charge, and the availability of the alternative to shop in-store.

B2C firms believe that S&H charges should be designed to motivate larger order sizes, e.g. if you order two or more books (Amazon.com), or, more than \$50 of cosmetics (drugstore.com), shipping is gratis. Peapod says that \$75 is the minimum order that will be delivered. On the other hand, Amazon's Jeff Bezos stated on MSNBC that income from S&H had been a major source of revenue to the company when products were fully discounted. He would not dismiss the use of S&H for revenue generation in the future. At the time of this statement, Amazon.com was experimenting with requiring a minimum dollar amount for free S&H.

From conversations with the various Internet retailers of goods, all project teams were told the same thing, namely, when customers think that the S&H charge is excessive, their probability of ordering and reordering is decreased. A major trigger for customers leaving a Web page without buying is when the shopping cart has S&H charges added to the total. On the other hand, free delivery is often viewed as a product discount. As soon as that perk is removed, loyalty-based on free delivery may evaporate (*The Standard*, 2001).

Weather changes can make a walk to the store attractive in spring, but not in winter. What product is being delivered matters, e.g. if Dell charges \$20 to deliver a \$2,000 computer that 1 per cent charge is likely to be acceptable. On the other hand, a \$20 delivery charge by a garden shop to deliver 50 pounds of soil that costs \$20 is a 100 per cent charge and that might not be deemed satisfactory.

How much should the delivery charge be for a 50-pound bag of dog food? PETS.com never found a satisfactory answer to that question (Pets.com, 2001). What should Webvan.com have charged for delivering a \$3 loaf of bread? This is another instance of where the delivery cost can exceed the product price. Webvan probably would have followed the present trend, which is to charge \$9.95, as well as to have a minimum order size.

Webvan.com, Amazon.com, Peapod.com, drugstore.com, PETS.com, and other B2Cs have wrestled with the fact that what seem to be acceptable delivery charges are different for various market segments. Worse yet, the criteria appear to be unstable. They change over time for all segments in a pattern that is not clear. The elasticity of delivery charges is a subject that continues to require study. From the operations point of view, attention might be paid to cutting the S&H costs through judicious use of vehicle routing models, as well as other operations management considerations. Creating

neighborhoods of loyal customers in conjunction with focused marketing efforts might reduce delivery distances.

Returns and adjustment

Further complications arise with respect to the costs of correcting customer complaints. An incomplete order can have a high correction costs. The same applies to unsatisfactory merchandise that the customer wants to return. Many mail order firms charge customers for the return delivery adjustment. CompUSA, Circuit City, etc., introduced a restocking charge of 15 per cent for their electronics as well as unopened CDs and DVDs.

Supermarkets do not charge for returns although an increasing number of retailers levy so-called "restocking" charges (*Wall Street Journal*, 2002). Complaints and returns of merchandise are generally easy to take care of in the store. On the other hand, customers on the Internet do not have good systems for correcting problems. Internet retailers do not have systems in place for placating upset customers. The approach that blends using the Internet with in-store (and sometimes mail order) systems for handling pick-ups and returns may be the best method at present for providing customer satisfaction.

Strong measures can be taken to assure quality by inspection of shipments before they are released. While this may not be the most desirable approach in a Deming-world, it does promise lower probabilities of returns. Similarly, the quality of packaging might be an important factor in reducing damaged products that decrease customer loyalty. The issue of operations management of quality (Sousa and Voss, 2002) is in keeping with the most recent evaluation of the impact of quality performance on firm performance.

Although the project teams did not find evidence of conscious quality management, Amazon's Jeff Bezos recently stated that in addition to cutting costs, his company has reduced the number of incorrect and damaged shipments. At the same time, Amazon has lowered prices to their book customers. For those cases where something goes wrong with Amazon electronic products, the firm has developed in-store return and exchange arrangements with Circuit City. Amazon's customers can avoid S&H by picking up goods at the stores that were purchased online. Amazon has reported greater customer (service) satisfaction as a result of this cooperative effort.

PETsMART and Petco find a way

The project teams' results provide further information for useful comparison. Pet food was one of the first retail categories that turned its attention to investments in alternative retailing using Internet B2C. Delivery of food products to customers for their pets was one of PETS.com's major problems. High S&H charges alienated customers, even though they did not cover the company's real costs of delivery. It may be doubtful that this factor alone caused PETS.com to file for bankruptcy, but it was significant.

The URL for www.pets.com was sold to PETsMART with its www.PETsMART.com

PETsMART has the entire in-store infrastructure to support its Internet business. When visiting PETsMART.com, the first Web page prompts “Find a store near you”. Test that challenge and you will find that there are many PETsMART stores to share their sales and costs with the Internet business. The author’s zip code produced a list of five stores that qualify as being “nearby”. The list of in-store activities for training, grooming, and meeting other pet owners is impressive. The firm has blended Internet convenience with in-store attractions to provide operational fixed and variable cost-cutting advantages. Consider the following quote from Brian Devine of Petco (*Southwest Airlines, SPIRIT Magazine, 2002*). He states that:

The start-up guys didn’t have what we had. They were going to buy less from manufacturers, so they were not going to be able to buy at as strong a price as we can. Second, they would somehow have to distribute this merchandise, which meant building distribution centers and hiring people, buying rolling stock to deliver or finding somebody to deliver. We already had distribution centers.

A visit to Petco.com prompts “Locate a store near you”. Petco has 561 stores located in 41 states and the District of Columbia. The financial performance of Petco in 2001 was strong. In fact, Petco is judged to be one of the first IPOs that is likely to be successful in the 2002 stock market[5]. The explanation given is that Petco’s business model is effective. This provides yet another example of a successful blend of Internet and in-store capabilities.

As an alternative to the successful Petco model, the powerful in-store retailer Toys“R”Us has arranged for Amazon to represent them on the Internet. Click on: www.toysrus.com and Amazon.com’s Web page for toys appears. Meanwhile, www.etoys.com has a pure Internet strategy, with an interesting Web site where customers can shop by age, brand, or toy-type category. There are numerous opportunities to read and learn about toys on the Web site, but etoys.com lacks any store infrastructure. The project teams did not obtain any performance statistics for etoys.com. As a parenthetical note, Webvan did carry a toy line. It played an insignificant revenue role but it may have siphoned off managerial attention. There are similar concerns about Amazon which, in addition to books, music and toys, carries many other types of retail items.

drugstore.com has its own special issues

The project team that worked on www.drugstore.com found that delivery charge policies were changed often. For a while, prescription drugs had no charge for standard delivery. That was altered to a small S&H fee. Sometimes, special offers on delivery charges were made, e.g. if the customer mailed in a new prescription. For about six months there was a policy of no charge for shipping three-months supply of the prescription at one time.

As of 24 June 2002, charges for non-prescription items run counter to the idea of providing incentives to increase order size. This is shown in Table IV.

The options for two and three-day shipping have similarly higher S&H as the size of the dollar value of the order increases. This illustration is provided to counter the belief that all e-tailers are following the “larger order has lower charges” concept.

Customer complaints often dealt with delivery issues. For example, deliveries made using the US postal service could sit in a mailbox for hours under conditions (heat, cold, rain) that altered the effectiveness of the product. Enough mailboxes are not secure to raise the issue of drug theft. Packages labeled with the logo of drugstore.com, appear to be at a higher risk of theft than what is normal for small parcels.

Several users of drugstore.com’s Internet B2C-service who were interviewed by the project team said that they prefer to go into Rite-Aid retail stores for pick-ups. There are 3,700 of these stores in the USA and drugstore.com has an alliance with Rite-Aid. This is another example of a blending of functions, where orders are placed via the Internet and customers pick them up in the retail store.

drugstore.com sells many items that do not require a doctor’s prescription. These include cosmetics, toothpaste, soap, greeting cards, etc. Once any drugstore holds the customer’s prescription, it has a competitive advantage of getting that customer to buy its other products (see the paragraph below). This means that whoever holds a prescription has a loyalty advantage, so holding costs are lower. However, the other side of the coin is that getting new customers from other competitors (called the switching cost) is higher.

If Webvan had used a pharmacy to capture and keep customers for grocery shopping, it is not evident in the materials that were available to the project team. In line with this, it is noteworthy that shifting prescriptions from one provider to another is not difficult to do, but it is alarming to many customers. This translates to the fact that once drugstore.com gets a doctor’s prescription, it has an inertial competitive advantage, at least until the prescription expires.

In marketing terms, whoever holds the doctor’s Rx has a honeymoon period of strong customer loyalty for that prescription and some carry over for other prescriptions. All Internet-based drug retailers, such as Cornerdrug.com, LowRx.com, Phar-Mor.com, ePharmacy by Eckerd, and 4drugstores.com are in the same game and they know it.

Markov models provide a robust mathematical model for dealing with switching and holding. The basic issue in this case is captured by a 3 × 3 matrix which studies how customers switch between their in-store buying, Internet shopping and combinations of the two. This kind of study must be

Order size	Standard shipping	Overnight shipping
\$0-\$249.99	\$5.49	\$29.95
\$250-\$499.99	\$19.95	\$89.95
\$500 or more	\$99.95	\$199.95

Table IV.
S&H charges for
non-prescription items
from drugstore.com

category sensitive, e.g. different for groceries, drugs, toys, and books. It will provide information about cash flow generation, future revenues, and volumes, that none of the dot.com startup firms are able to obtain at the present time.

One great advantage that drugstore uses very effectively is the ability to communicate with its customers via e-mail. They notify prescription users of their need to reorder. It provides every customer with a status report of what they have ordered before and how much they have paid. There is a complete record of the prescribing doctor and the expiration dates of prescriptions. It is able to monitor harmful interactions and to work with the customers' health insurance companies. However, drugstore.com has only limited insurance participation, accepting about 60 per cent of the national coverage. The customer has to shop around to find which company (if any) accepts their specific plan.

Useful dichotomy: two types of dot.coms

It should be noted that among the Internet B2C companies a distinction can be made regarding carrying inventory. Companies like Webvan, Peapod.com, Amazon.com, drugstore.com, Tupperware, and Pets.com have a large part of net sales invested in the COGS, which is an inventory that must be purchased, carried in storage, and delivered.

On the other side of the dichotomy, companies like eBay (auctions), Priceline.com (airline tickets, etc.), Orbitz (like Priceline and Expedia), and Fandango (theater tickets) do not carry inventory. Congruent with this fact, the costs of delivering goods raise additional hurdles for inventory-burdened companies. The costs for delivering airline tickets are near zero to Priceline.com and Orbitz. The auction platform of eBay serves as a communication link between buyers and sellers. eBay does not deal with inventory and lets the buyer pay the seller for the shipping costs.

eBay has developed an auction process between individuals as a successful buyer-to-seller business model. The costs of operating the auction process are low because eBay has virtually automated all of the operations:

eBay, the Internet auctioneer, is a near-perfect model of software and network economics. Once its programmers built the auction tools, eBay could almost run itself (*The Economist*, 2000).

The non-inventory carrying dot.coms have financial statements that appear to be closer to achieving breakeven volumes. In the year 2001, Priceline.com had margin contribution of \$200,074,000 with fixed costs of \$202,592,000 producing a loss of \$2,518,000. There were no additional inventory or delivery costs. Thus, Priceline was operating just below its breakeven volume in 2001. It is not a surprise that the fourth quarter (2001) for Priceline was profitable, and that the first quarter of 2002 is also expected to be profitable.

Priceline states that it will continue to improve productivity and decrease its fixed costs of doing business during 2002. On the other hand, Priceline has a volume-of-business burden, stemming from 11 September, which is to generate

airline ticket purchase demand that will keep their fixed-cost transaction systems sufficiently occupied. Also, a revenue problem exists. Priceline must cope with a significant decrease in the average dollar value of an airline ticket. One published estimate (Travel Industry Association of America, 2002) is that the cost of the average airline ticket decreased 6 per cent from 2000 to 2001. The decrease from 2001 through 2002 may be even greater. The decline in revenue will necessitate increasingly stringent decreases in fixed and variable costs related to operations.

Conclusions about S&H

A study by Forrester in May 2001 concluded that among all firms requiring S&H, one third overcharge their customers and one third undercharge them (*The Standard*, 2001). That means that one third (according to their calculations) breakeven on their S&H costs. These firms should know what their real costs are in comparison to what they are charging their customers. That is a different matter from what the customer perceives.

The main penalty for customer perception of being overcharged is loss of customer trust and loyalty. Lower customer loyalty is reflected by less likelihood of repeat purchases. Alternatively, switching to other vendors will increase.

The overcharge perception may lead customers to return to in-store buying where S&H is not incurred. From the company's point of view, where conscious overcharging is used to bolster revenues and profits, the amount overcharged must be equal to or greater than the lifetime value of sales lost because of perceived overcharging. Thus, overcharging is common where the probability of a repeat purchase is considered nil. For example, when foreigners (traveling anywhere in the world) are charged for shipping vacation purchases to their homes.

The real amount undercharged for S&H is an additional cost subtracted from revenue. However, there is a question whether customers are more likely to repurchase when they perceive that there are low (or no) charges for S&H. Ironically, in such circumstances, many customers express the belief that S&H charges are already included in the price per unit that they are paying. On the other hand, if the customer is an informed shopper and knows that the price being paid is already discounted, then the low S&H is an added benefit.

The condition in which merchandise arrives, and the time required for delivery, play a part in customer satisfaction with purchasing on the Internet. When a problem arises, the methods for recourse to seek adjustments can play a major role in determining future customer purchase behavior. Companies that are trying to establish themselves in the B2C marketplace often overlook such elements. In summary, the effect of S&H costs on the position of the breakeven volume with respect to actual demand levels is likely to be a "best" guide to feasibility of an e-tailing adventure.

Conclusions for Webvan

At bankruptcy time, a Webvan spokesman, Bud Grebey, blamed the total shutdown of the company on “an unexpected drop-off in orders when the company changed its delivery fees.” He also said that serious problems arose when Webvan acquired HomeGrocer and began shifting from their warehouses to those of Webvan (Farmer and Sandoval, 2001). The two issues seem related.

But the seeds of trouble had been sown long before. “Once worth \$1.2 billion and touting an ambitious 26-city plan, Webvan signed a \$1 billion Bechtel contract to build a string of high-tech warehouses worth about \$30 million each” (Farmer and Sandoval, 2001). Racing ahead because it was believed that testing the waters was unneeded, Webvan headed into self-created problems that could have been avoided.

In answer to questions raised at the start of this paper, Webvan’s rollout was too fast and too extensive. The company did not take time to apply operations management thinking to the situation. Among the various types of e-tailers, the electronic grocery business must be at the apex with respect to extensive and costly inventories. No one else has the short-shelf life problems that result in such high carrying costs and turnover requirements. Electronic obsolescence is slow in comparison and old models can be sold at discounts. Food is perishable even before the product becomes outdated if transport is mishandled. As an example, fish must be properly destroyed if the temperature in its truck rises above a specified level[6].

Webvan’s rush to absorb all markets with the most expensive technology should have been scrutinized in terms of when breakeven could be achieved with the combination of variable and fixed costs that had been set in motion. Demand levels to feed such a system could have been recognized as impractical (at least) within the same time horizon as Webvan’s spending rate.

With hindsight, it is always easier to know what to do, and what to avoid. Nevertheless, Webvan’s level of risk in this situation could have been reduced by entering into an alliance with an established supermarket chain of stores. Initially, profitability would have been compromised but survivability enhanced. The joint venture would have been a worthwhile insurance policy.

Generic summary

The specific category of merchandise carried by e-tailers is very significant in evaluating performance of the firm. Tickets (e.g. Priceline) and auctions (e.g. eBay) are categories that are inventory-free. Both could be considered as forms of services. Drugs and food require physical inventories which are dated for safe use and demand care in handling. Toys, books, and clothing have various categories of demand patterns including seasonal, stable, and faddish.

Each merchandise category has its own supply chain characteristics with respect to sourcing and selling. A lot can be learned from the mail order business which has been studied from every angle including operations. Some of the crucial issues include who is empowered to purchase what from whom,

and in what quantity. Inventory-based retailers have found hybrid means of blending Internet ordering with in-store pick-up and returns.

This modification of the pure-Internet retailing model is a challenge for production and operations management (POM) which has already developed deep understanding of in-store retailing requirements but has yet to learn about the best way to deal with the marriage of in-store and Internet systems.

Notes

1. It should be noted that while Webvan's main business was in competition with supermarkets, their B2C product line included house wares, pet supplies, consumer electronics, books, and entertainment products. However, groceries were the major component of the cost of goods sold.
2. See Ahire (2001). This article describes the win-win situation that occurs when students do research under the careful supervision of knowledgeable faculty.
3. *Peapod's 10K 2000 – Annual Report*, available at: <http://www.sec.gov/Archives/edgar/data/1036992/000091205701506551/a2043710z10-k.txt>
4. See *New York Times* (2002), Amazon's first-quarter results reported in April of 2002 showed sales up 21 per cent the same quarter in 2001 and losses had narrowed from \$217 million to \$23 million, Sunday, 19 May.
5. Petco Animal Supplies, a pet food and supplies retailer based in San Diego, plans to sell 14.5 million shares at \$18 to \$20 each in an initial public offering on Thursday. On 3 July, 2002, PETC closed at 24.10 which is good performance during a down market (see *New York Times*, 2002c.).
6. See HACCP FDA regulations at: <http://vm.cfsan.fda.gov/~dms/haccpro.html>

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