

**Demand Allocation Strategies in the Seasonal Retail Industry**

Carin H. Chan

B.S. Information and Computer Science, University of California, Irvine (2003)

Submitted to the MIT Sloan School of Management and the Engineering Systems Division in  
Partial Fulfillment of the Requirement for the Degrees of

Master of Business Administration  
and  
Master of Science in Engineering Systems

In conjunction with the Leaders for Manufacturing Program at the  
Massachusetts Institute of Technology  
June 2007

© Massachusetts Institute of Technology, 2007. All rights reserved.

Signature of Author \_\_\_\_\_  
MIT Sloan School of Management  
Engineering Systems Division  
May 11, 2007

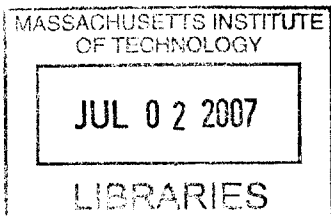
Certified by \_\_\_\_\_  
Deborah Nightingale, Thesis Advisor (Engineering)  
Professor, Department of Aeronautics and Astronautics and Engineering Systems Division

Certified by \_\_\_\_\_  
Sara L. Beckman, Thesis Advisor (Management)  
Senior Lecturer, UC Berkeley, Haas School of Business

Certified by \_\_\_\_\_  
Don Rosenfield, Thesis Reader (Management)  
Director, Leaders For Manufacturing Program  
Senior Lecturer, MIT Sloan School of Management

Accepted by \_\_\_\_\_  
Richard de Neufville, Professor of Engineering Systems  
Chair, Engineering Systems Division Education Committee

Accepted by \_\_\_\_\_  
Debbie Berechman, Executive Director of Masters Program  
MIT Sloan School of Management



**BARKER**

[This Page Intentionally Left Blank]

# **Demand Allocation Strategies in the Seasonal Retail Industry**

By  
Carin H. Chan

Submitted to the MIT Sloan School of Management and Engineering Systems Division  
on May 11, 2007 in Partial Fulfillment of the Requirements  
for the Degrees of Master of Business Administration and  
Master of Science in Engineering Systems

## **Abstract**

Amazon.com is a publicly-held company headquartered in Seattle, Washington. It revolutionized the retail industry by being one of the first major companies to sell goods over the Internet. It is an international company servicing countries throughout the world with goods ranging from books to jewelry. Amazon.com fulfills its customers' orders through a series of fulfillment centers throughout the United States.

The goal of this thesis is to present a framework for testing and validating off-peak demand allocation strategies. Using Amazon.com as a primary study, this framework explores variable cost and transportation cost for the retail industry. The Amazon.com organization is discussed. Then a presentation on variable cost and transportation cost is introduced. A model is then introduced that ties variable and transportation costs together. This thesis concludes with a discussion on labor and transportation improvements implemented by other companies.

## **Thesis Advisors**

Sara Beckman  
Senior Lecturer, UC Berkeley, Haas School of Business

Deborah Nightingale, Thesis Advisor (Engineering)  
Professor, Department of Aeronautics and Astronautics and Engineering Systems Division

[This Page Intentionally Left Blank]

## **Acknowledgements**

### **To Amazon.com:**

Thank you to Amazon.com for their continued support of the Leaders for Manufacturing program. I have been impressed by Amazon.com's passion to excel in its industry. In particular, I would like to thank:

Micah Samuels – Thank you for guiding me throughout the internship. I enjoyed the ability to learn everything I can about RNO1 and its processes.

Lisa Bombard – Thank you for listening to all my ideas.

Tim Collins – Thank you for your continual support of the LFM program.

Mark Phillips and Cynthia Dean – I love finance. Finance is an endless source of data. My project would have never been completed without it.

LFM Alumnis- Jeff Wilke (My best Amazon.com takeaways were from the presentation).  
Kristin Toth (Thank you for answering all my questions especially with transportation).  
Thank you to Kerry Person and David Jackson for sharing your experience with me.

### **To my advisors:**

Thank you for everything! I am happy that you have learned about Amazon.com through me and I hoped you enjoyed it.

Professor Sara Beckman – Thank you for being my sounding board throughout my internship. I enjoyed the feedback and insights that you have shared.

Professor Debbie Nightingale – I will always remember your comments on picking.

### **To my friends:**

As a group you are as varied as my interests. Thank you for pushing me to excel and be who I am today. Thank you for catching me when I fall and the countless hours of support.

### **To my family:**

Thank you for your constant support and allowing me to pursue my dreams. No matter if you're 8000 miles away or in the next state, I know you will always be there for me. Thank you for allowing me to continue my nomadic life. Home will always be where you may be.

[This Page Intentionally Left Blank]

## Table of Contents

Chapter 1: Introduction .....	10
1.1 Problem Statement.....	11
1.2 Document Overview .....	12
Chapter 2: Amazon.com Background and Operations .....	13
2.1 Earth’s Biggest Selection.....	13
2.2 Amazon.com Fulfillment Network.....	14
2.2.1 Corporate Governance.....	15
2.2.2 Organization Structure .....	16
2.2.3 Fulfillment Center Processes.....	17
2.2.4 Order Fulfillment.....	19
2.3 Focus on Customer Service .....	21
2.4 Demand Levels .....	22
2.4.1 Weekly Demand Levels .....	27
Chapter 3: Variable Cost.....	28
3.1 General Labor Information.....	28
3.2 Amazon Labor .....	30
3.3 Labor Planning .....	31
Chapter 4: Transportation Cost.....	34
4.1 Transportation Background .....	34
4.2 Transportation at Amazon.com .....	36
4.3 Future of Transportation .....	39
Chapter 5: Model .....	41
5.1 Model Schematics.....	41
5.2 Model Scenarios .....	46
5.3 Model Findings.....	49
5.4 Potential Savings Opportunities .....	54
Chapter 6: Cost Saving Opportunities .....	56
6.1 Potential Variable Cost Savings .....	56
6.2 Potential Transportation Savings.....	58
References.....	64

Appendix A: Labor Management ..... 66  
A.1: Catalogs Advice on Finding Seasonal Labor ..... 66  
A.2: Exit Interview Questions ..... 66  
A.3: Lands End ..... 67

o



## Table of Figures

Figure 1: Amazon.com Sortable Fulfillment Center Map .....	15
Figure 2: Amazon.com Organizational Structure .....	16
Figure 3: Amazon.com Fulfillment Center Process Flow .....	17
Figure 4: Order Software Flow Diagram .....	20
Figure 5: 2005 US Retail and Food Service Sales .....	23
Figure 6: Amazon.com Y2006 Quarterly Revenue .....	24
Figure 7: Target and Wal-Mart 2006 Sales.....	24
Figure 8: Representative Amazon.com Overall Demand Sample .....	25
Figure 9: Sample Package Distributions.....	26
Figure 10: Representative Amazon.com Yearly Demand Sample .....	27
Figure 11: Number of Separations as a Percent of Total Number of Employees.....	29
Figure 12: Zoning Example based on RNO1.....	35
Figure 13: UPS Ground Cost by Zone.....	36
Figure 14: Amazon.com Y2006 Package Zoning Distributions.....	38
Figure 15: Pareto Chart Y2006 Weight Distribution.....	38
Figure 16: Model Schematics .....	42
Figure 17: Model Sample Zip Code Distribution .....	44
Figure 18: Model Scenarios- Option A.....	46
Figure 19: Model Scenarios- Option B.....	47
Figure 20: Model Scenarios- Option C.....	47
Figure 21: Model Scenarios- Option D.....	48
Figure 22: Fulfillment Center A Result Subset.....	51
Figure 23: Fulfillment Center B Result Subset.....	51
Figure 24: Fulfillment Center C Result Subset.....	52
Figure 25: Fulfillment Center D Result Subset.....	53
Figure 26: Fulfillment Center E Result Subset.....	53

## Chapter 1: Introduction

The retail industry faces numerous challenges. There are a multitude of reasons for a retail business to grow exponentially or to perform poorly. Macroeconomic issues, such as recessions and internal industry competition, are just some of the problems that make the retail industry challenging. It is up to the company's leaders to recognize the problems and make changes appropriately. Poor performance should be recognized and corrective action taken via the financial markets. There are a number of corporate strategy examples in the retail industry, and varying levels of success associated with each strategy.

In recent history, the Gap serves as an example of a retailer that revolutionized the clothing industry through its ability to brand its image, but has stumbled in recent years due to its inability to capture customer demand. Zara and Hennes & Maurtiz (H&M) have successfully segmented the price conscious market and manipulated its supply chains to capture clothing seasonality. Beyond the apparel industry, Wal-Mart has had explosive growth with its hub and spoke model. Target has been known to be the "hip discounter"<sup>1</sup> able to sustain growth in the world of Wal-Marts. Though it may be true that the "forecast is always wrong",<sup>2</sup> these companies not only understood the importance of having the right product at the right time, but managed to find operational strategies to achieve that goal.

Born in the dot-com era of the 1990s, Amazon.com revolutionized the book business and managed to survive the dot-com bust with its revolutionary business model. Amazon.com had been a risky bet that was given considerable leeway by financial markets. It did not even make a profit until 2002. Since then, Amazon.com has emerged as one of the Top 50 sites in the world,<sup>3</sup> ranking as the 11<sup>th</sup> most visited site in the United States and the 23<sup>rd</sup> most visited site in the world. Leveraging this large volume of internet traffic, Amazon.com has established itself as a successful retail company in a large part due to its use of innovative technology.

---

<sup>1</sup> Arlen, Jeffrey. "Why is Target So Cool?" DSN Retailing Today. April 2, 2001. (Retailing Today)

<sup>2</sup> Simchi-Levi, David et al. Designing and Managing the Supply Chain. McGraw-Hill Publishing Co. 2002

<sup>3</sup> Alexa.com Traffic Rankings ([http://www.alexa.com/site/ds/top\\_500?qterm=](http://www.alexa.com/site/ds/top_500?qterm=)) 2007

Amazon.com persisted, even after its IPO, in making decisions for the long term and focusing on the customer rather than its stock price. Despite the inevitable pressures of the financial markets, Amazon.com has made investments for the long term, instead of concerning itself solely with a short term ROI. The Amazon.com business model is unique in its use of a wide variety of proprietary software coupled with excellent supply chain practices.

It may be easy to simply view Amazon.com as a unique company, but at its core Amazon.com is an atypical company with typical operational challenges. Like other industries, Amazon.com must meet or exceed customer demand and expectations. It must minimize costs by increasing productivity through measures such as process improvement and sourcing techniques. It must attract a labor pool and train efficient labor. While Amazon.com would like to fix all the problems within its system at once, it has a limited amount of capital it can expend on fixing them in any given year. These are challenges that exist not only in retail industry but also in the manufacturing industries. That fact that Amazon.com has been successful despite facing the same challenges as a number of other companies (who have not been as successful) is what makes it an interesting company to study.

Amazon.com must also handle the seasonal nature of the retail industry. During the holiday season, demand increases from 2 to 4 times the normal volume. As a result, its operating cost increases due to a wide variety of other costs associated with fulfilling large swings in demand such as labor costs. This demand increase tests the processing limits of a number of its facilities.

### ***1.1 Problem Statement***

This internship's goal was to examine the variable and transportation costs associated with fulfillment centers throughout the United States and determine the outbound demand allocation to each center. Seasonality will continually persist each year, but it may be possible to better prepare a particular fulfillment center by shifting the demand allocation among the various fulfillment centers. The basis of this thesis is that it may be possible that suboptimal demand allocations during off-peak periods yield an overall optimum in the long term. An examination of the variable and transportation costs formed the basis of a cost benefit analysis of employing different strategies of distributing demand across the various centers.

## ***1.2 Document Overview***

### **Chapter 2: Amazon.com Background and Operations**

This section describes Amazon.com's unique operations. The Amazon.com network consists of various fulfillment centers throughout the country. These fulfillment centers work together to make on-time deliveries to the customer. The typical retail demand profile and its associated challenges are discussed.

### **Chapter 3: Variable Cost**

A definition of variable cost for Amazon.com's fulfillment center is described. In this section labor cost is discussed as a major contributor to variable cost. An initial variable cost modeling methodology is presented.

### **Chapter 4: Transportation Cost**

A discussion of outbound transportation cost and modeling outbound transportation cost.

### **Chapter 5: Model**

This sections details the model components as well as model scenarios. It further dissects the key model conclusions.

### **Chapter 6: Cost Saving Opportunities**

With the model learning, potential variable cost and transportation cost savings are discussed in this section. Literature from various sources was taken to discuss general cost saving techniques of other companies.

### **Chapter 7: Conclusions**

This summarizes the key findings and recommendations.

## **Chapter 2: Amazon.com Background and Operations**

### ***2.1 Earth's Biggest Selection***

Founded in 1994 by Jeff Bezos, Amazon.com's original goal was to become the world's biggest bookstore. After going public in 1997, Amazon.com's mission has expanded to be Earth's most customer-centric company where people can find and discover anything they want to buy online. This customer service focus persists today. The annual reports include the 1997 Shareholder Letter to remind the shareholders of the emphasis Amazon.com places on its customers and on making long term investments for the future. Amazon.com's business strategy is to relentlessly focus on customer experience by offering customers low prices, convenience, and a wide selection of merchandise, to provide e-commerce solutions and services to other businesses and to offer web services applications to developers.<sup>4</sup> Ten years later, Amazon.com is an established Fortune 500 company.

Amazon.com is an international company with operations in the United Kingdom, Germany, France, Japan, Canada, and China. In 2005, Amazon.com's sales figure was \$8,490M, with North America sales amounting to \$4,711M (55% of total). In comparison, Amazon.com's sales figure in 1995 was \$511K. This impressive growth figure is a result of a revolutionary business-to-customer model that emphasized excellent customer service. Excellent customer service is ensured by on-time order delivery and inventory availability. In the early days, this focus on customer service spurred growth in the online-industry.

Amazon.com is a retail company with a unique software asset. Its software integrates the Internet storefront and drives customer fulfillment. Amazon's software group has been tasked to solve supply chain problems no one else in the industry is even considering. By continually being the leader in software usage for operations, Amazon.com has been able to find solutions to advanced supply chain problems that others have not.

---

<sup>4</sup> Amazon.com 2005 Annual Report

The majority of Amazon.com's product selection consists of books, CDs, DVDs, and videos, which account for 70% of its sales.<sup>5</sup> Amazon.com also has product categories such as auto parts, toys, tools, electronics, home furnishings, apparel, health and beauty goods, prescription drugs, and groceries demonstrating that Amazon.com has the ability to deliver anything customers may desire.

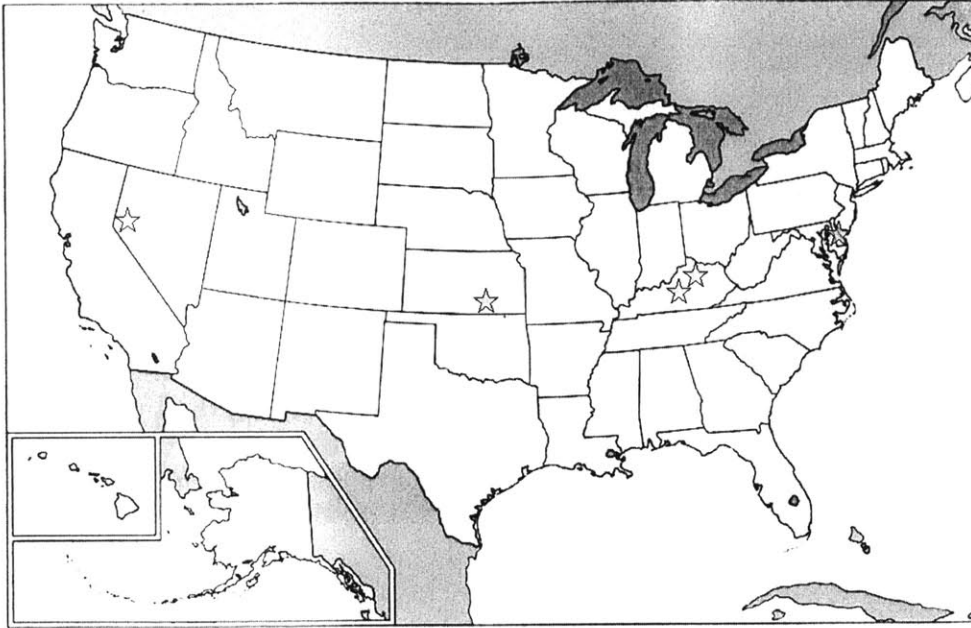
## ***2.2 Amazon.com Fulfillment Network***

Amazon.com's fulfillment network is strategically optimized to lower cost and to meet customer demand. Amazon's fulfillment network consist of nodes that are either sortable fulfillment centers (FC) or nonsortable FCs. The typical inventory in a sortable fulfillment center (FC) is an item that is "smaller than a breadbox." Items that are smaller than a breadbox include items such as books and DVDs, which make up a large portion of total sales. Nonsortable fulfillment centers contain goods such as TVs and barbeque grills. This division between FCs is mainly due to physical and mechanical constraints such as those associated with sorting systems and conveyors. The topic of this thesis is limited to sortable FCs in the United States.

Amazon.com's United States sortable fulfillment network consists of 5 sites strategically placed throughout the United States. Named after the closest airport to the particular FC, Amazon.com's 5 sortable FC sites are located in LEX (Lexington, KY), PHL (New Castle, DE), RNO (Fernley, NV), SDF (Campbellsville, KY) and TUL (Coffeyville, KS). Figure 1: Amazon.com Sortable Fulfillment Center Map depicts the various FCs on the United States map.

---

<sup>5</sup> Hoovers.com, Amazon.com Fact Sheet



**Figure 1: Amazon.com Sortable Fulfillment Center Map**

Since Amazon.com strives to be a marketplace where customers can buy anything they desire, it fulfills this promise by increasing its warehouse inventory and allowing third party sellers on its website. Amazon.com operates with inventory from categories such as:

- Apparel, shoes, and accessories
- Baby care products
- Beauty
- Books
- Camera and photography
- Cell phones and service
- Computers and computer add-ons
- Consumer electronics
- DVDs, including rentals and videos
- Gourmet food
- Health and personal care
- Home, garden, and outdoor living products
- Jewelry and watches
- Kitchenware and housewares
- Music and musical instruments
- Office products
- Software
- Sports and outdoors
- Tools and hardware
- Toys and video games

### **2.2.1 Corporate Governance**

Amazon.com's current business strategy is to relentlessly focus on customer experience by offering its customers low prices, convenience, and a wide selection of merchandise, providing e-commerce solutions and services to other businesses, and offering web services applications to

developers.<sup>6</sup> A key differentiating factor for Amazon.com is its ability to innovate for its customers through the website and on the operational level by maximizing its software capabilities.

One of the unique ways Amazon.com preserves itself as a young entrepreneurial company is the 2PT (Two Pizza Team) concept. The 2PT strategy limits the number of people on a particular team by suggesting that teams should be able to be fed by two pizzas. These small teams allow Amazon.com to be agile enough to solve various problems throughout the organization. These 2PT are in charge of various topics throughout the organization such as process management and storage management. For instance, an FC experiencing bad quality items on the receiving dock will notify the 2PTL (2 Pizza Team Leader) of the experience and develop a resolution plan together. The 2PTs also use the FCs as their eyes and ears to determine projects they should be focused on to improve FC performance. Through this mechanism the FC has the ability to change the organization.

### 2.2.2 Organization Structure

Amazon.com is unique in that each FC is fairly autonomous. For instance, improvements made at one site are not rolled out to the others unless that FC believes that those improvements will work in its FC. The FCs tend to be organized by function (Figure 2: Amazon.com Organizational Structure). The Operations Manager is in charge of the several Area Managers that perform similar functions. An alternative to this structure is organizing the FC by flow. The Operations Manager will then be in charge of Area Managers working on the same shift.

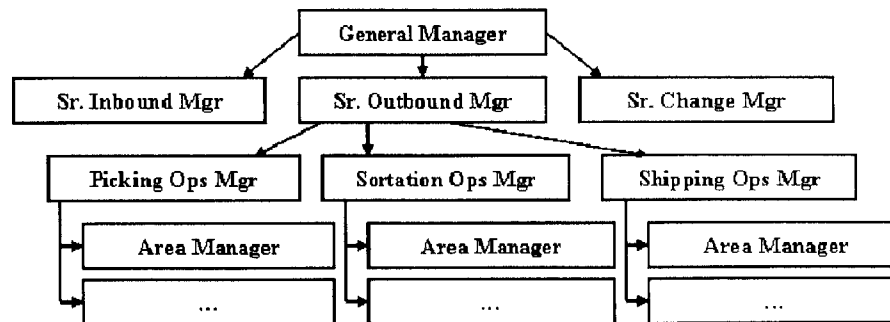


Figure 2: Amazon.com Organizational Structure

<sup>6</sup> Amazon.com 2005 Annual Report



### 2.2.3 Fulfillment Center Processes

The typical FC is divided by functions. Although there are exceptions, the typical FC is traditionally divided by Inbound and Outbound functions.

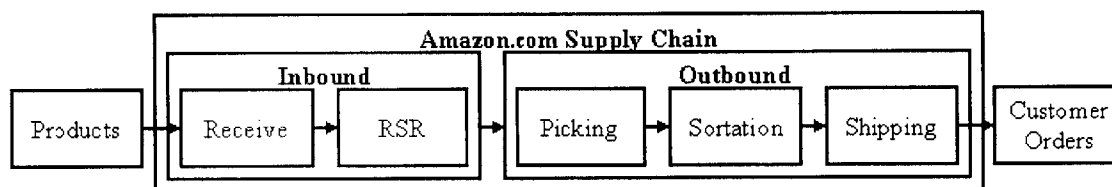


Figure 3: Amazon.com Fulfillment Center Process Flow

**Inbound:** This consists of the functions needed to get an item ready for Amazon.com to ship it. The typical group includes Receive, RSR (Replenish, Stock, Repofile), and VAS (Value Added Services).

Receive: Receive handles the function of unloading trucks and receiving items into the warehouse. Receive performs duties that aid RSR. Items must be received before customers can place orders against the item.

RSR: RSR works with Receive to receive items in the warehouse. This group is responsible for moving pallets into the picking modules. RSR performs a reprofile function to measure an item's dimension. RSR also aids Picking by replenishing items into prime locations (locations assessable to picking associates) such that pickers can pick the items for an order.

VAS: This group adds additional value for the customer at Amazon.com's expense. A VAS (value added services) example is providing additional detail to an assortment of toys. For instance, a shipment of *The Simpsons* toys will contain an assortment of Homer, Marge, Bart, and Lisa dolls. The vendor will associate all *Simpsons* toys with the same SKU (Stock Keeping Unit). Amazon.com would then produce an ASIN (Amazon Standard Identification Number) to separate each doll so an online customer will be able to specify which doll he or she wants. Another VAS example is wrapping shampoo bottles in plastic so that upon delivery there will be no chance of spillage.

**Outbound:** This consists of the functions needed to fulfill a customer order. Additional detail on this process is listed in the Order Fulfillment section below.

Picking: Picking involves picking the item out of the warehouse for a customer order. There are various types of pick paths depending on the item type.

Sortation: This is where orders are assembled together. This typically involves grouping the orders in some sort of location, placing the order into a box, closing the box, and applying a label to the box.

Shipping: This involves sorting the packages by trailers and loading those trailers. In some FCs, the sortation function is part of the shipping function.

Each FC has a series of metrics on each of the various processes. The Operations Manager and Area Manager are held accountable for their individual processes each day and must explain any deviation from the plan set for the year.

Safety has a high importance in each of the FCs. It is the first topic in any meeting. Not only does the FC have performance metrics, but it is held accountable for any incidents that happen within the FC. There is a safety manager in each FC that does not report to the General Manager, which removes the incentive for a safety manager to be inaccurate in his or her reports.

Finance also has departments that do not report to the General Manager which also preserves the integrity of the data. The finance data is located on a server not accessible to people not in Finance. Finance reports to the Operational Finance group. It aids an FC on the daily performance metrics and capital expenditure projects.

Each FC also has a Change Department. Typically this houses Training, Operational Excellence (Black belts), and Inventory Control Quality Assurance (ICQA).

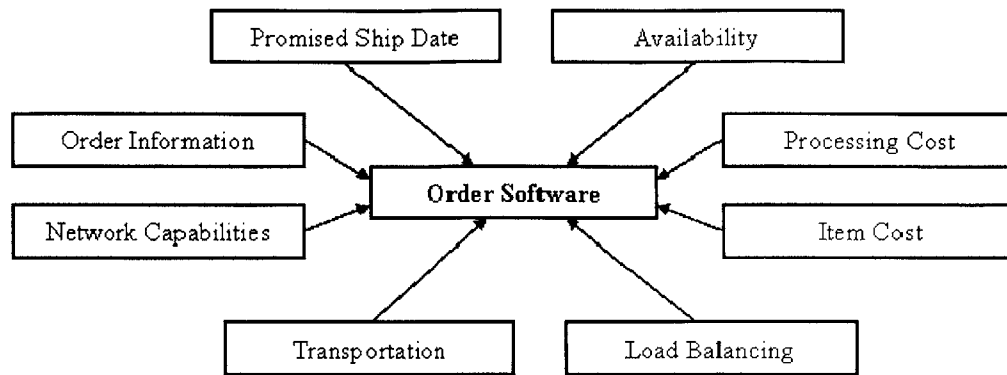
Training: The training department is responsible for the training of all new associates. Each department has an assigned trainer. These trainers are responsible for knowing the Standard Operating Procedure for each task.

Operational Excellence: This group is responsible for the various black belt and green belt projects in the FC. They monitor the progress of the projects throughout the year. Typically the projects start in January and end before the holiday season. The typical project follows the DMAIC (Define, Measure, Analyze, Implement, Control) process.

ICQA: This group monitors the accuracy of the inventory levels of the FC. Inaccurate inventory affects the customer order being fulfilled. In addition to the accurate monitoring of inventory, this group also implements various quality assurance tests throughout the many processes. This group collects metrics that identify areas of improvement. Although this group has no authority over the other areas, it can partner with process owners to improve productivity.

## **2.2.4 Order Fulfillment**

Amazon assigns orders to FCs based on a variety of factors. Amazon.com uses complex software to determine where the order should be fulfilled. The general goal of this software is to minimize cost. Some of the costs include transportation cost, processing cost, and item cost. Amazon.com also considers the promised ship date, when the item is available to be fulfilled, and the FC that can fulfill the item. Figure 4: Order Software depicts some of the factors that influence the FC order decision making.



**Figure 4: Order Software Flow Diagram**

Once the order is assigned to an FC, it is queued within the system. Once the order is ready to be prepared it goes through the outbound processes namely Picking, Sortation, SLAM (Ship, Label, and Manifest) and shipping.

**Picking:** The picking process involves an Amazonian (Amazon.com associate) with a scanner. The Amazonian reads the scanner that displays the item and item location. Once the item is located the item is physically scanned and placed into a tote. This process repeats until the Amazonian sends the tote to the next process.

**Sortation:** This process involves putting the various items together into a completed order. Amazon.com uses two different types of sortation processes depending on the type of FC. The process is either an automated or manual process. Typically the manual process is referred to as a batch process.

Batch Process: As the totes are gathered, they are grouped into batches. Another worker then takes these batches to his or her workstation. This workstation is equipped with a scanner and a manual sortation device containing slots. The Amazonian scans each item, reads the slot number and places that item into the slot. Once the totes are empty, the sorted orders are moved to the SLAM process.

Automated Process: In this step, the totes arrive at an induct station. At the induct station, an Amazonian takes each item out of the totes and scans the item into the system. The item is then placed on a tray and the tray drops the item into a chute. Once the order is fulfilled the chute light turns on to indicate that the order is complete. An Amazonian on the lookout for these lights will use his or her scanner to scan the chute, scan the items to verify the items are part of the order, and place the item into the box. Once the order is complete, the box is placed on a conveyor to be taken to SLAM.

**SLAM**: At this point, each order will have an order slip. The next step is to add packets of air to prevent damage to the items upon shipment. The box is then taped shut. At the end of the line, a shipping label is placed onto the box and the box is taken to the Shipping area.

**Shipping**: The main goal of shipping is to sort the packages onto the various trailers that arrive. This is done either by Amazonians examining the shipping label or by electronic readers that divert packages into the correct trailers based on the box's shipping label.

The boxes are then placed onto pallets or "fluid loaded" into a truck. "Fluid loading" is the process of placing boxes into the truck without stacking them into a pallet. Once the package leaves the FC the package is considered shipped.

### ***2.3 Focus on Customer Service***

Not only does Amazon.com strive to be the one stop shop for Internet users, it also makes a promise to its customers for superb customer service. Amazon.com strives to make shipments on time and decrease the delivery wait times. Amazon.com makes promises to its customer on on-time delivery and holds each FC accountable for wrong or missed shipments each day.

Missed shipments are costly for the FC, because they are viewed as lost potential revenue. Missed shipments are circumvented by upgrading the shipment method, which is an increased transportation cost. Another method to prevent missed shipments is to personally deliver the missed packaged to the local carrier office. Potential missed shipments must be tracked in the FC

before the critical pull time or before the last truck leaves. These adhoc processes require trained personnel to determine where these orders are in the building.

Accountability for missed shipment falls on the ship process owner. This owner must then determine if this problem happened upstream and work with his or her counterpart to improve the process. The bottom line is that these processes need to be fixed by not only the process owner, but by all groups involved, requiring they maintain working relationships with each other.

Amazon.com also provides increased customer service through its Amazon Prime initiative. Amazon Prime, Amazon.com's first-ever membership program, is available to customers for a flat fee of \$79 per year. Amazon Prime members receive unlimited, express two-day shipping for free, with no minimum purchase requirement on over a million eligible items sold by Amazon.com. Members can order as late as 6:30 p.m. ET and still get their orders the next day for only \$3.99 per item, and they can share the benefits of Amazon Prime with up to four family members living in their household.<sup>7</sup>

Amazon.com is able to offer Prime due to its efficient processing times and innovations. One such change is adding FDFC (Forward Deployed Fulfillment Centers). These FDFC are focused on one to two day delivery of high volume goods, and are located near large metropolitan areas, allowing for decreased transportation cost. The FDFCs receive high turnover inventory for their local market from their base FC and fulfill orders as it is placed into its system. Through this initiative Amazon.com is able to offer same day or next day shipments at a lower transportation cost.

## ***2.4 Demand Levels***

Amazon.com, like other companies in the retail and food industry, experiences demand fluctuations throughout the year. The typical retailer experiences a sharp fluctuation in the last quarter. The typical retailer experiences a steady increase of sales throughout the year which is followed by a sharp decline in January. Figure 5: 2005 US Retail and Food Service Sales

---

<sup>7</sup> Amazon.com, Investor Relations Press Release.

represents retail sales figures from 2005 which represents the typical retailer behavior with a demand spike in December. The demand in November is 117% higher than the February numbers.

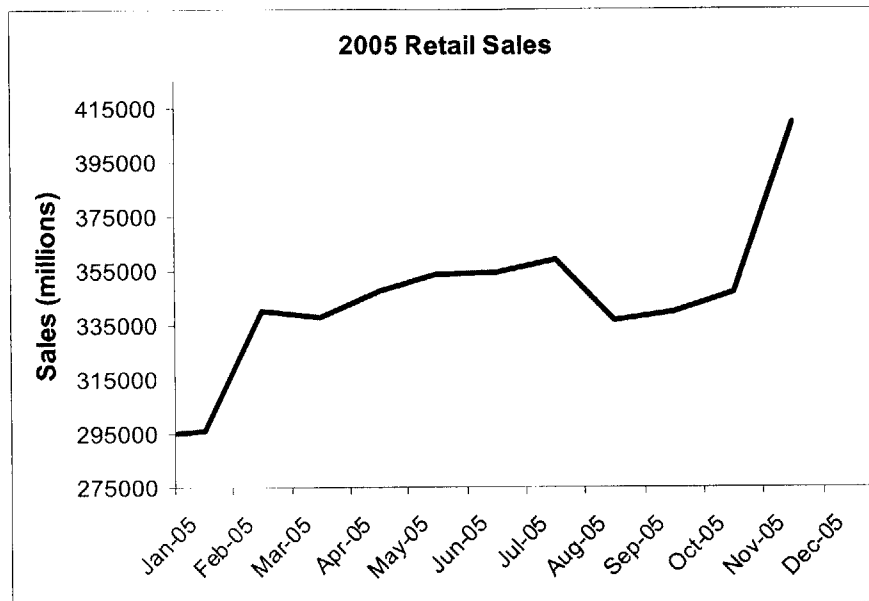


Figure 5: 2005 US Retail and Food Service Sales<sup>8</sup>

In comparison, Figure 6: Amazon.com Y2006 Quarterly Revenue shows Amazon.com’s revenue follows a slightly different curve than Figure 5. The Amazon.com sales depict a decline that hits the minimum sometime in the Second Quarter. This data pulled from Y2006 Amazon.com’s Quarterly Income Statement suggest relatively flat sales in Q1, Q2 and Q3. In comparison to Figure 5: 2005 US Retail and Food Service Sales the sales are not as flat as Amazon. Unlike other retailers, Amazon.com does not have a steady increase in sales as a result the holiday season is potentially more difficult for Amazon. Other retailers have product offerings that have a summer seasonality, which may account for the drop in revenues in its second quarter. The increase from Q3 to Q4 is a 174% increase in sales.

---

<sup>8</sup> US Department of Commerce: Census Bureau. “Retail and Food Service Sales.” 2005



Figure 6: Amazon.com Y2006 Quarterly Revenue

In comparison to Amazon.com, Wal-Mart and Target Y2006 monthly sales were gathered and depicted in Figure 7: Target and Wal-Mart 2006 Sales. This figure shows brick and mortar stores have a similar sales pattern to Amazon.com. Similar to Amazon.com, Target and Wal-Mart have relatively flat sales during the year and experiences a spike during the holiday months of Q4. However, Wal-Mart does experience demand fluctuations throughout the year. It may be possible that Amazon.com's flatter sales may be easier to manage in terms of labor staffing.

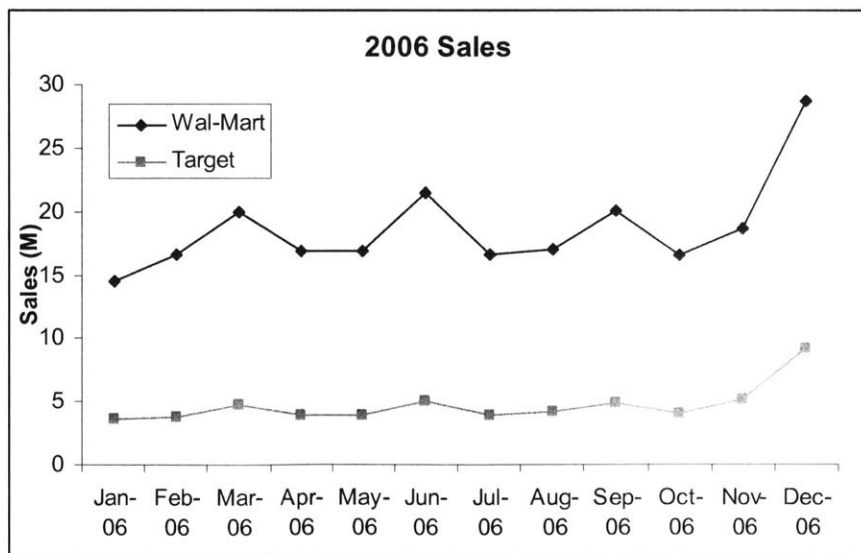
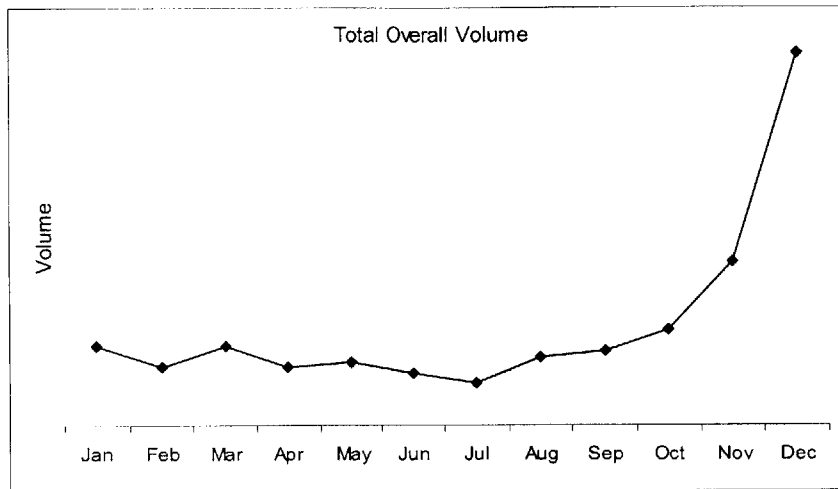


Figure 7: Target and Wal-Mart 2006 Sales<sup>9</sup>

<sup>9</sup> PR Newswire Issues – Combination Jan-Dec 2006. 6 May 2007. <http://www.prnewswire.com>



Amazon.com, Target and Wal-Mart experience a similar seasonal demand spike. Target experiences a 180% increase from November to December while Wal-Mart experiences 164% increase in those months.

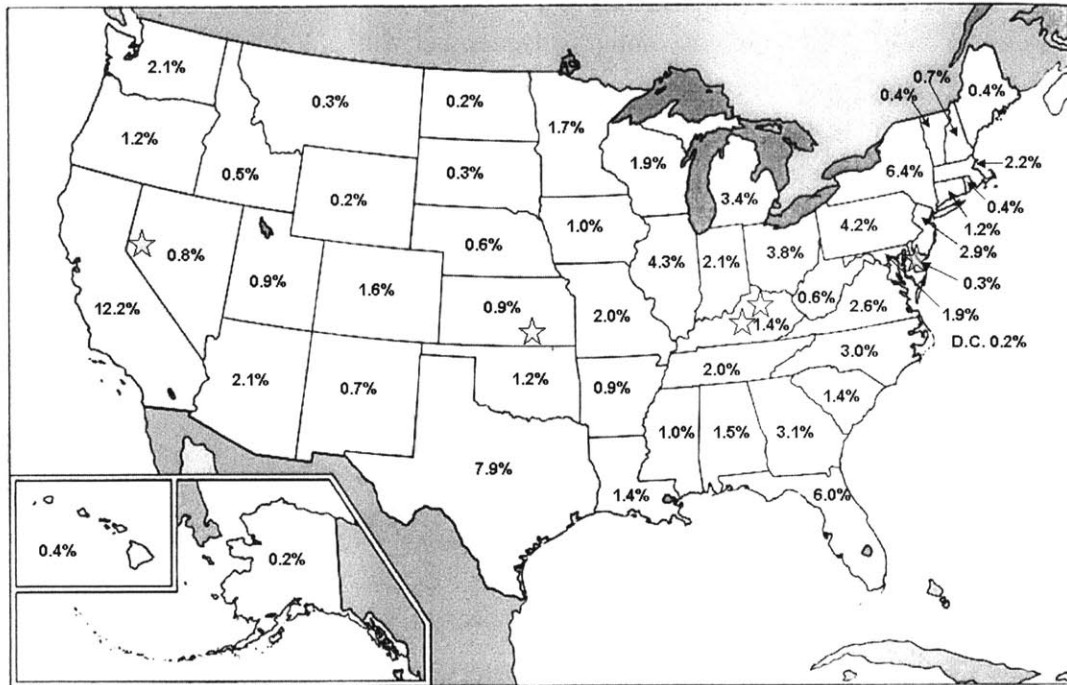


**Figure 8: Representative Amazon.com Overall Demand Sample**

This demand is distributed across the United States. Figure 9: Sample Package Distributions<sup>10</sup> is used to show an example of where the customer demand might be for Amazon.com by using United States demographics. The data used to populate this figure do not use Amazon.com actual dataset; instead, the data have been changed to disguise confidential information.

---

<sup>10</sup> US Census Bureau, 2006 estimates. 6 May 2007. <http://www.census.gov/popest/states/NST-ann-est.html>

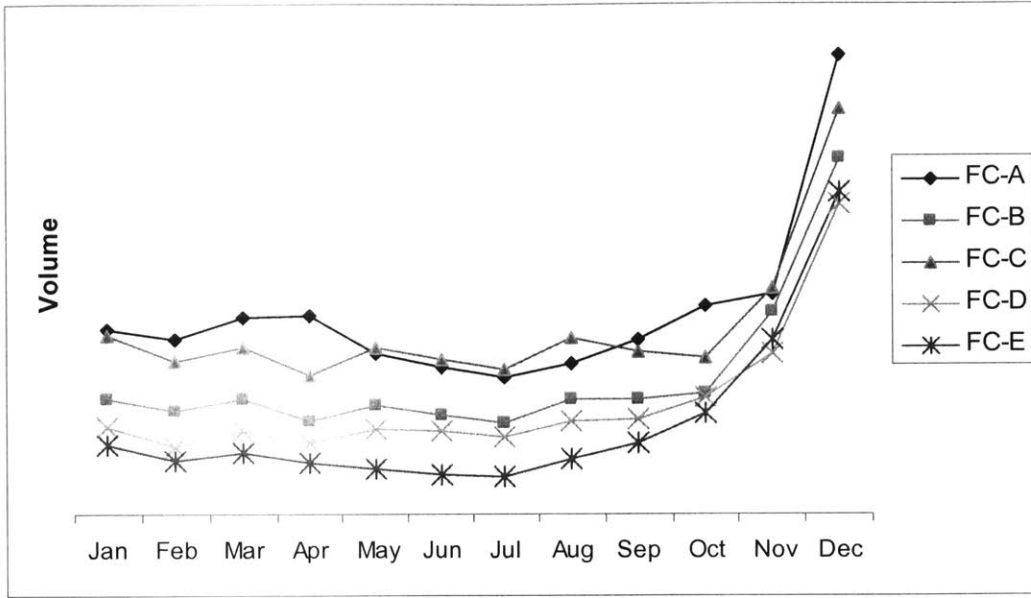


**Figure 9: Sample Package Distributions  
(Actual Amazon.com data was not used)**

Amazon.com faces two different demand challenges throughout the year:

1. How to efficiently answer the demand spike.
2. How to handle stable demand.

The Amazon.com demand curve is similar to other retailers in which they experience a spike in orders during the December holiday season. Amazon.com’s fulfillment network must be flexible to handle weekly demand levels and the increased demand during peak. During the non-peak season, the demand level for Amazon.com is relatively stable but fluctuates due to customer orders throughout the week. Demand levels are illustrated by Figure 10: Representative Amazon.com Yearly Demand Sample. The fulfillment center names are masked to protect the actual fulfillment center demand levels. The demand curves have also been adjusted.



**Figure 10: Representative Amazon.com Yearly Demand Sample**  
 (Amazon.com demand curves have been adjusted to retain confidentiality)

### 2.4.1 Weekly Demand Levels

Although the demand looks relatively stable throughout the year, the demand actually fluctuates depending on the number of orders placed. Each fulfillment center manages the weekly fluctuation by adjusting labor to maintain lower variable cost. The projected demand yields a projected labor hours needed resulting in potential labor changes to manage the variable cost. Due to the fluctuation of demand, managing labor hours requires a delicate balance of manpower.

The remainder of this document is a discussion on reallocating non-peak demand in Amazon.com’s sortable FC network. A model has been developed to discuss the key issues surrounding this demand allocation. In particular it will highlight the variable cost of an FC and package related outbound transportation costs. These key issues include variable cost and transportation cost.

## Chapter 3: Variable Cost

In the Amazon.com fulfillment centers, variable cost is defined as labor cost and processing related cost. Labor costs consist of costs related to hiring associates, wages, and employee benefits. Processing related costs are the costs related to materials required to complete a shipping order. Typically these are disposable goods that are used in the warehouse process such as box knives. The labor costs account for 97% of the total FC variable cost.

### 3.1 General Labor Information

Retail in general has a higher turnover rate than other industry. One source puts the retail and wholesale trade rate at 20.7%.<sup>11</sup> Figure 11: Number of Separations as a Percent of Total Number of Employees compares this turnover rate across different industries. The turnover rate fluctuates throughout the year. This turnover rate is a costly problem when companies spent an average of \$1,000 to \$1,430 per new employee to provide 34 to 41 hours of training in 2005. According to a survey conducted by Kronos Incorporated,<sup>12</sup> 46% of U.S. retail employees surveyed said they could walk off the job this holiday season. The top three reasons why they might walk off the job were: I am not treated with respect by my boss; I am too busy at work because there are not enough employees; and my time-off requests are ignored.

---

<sup>11</sup> "How Do Your Turnover Rates Compare." *HR Focus*. Institute of Management & Administration. August 2006.

<sup>12</sup> "Retailers in Jeopardy of Employees Quitting This Holiday Season; New Survey Finds That Employees Will Walk out If They Don't Receive What's on Their Wish List." *Business Wire*. November 22, 2006

	<b>Median</b>
Entire sample combined	14.3%
<b>Industry sector analysis</b>	
Durable goods manufacturing	13.9
Nondurable goods manufacturing	16.5
Utilities and energy	7.1
Retail and wholesale trade	20.7
Services	14.2
Health care	16.0
Banking and finance	15.8
Insurance	12.7
<b>Regional analysis</b>	
Northeast	10.4
Southeast	19.5
North Central	14.9
South Central	11.5
West Coast	13.7
<b>Employee (FTE) size group analysis</b>	
Less than 500	14.9
500 to 999	13.4
1,000 to 1,999	18.4
2,000 to 4,999	12.3
5,000 or more	14.4
All employee size groups combined	14.3

(Source: Watson Wyatt Data Services)

**Figure 11: Number of Separations as a Percent of Total Number of Employees<sup>13</sup>**

Best Buy:<sup>14</sup> At this retailer, annual employee turnover at big-box stores is close to 100 percent. All the clerks in an average store will quit or be fired within a year. Best Buy, whose retail floor staffers are known as "blue shirts" is particularly notorious. The company says that turnover costs — recruiting, training, and loss of operational time — are \$102,000 per blue shirt, or about 250 percent of their salary.

The Container Store:<sup>15</sup> The first step to reducing turnover in the retail industry is hiring the right people to begin with. The Container Store, a Dallas-based company, with 37 stores and roughly 3,500 employees, tries to maintain a philosophy of "one great person equals three good people"

<sup>13</sup> "How Do Your Turnover Rates Compare." *HR Focus*. Institute of Management & Administration. August 2006.

<sup>14</sup> Brandon, John. "Rethinking the Time Clock." *Business 2.0*. March 2007, Vol. 8, Issue 2

<sup>15</sup> Medina, Alison Embrey. "Love your job." *Display & Design Ideas*. Oct2006, Vol. 18 Issue 10, p34-36, 3p, 2 charts, 5c

in its hiring practices. "Our overarching theme in the company is that every employee is a recruiter for The Container Store," says Karyn Maynard, the company's recruiting director. Store associates keep recruiting cards on their person and behind the cashwrap while working, and are encouraged to actively recruit new members to the team. "When people ask me how many people are in our recruiting department, my answer is 3,500. It really empowers our employees to involve them in this process," Maynard says. A first-year employee will receive about 240 hours of training if full-time, and 165 hours if part-time. With wages 50 percent to 100 percent better than retail industry average, health benefits for both part-time and full-time associates, and a desire to promote from within whenever possible, the company's turnover rate stands at a mere 10 percent. "Our focus is geared more on retaining employees than trying to replace them," she explains.

Lands' End: Lands' End also faces seasonality, but approaches its retail problems differently than Amazon.com. An interview conducted on Lands' End's seasonal labor hiring practices is included in Appendix A.3. This interview discusses Lands' End's distribution network, approach to seasonal hiring, and employee related programs.

### ***3.2 Amazon Labor***

Amazon.com obtains most of its labor for its FCs through its staffing agencies. Amazon.com requires that all associates have the equivalent of a high school diploma and meet the basic skill set at the staffing agency. The staffing agency keeps a record of those who meet the qualifications and supplies Amazon.com with labor when needed. These two groups work together to develop an efficient staffing policy for the holiday season.

Temporary associates may transition to an Amazonian (Amazon associate), if more Amazonians are needed and if they are in good standing. Good standing requires the temporary associates to be at an acceptable attendance and quality level. The employees that are considering transition must meet the acceptable performance level.

The typical workweek for an Amazonian is a 4 day 10 hour shift schedule. However this varies among the sites ranging from four to five workdays. Depending on the site needs, the overlap day (where two shifts are in the building at the same time) is also different. Amazon.com like any typical warehouse industry experiences a level of attrition. As long as Amazon.com's wage stays competitive with other employers in the area, the attrition stays at a fairly constant level.

All new associates are trained by a trainer who is an expert in the process. Each associate will be expected to perform at a Reasonable Expectation (RE). In most FCs, there is a three week learning curve, but this varies among FCs and among the processes. The learning curve describes a reasonable performance level each associate should be progressing towards. Each FC is attempting to shrink minimize its learning curve.

Temporary associates are recruited from the surrounding area. During the holiday season, the area from which associates are recruited from may be extended to increase the labor pool. Amazon.com will then offer to bus associates into its FCs. Additional incentives maybe offered to attract more associates into Amazon.com. An incentive offered last year was a \$100,000 prize for seasonal workers who have perfect attendance from November 26, 2006 to December 22, 2006.<sup>16</sup> Many of Amazon.com's employment sites are located where the unemployment rate is lower than the national unemployment rates suggesting that demand is greater that supply. Thus Amazon.com competes for workers in the hourly labor workforce pool.

### ***3.3 Labor Planning***

Amazon.com has a target number of associates each year. Since demand fluctuates, maintaining labor is not an easy task. Amazon.com like other retailers allows employees to work overtime to meet demand or to take voluntary time off if they have more employees than work available.

One of the problems with labor planning is the effect of dilution in the productivity rates. Dilution is when associates are not performing at their expected rates. This initially happens

---

<sup>16</sup> "Staff Management and Amazon.com Offer \$100,000 Prize to Seasonal Workers Hired for Holiday Shipping Rush." BusinessWire. October 27, 2006

when a new associate learns a new process. Thus when hiring new associates, one must account for this performance gap in staffing for the future. The result is hiring more associates than needed to compensate for this performance gap.

Dilution is also experienced during peak as a form of diminishing returns. One form of diminishing return is crowding at certain processes where there is more labor than work available. For instance, associates examine a series of lights to determine if an order can be completed. If the workers' processing rate is faster than the order completion rates, associates will wait for work. In the perfect world, there are always customer orders for associates available at the right time. The additional headcount may lead to general confusion during peak. Associates will be unfamiliar with the warehouse and are attempting to learn the process.

Amazon.com also staffs extra associates to critical processes during peak. This in essence is adding more overhead to the processes. It is questionable if extra associates improve the processes or contribute to diminishing returns. Since there are extra people shouldering the extra work, workers then have an opportunity to avoid work in the many hiding areas in the fulfillment center. Amazon.com would rather have slightly more labor available than to not have enough labor. In addition, Amazon.com can staff extra labor in critical process paths to prevent downstream starvation and to prevent unexpected downtimes costing a greater amount. Process paths are defined in Amazon.com as a set of standard operating procedures that yields a full process. An example would be the picking process path, which consists of various steps.

Amazon.com must also account for voluntary or forced attrition. Amazon.com competes with other companies for its labor. Amazon.com must be attractive to the labor pool to maintain the labor levels it sets each year. Labor planning involves determining the number of new associates needed throughout the year so that Amazon.com can maintain its output level and minimize labor costs.

The labor market and its attrition rates are the most challenging in this project. Throughout the year, the FCs in labor constrained markets must reexamine their wage rates and their recruiting strategies when there is a projected attrition rate deviation. Often Amazon.com requests labor



studies from its temporary staffing agency to understand the surrounding market through the year to set the wage rates for the year.

Another problem that affects labor cost is unplanned downtime. Unplanned downtime is caused by either broken machinery or software glitches. Often unplanned downtime results in associates waiting for work to resume, which costs the company money. If the downtime is expected to be longer than usual a call may be made to send the associates home. A thorough preventative maintenance schedule combined with FC communication with FC software will decrease unplanned downtime.

A final problem is when FCs are inaccurate on the total headcount needed during peak. A poor headcount prediction may result in insufficient labor during peak causing demand to be redistributed to other fulfillment centers increasing other costs. However, if each FC over compensates for the inadequate labor, Amazon.com will have more labor cost than needed which adds unnecessary labor costs.

The labor phenomenon discussed above is described in System Dynamics.<sup>17</sup> Highlights of this book include how production schedules and hiring policies can interact to generate instability and oscillation. It provides a system dynamics model that describes labor and inventory planning and introduces how changes can affect the model. The model oscillates due to the feedback from changes in the system. For instance the model signals for additional labor. Due to the nature of the hiring cycle, additional labor cannot instantly adjust the production system. As a result, this problem will cause an oscillation in the system. The book concludes that flexibility in the workweek and capacity utilization can help stabilize oscillation.

Among the FCs, variable cost is a key factor to measuring efficiency. Although variable cost is the key factor, it is important to understand other factors influencing the FCs, such as inventory holding and transportation. Amazon.com requested further investigation into transportation costs.

---

<sup>17</sup> Sterman, John D. System Dynamics: Systems Thinking and Modeling for a Complex World. McGraw-Hill Publishing Co. 2000

## **Chapter 4: Transportation Cost**

Although this project's primary interest is variable cost, transportation cost was requested by the individuals at Amazon.com due to the high cost of transportation. Transportation costs were used as a benchmark for an acceptance test of proposed solutions. Freight assignment is determined by factors such as contract agreements, weight, package size, and distance.

### ***4.1 Transportation Background***

The cost to ship a package on a national parcel carrier such as UPS or USPS is determined by the package size, package weight, shipment method, shipping speed and distance. The speed a package travels varies with the shipping method. Methods include both air and ground methods, with air travel being more costly. Once the delivery speed is determined the package weight and distance determine the total cost. These factors relate such that any increase in these factors will yield higher costs.

In the United States, the distance the package travels is referred to as its zone. A three digit zip code can be used to describe each different region of the United States. This three digit code represents a Sectional Center Facility (SCF) within the United States Postal Service. A SCF is a Processing and Distribution Center (P&DC) of the United States Postal Service (USPS) that serves a designated geographical area defined by one or more three-digit ZIP Code prefixes.<sup>18</sup> For instance, the zip code 89147 corresponds to Las Vegas, NV. The first three digits "891" corresponds to the Las Vegas area. Using the three digit zip code allows package distributors to understand the distance to the destination. Using the origin and the destination, the package zone can be deduced.

---

<sup>18</sup> United States Postal Service: 3-Digit ZIP Code Prefix Groups—SCF Sortation. 6 May 6, 2007. <http://pe.usps.com/text/dmm300/L005.htm>

Using the zip codes, an individual customer may look up the zone and estimate cost by using the national carriers' websites. Various package carriers provide detailed zone lookup charts on their websites. The following links are to the national shipping agents current zone lookup tables.

DHL International: <http://www.dhl-usa.com/Using/ZoneChart.asp?nav=GetRates/ZoneChart>

Federal Express: <http://www.fedex.com/ratetools/RateToolsMain.do?link=2>

United Parcel Service: <http://www.ups.com/content/us/en/shipping/cost/zones/index.html>

United States Postal Service: <http://postcalc.usps.gov/Zonecharts/>

Using UPS's zone chart<sup>19</sup> and United States SCF zip code mapping,<sup>20</sup> Figure 12: Zoning Example based on RNO1 was constructed to illustrate the various zone bands in the United States. This map used Amazon.com's RNO1 site's 3 digit zip code of 894. The numbers on the map represent the approximate zone. For instance shipping to Kansas is a Zone 6 which correlates with shipping cost. Given two packages of equal size and weight, a higher zone number implies a higher package cost.

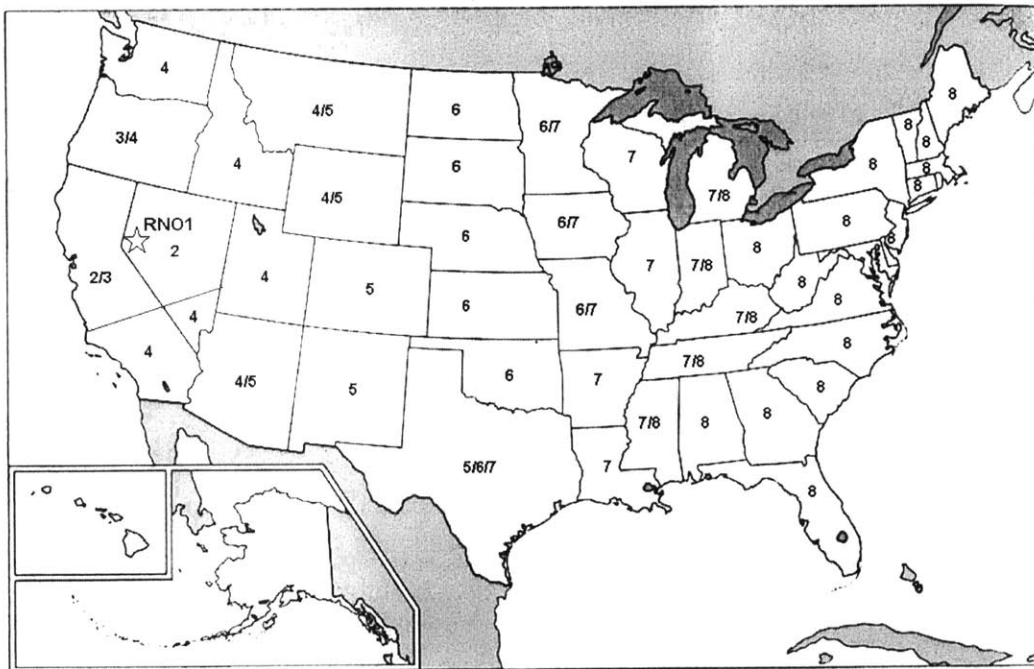


Figure 12: Zoning Example based on RNO1

<sup>19</sup> United Parcel Service. 6 May 6, 2007. <http://www.ups.com/content/us/en/shipping/cost/zones/index.html>

<sup>20</sup> United States Postal Service: 3-Digit ZIP Code Prefix Groups—SCF Sortation. 6 May 6, 2007.

<http://pe.usps.com/text/dmm300/L005.htm>

As previously mentioned, the zone number increases the further the package travels from its origin. Once the zone is determined the weight plays a factor in the final package shipping cost. After 70 lbs, most carriers experience a spike in cost as demonstrated in Figure 13: UPS Ground Cost by Zone. Other carriers besides UPS also increase their rates around 70 pounds. The rates used in this figure were the rates published on the UPS website in August 2006. This illustrates the cost using weight and zone.

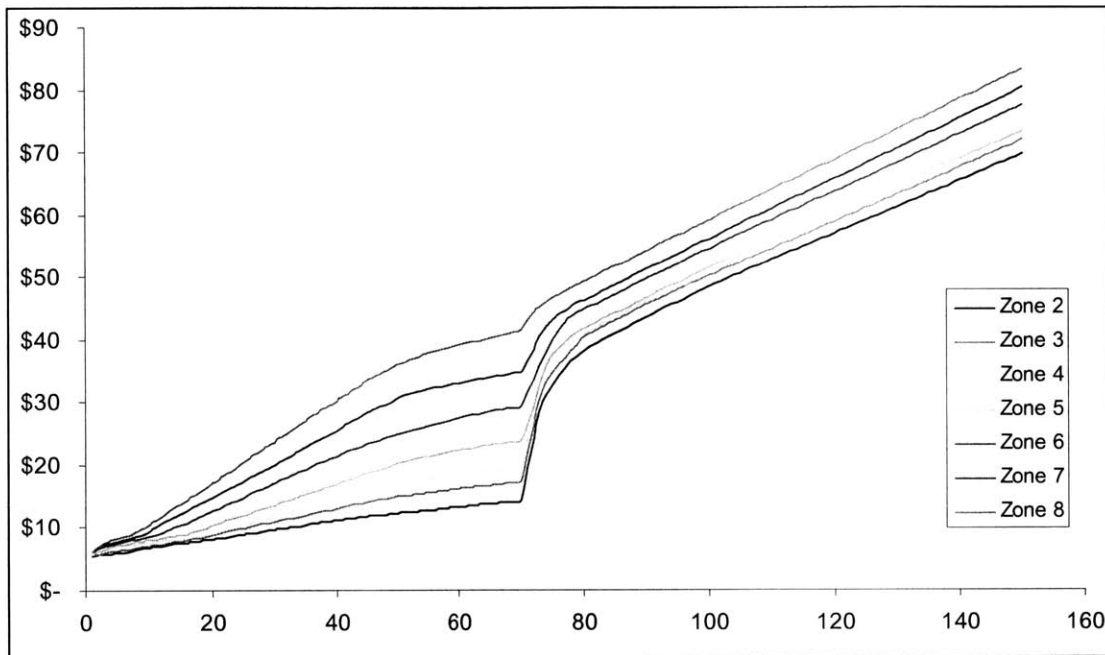


Figure 13: UPS Ground Cost by Zone

#### 4.2 Transportation at Amazon.com

Amazon.com uses a combination of local and national carriers for its inbound and outbound transportation needs. A greater concern is placed on outbound transportation cost because it is harder to optimize this cost. As one can imagine, the outbound costs may be harder to minimize due to the empty space within the packages itself. As a result, Amazon.com studies its order shipment sizes and makes recommendations on the best box size for each shipment. Amazon.com makes a tradeoff between the cost of having too many box sizes and the cost of shipping empty space within a box.

Besides using national carriers, Amazon.com has the option of working with local carriers. Using local carriers, Amazon.com may be able to fill full truckloads or have LTL (Less Than Truckload) shipments. From an inbound perspective, Amazon.com can optimize the inbound process by reducing empty space in the trailer.

Another outbound shipping problem besides empty space is that shipments may not be shipped from the cheapest facility due to inventory constraints. This is a problem stemming from the increase in long-zone shipments. The tradeoff made in this scenario is the cost of holding additional inventory compared to the additional transportation cost. An example of this phenomenon is cross country shipping from the RNO1 facility to Boston, MA.

Another problem with outbound shipment is the concept of split shipment. A split shipment is when a customer receives an order from two different facilities which costs additional money. It is cheaper to pay the incremental charges of additional weight than to send two separate packages because of the initial base package price as illustrated with Figure 13: UPS Ground Cost by Zone. For instance a 20lb package doing a Zone 8 distance may cost \$18, but to send two 10lb packages would cost \$10 for each one.

An examination of available non-peak Y2006 data yields package information expected from an Amazon.com storable facility. The bulk of the packages were distributed among a Zone 2, 3, and 4 range which implies that Amazon.com makes use of minimizing the longer package distance travel or in other words minimizing cross country package travel. Figure 14: Amazon.com Y2006 Package Zoning Distributions is an example of the package distribution among the zones. An outsider understanding transportation would expect a decreasing step function with a greater number of Zone 2 packages. However the distribution is a bell shaped curve and the number of Zone 8 packages is higher than Zone 7. This suggests an opportunity for Amazon.com to potentially reduce transportation cost through an investigation of this phenomenon.

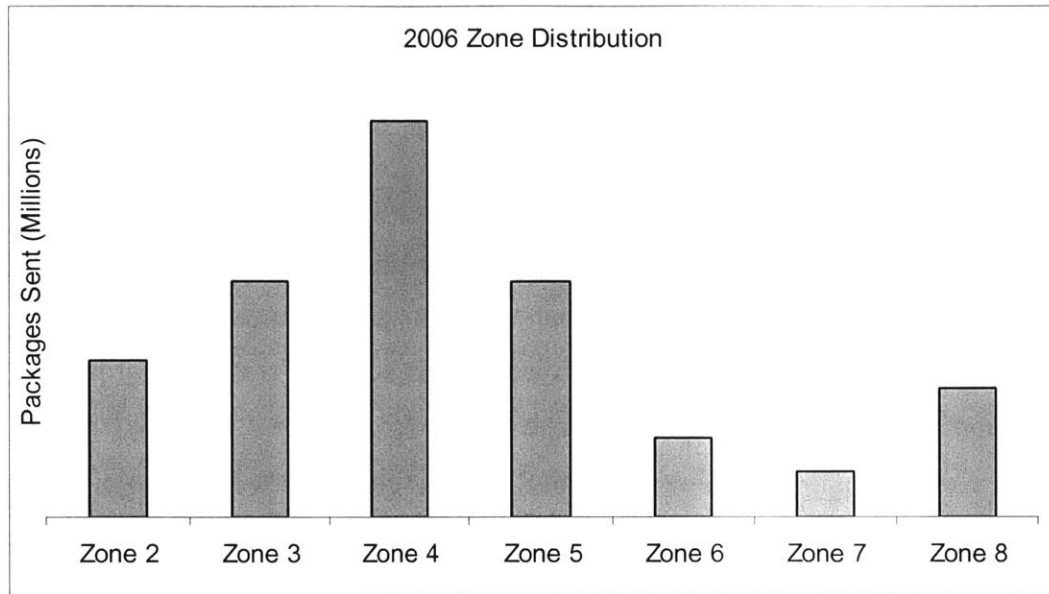


Figure 14: Amazon.com Y2006 Package Zoning Distributions

Another result from examining the historical transportation data yielded a package weight distribution. Figure 15: Pareto Chart Y2006 Weight Distribution is a sample distribution gained from examining this data. Packages from Amazon.com tend to fall under the A weight zone at a rate of 40%. Weight type A and B account for ~60% of the packages shipped from Amazon.com.

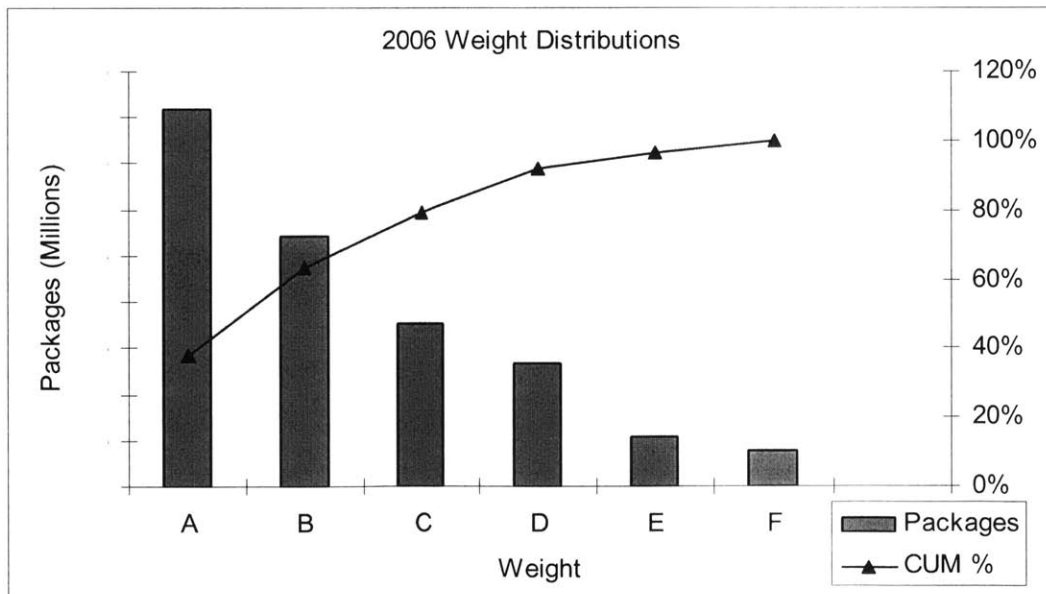


Figure 15: Pareto Chart Y2006 Weight Distribution

### ***4.3 Future of Transportation***

North America's warehouses are undergoing logistics realignment to address the rising fuel costs and capacity and driver shortages. This is forcing shippers to reassess fundamental inventory management and distribution processes. Shippers also are responding to expanding global networks of suppliers and customers that demand rapid, reliable delivery, especially big box retailers. New distribution strategies are spawning a generation of logistics-focused warehousing operations that make today's warehouses critical pivot points for distribution and the central points for new shipper strategies seeking the right mix of flexibility, lean pipelines and strategic advantage.<sup>21</sup>

In addition to the sky rocketing fuel costs, consumers want more options and better service. It is not acceptable to only optimize the plant or distribution center, but instead to optimize the entire supply chain as one big production line. This concept is known as demand-driven supply network.<sup>22</sup>

Another problem that plagues distribution centers is the ability to adequately staff a distribution center once the site has been optimized for transportation cost. Labor staffing is often neglected since warehousing accounts for a relatively small percentage of overall logistics costs when transportation accounts for two-thirds of logistics spending. However, a shortage of good workers in a distribution center can be a show-stopper. It can turn the distribution center into the weak link in the logistics chain, and negate the efficiencies gained from access to transportation networks.

Under pressure to hold costs down, distribution centers find it difficult to pay wages high enough to attract workers with the education and skills to handle the basic computer technologies that are widely used to track and locate merchandise within the facility. Labor shortage is a national

---

<sup>21</sup> Cassidy, William B. "Realigning warehouses." Logistics. Gulf Shipper. October 23, 2006.

<sup>22</sup> Trebilcock, Bob. "Building the Real Time Supply Chain." Modern Materials Handling September 1, 2006.

problem that appears to be especially acute at rapidly growing inland distribution hubs such as Dallas, Kansas City, Memphis, St. Louis and Indianapolis.<sup>23</sup>

Amazon.com had identified their key concerns as variable and transportation cost. The FCs are able to control their variable costs, but are unable to reduce transportation costs on their own. Using the data gathered on these costs, a model was developed to gain better understanding how changing demand will affect these costs.

---

<sup>23</sup> Mongelluzzo, Bill. "The human factor; Labor availability is a growing issue for operators of distribution center". Journal of Commerce. Commonwealth Business Media. January 22, 2007.



## Chapter 5: Model

A model was developed to gain insight on optimal distribution of demand to each fulfillment center. This goal of this model is to understand how altering the levels of demand at each center affected variable and transportation costs.

### 5.1 Model Schematics

Since this was a nonlinear problem, an iterative approach was taken. Various scenarios were tested, and the data generated for each run was analyzed to determine the benefits and costs of each scenario. Variable and transportation costs were calculated based on a number of different scenarios. The five FCs were randomly named FC-A, FC-B, FC-C, FC-D and FC-E.

The model operates with the following steps which are illustrated in Figure 16: Model Schematics:

1. Input demand test case and productivity rates
2. Calculate the number of baseline hours needed per FC using demand and productivities
3. Calculate variable cost for each FC
4. Calculate the transportation cost (Uses the transportation model)
5. Collect the calculated variable and transportation costs.
6. Repeat 1-5 until no more cases
7. Calculate variable cost per unit (VCPU), fixed cost per unit (FCPU), and total cost per unit (TCPU) for each case.

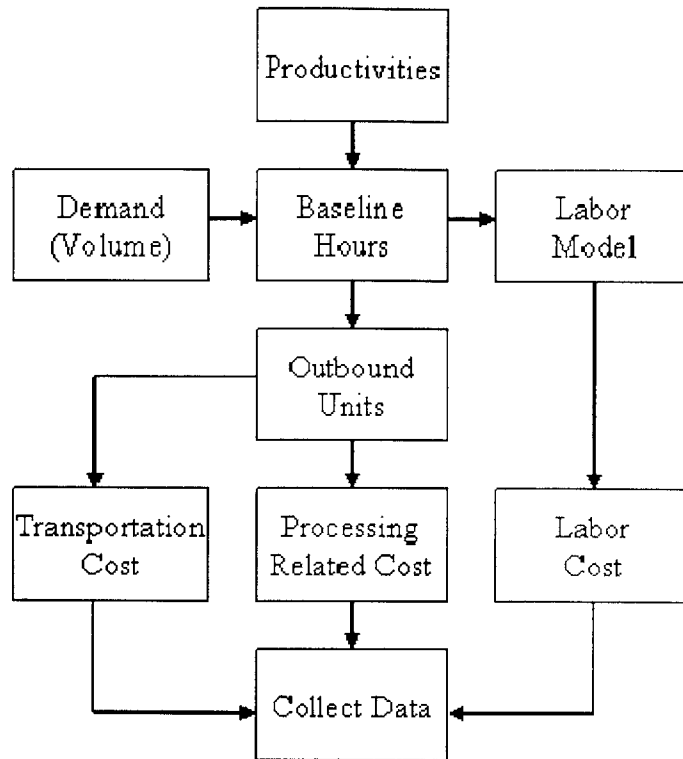
Notes:

Unit refers to the number of orders shipped.

VCPU is defined as (labor cost + processing related cost)/units

FCPU is defined as (variable cost + fixed cost)/units.

TCPU is defined as (variable cost + fixed cost + transportation cost)/units.



**Figure 16: Model Schematics**

As can be seen in the schematic above, a particular demand distribution and a set of productivity rates were input into the model. Productivities are defined as the rates at which a particular process can be completed. Using a simple mathematical calculation, baseline hours were calculated. Baseline hours are an estimated number of hours needed at each FC to perform all duties related to order fulfillment. The number of baseline hours was then used to estimate the variable and transportation costs. The labor model applies an algorithm to the baseline hours and determines the estimated labor costs. The transportation model used an approximation to determine the labor cost. The transportation model is described in further detail later in this section.

### **Variable Costs**

Variable costs were calculated for each demand distribution. As inputs, the model used the forecast demand volume and the expected productivity rates for each of the process paths. These inputs were obtained from Sales and Operations Planning. The model used historical and

projected attrition, combined with dilution, to model projected labor levels. Based on the expected demand projections, variable costs are calculated from the estimated labor component and processing rates. The variable labor cost component consists of temporary employee cost, hourly wages, overtime, holidays, sick leave, payroll taxes, and medical benefits. All of these costs were estimated using historical averages. Attrition for temporary employees and Amazonians is set to the same rate since previous studies show that, in the long term, attrition is the same for both groups. Current rates were used for costs associated with taxes, hourly wages, overtime wages, salaried headcount, and attrition.

The productivity rates used in the model were taken from Amazon.com's Operations Planning (OP) model. These productivity rates allow the model to estimate how many workers will be needed to complete activities necessary to fulfill demand. An attempt was made to generate productivity rates from a linear regression run on historical data, but the regression failed to be sufficiently predictive. From this productivity rate, demand hours per FC were calculated by dividing demand volume by productivity rate.

Although the model is very similar to the currently used method, there were some differences. In the model, the temporary associate's learning curve was slightly more generous than historical numbers. The rate was slightly more generous to reduce the temporary employee tracking in the model. In other words, the learning curve was adjusted to reduce the model complexity. The model does not breakdown temporary labor spending in individual items such as temporary staffing costs. No adjustments were made to cost of medical benefits from salaried headcount despite changing demand. Medical benefits are calculated as a fraction of salaried headcount. The salaried headcount was adjusted with the fluctuating associated headcount.

### **Transportation Costs**

Due to the vast volume of transportation data, a subset of transportation data was chosen. This transportation subset was created using ten weeks during the non-peak season and six weeks during peak season. The peak season data was included because a large portion of Amazon.com orders occur during this time frame.

Using this subset, a simple transportation dynamics model was created. Historical package destinations were taken from the representative data set (Y2005 and Y2006 actuals). These were used to create a mapping that related the historical number of packages bound for a particular destination to the fulfillment center it originated from. The destinations were encoded using the USPS Sortation Center Facility (SCF) code. This allowed us to approximate the percentage of packages going from a particular FC to a particular SCF code. The average cost of transporting a package from an FC to a particular destination was then used to estimate the total transportation costs. Figure 17: Model Sample Zip Code Distribution represents a potential package and zip code distribution for Amazon.com. For instance, 0.0213% of the total packages sent out of FC-A will be sent to the 195 SCF. Therefore, the columns represent the distribution of total packages among the FCs.

North America Truncated 3 digit Postal Code	FC-A	FC-B	FC-C	FC-D	FC-E
195	0.213%	0.362%	0.119%	0.196%	0.120%
196	0.036%	0.060%	0.020%	0.033%	0.020%
197	0.073%	0.128%	0.045%	0.062%	0.040%
198	0.045%	0.081%	0.026%	0.038%	0.027%
199	0.100%	0.178%	0.062%	0.106%	0.065%
200	0.178%	0.316%	0.116%	0.215%	0.119%
201	0.061%	0.108%	0.030%	0.056%	0.033%
202	0.329%	0.648%	0.204%	0.364%	0.221%
203	0.327%	0.598%	0.219%	0.401%	0.244%
204	0.265%	0.483%	0.163%	0.268%	0.167%
205	0.246%	0.485%	0.170%	0.310%	0.184%
206	0.837%	1.587%	0.426%	0.790%	0.467%
207	0.041%	0.076%	0.017%	0.037%	0.020%

**Figure 17: Model Sample Zip Code Distribution**  
(Actual values were not used)

The model will operate by redistributing the demand among the FCs given the proposed variable cost change. The model will sum the demand from each zip code that is being shifted away from each FC and then redistribute that demand to the other FCs accordingly. Each amount removed or gained reflects a different test case. Each zip code was indexed by the respective FC to get the zone information. Since the zone information defines the distance a package must travel, it can

be combined with shipping rates to determine the total shipping cost for a package. The international package cost was estimated in this model. The international package cost was estimated from transportation estimates. No unit optimization was performed to assign redistributed packages to cheaper locations. Inbound transportation costs were not considered in this project.

### **Assumptions and Simplifications in the Model**

The model operates with various assumptions. One simplification made in this model is that it assumes that the inventory distribution is the same in each fulfillment center (FC). Essentially any FC can fulfill the redistributed demand. Realistically, orders cannot be fulfilled from any FC, because Amazon.com limits the duplication of inventory across FCs. As a result, shifting demand may result in higher inventory costs and potentially strain capacity.

Since this study's overall goal was to understand factors influencing variable cost in each FC, the transportation estimate used was deemed satisfactory. Simplifications were also made in calculating the average cost per zone per FC. It neglects to factor in the weight of the packages, which may vary between the fulfillment centers. The assumption made was that packages will have a similar distribution and weight throughout the year. As a result, this will yield potentially inaccurate cost fluctuations when shifting the demand among the FCs.

Another assumption made is that the ratio between inbound and outbound volume is constant regardless of changing volume. This ratio changes throughout the year depending on the inventory buildup for peak. For instance in the months leading up to peak, Amazon.com has a higher inbound volume than outbound volume. During peak, there is lower inbound volume than outbound volume. As a result, any costs associated with changes in the inbound to outbound volume ratio were not reflected in this model.

This model operates on the assumption the same dollar amount is spent on Amazonians and temporary labor. HR has stated that the amount spent on Amazonians on hourly wages and medical benefits is equal to temporary hourly wages plus the temporary hiring agency cost. The

wage estimation was based on projected productivities for each of the process paths. The model also assumes that there is an infinite labor pool.

## 5.2 Model Scenarios

All of the scenarios explored in this model fell into one of four basic categories. Each of these categories is defined by a hypothesis associated with the category. A discussion of each of the four core hypothesis and the reasoning behind them follows:

### Option A: Keep the current demand distribution

This option implies that Amazon.com's current distribution of demand is optimal. Figure 19 illustrates a potential scenario modeling the current distribution of demand among each FC.

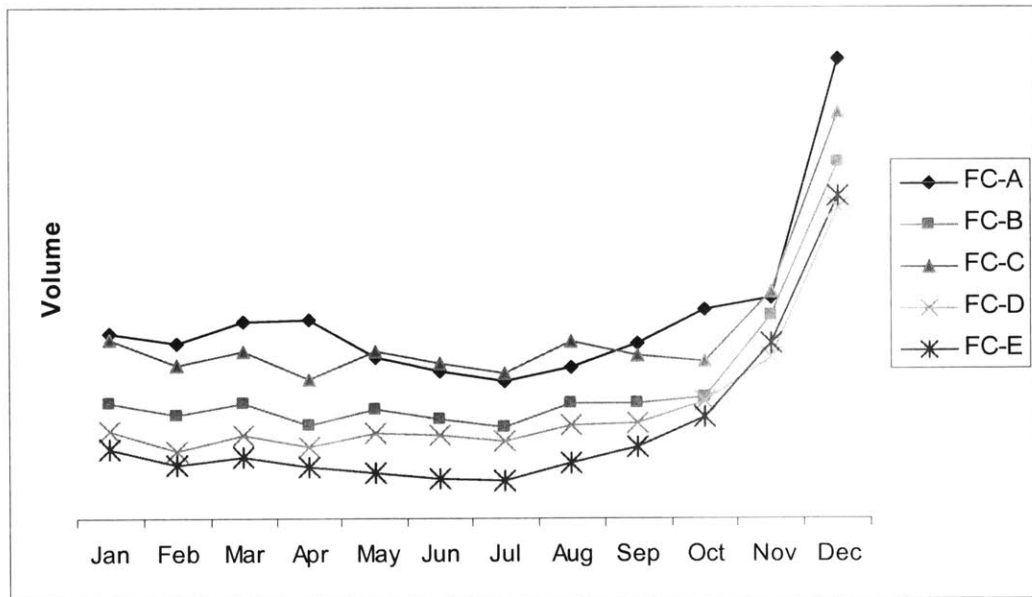
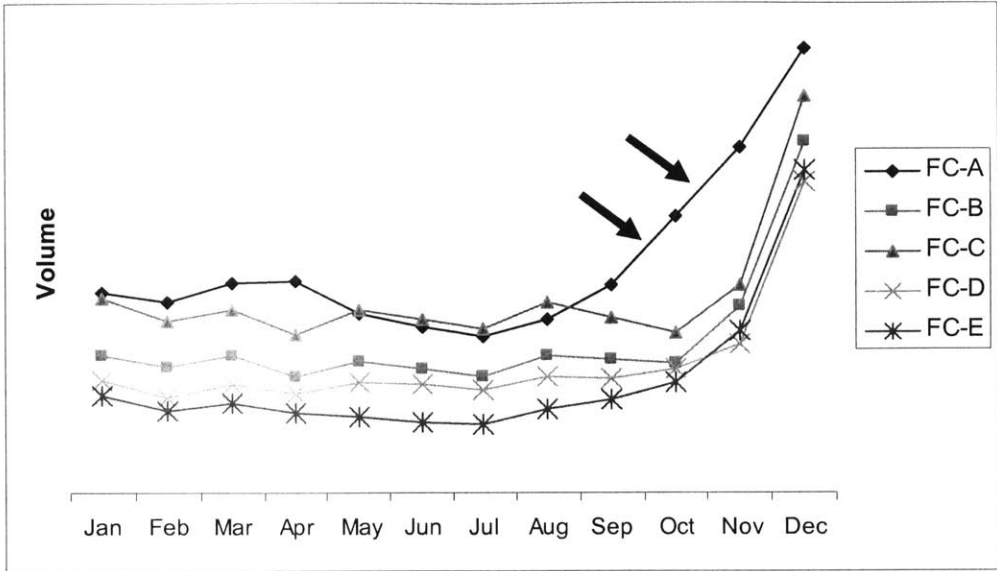


Figure 18: Model Scenarios- Option A  
(Amazon.com demand curves have been adjusted)

### Option B: Adjust the ramp leading up to peak

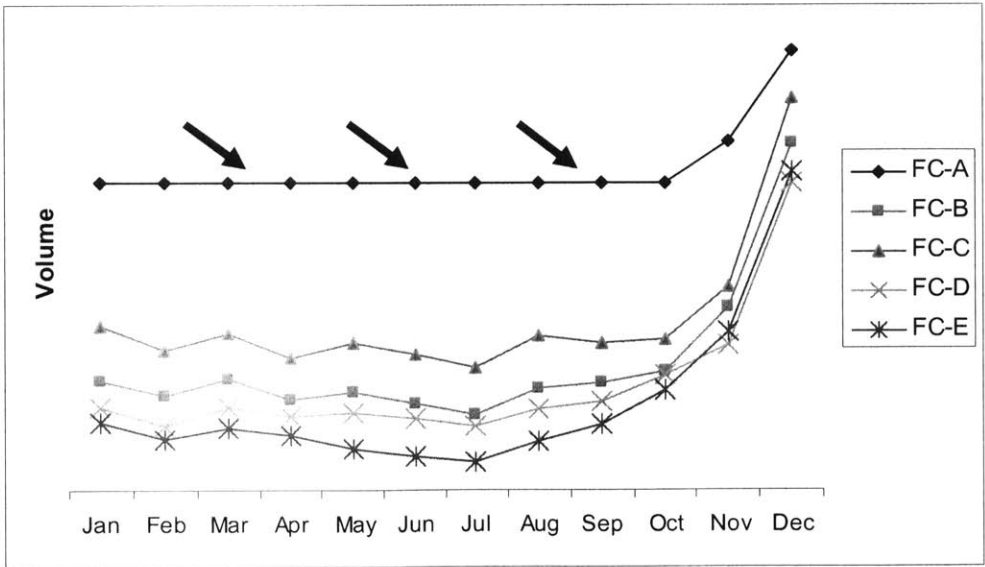
This category contains scenarios based on the idea that overall labor costs can be reduced by adding labor earlier and more evenly during the build-up to peak. Overall savings would be achieved by lowering the costs associated with labor dilution, and by increasing the efficiency of labor during peak periods.



**Figure 19: Model Scenarios- Option B**  
 (Amazon.com demand curves have been adjusted)

**Option C: Run at a higher level during the non-peak season**

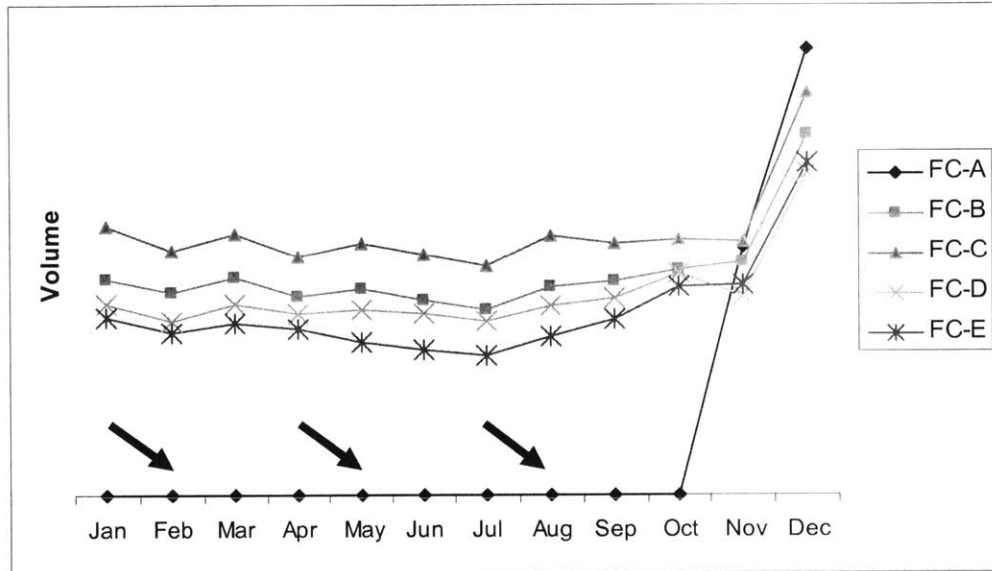
Running an FC at a higher level during off-peak periods will reduce the volume increase leading up to peak. This will also help FCs in labor constrained markets since they will have more available labor at the beginning of the peak period. The drawback of this scenario is that there may be excess capacity during non-peak periods and process paths will have a larger volume increase than they had previously.



**Figure 20: Model Scenarios- Option C**  
 (Amazon.com demand curves have been adjusted)

**Scenario D: Operate only during peak**

Since there is less demand during the year, one FC could be temporarily closed during the non-peak season. This will allow the other FCs to run at a higher level during off-peak periods, which, when later combined with the additional capacity added during the peak period, would result in a smaller ramp leading up to peak. However, this may present logistical challenges, such as the effect on inbound and outbound carriers, labor staffing, and building maintenance.



**Figure 21: Model Scenarios- Option D**  
(Amazon.com demand curves have been adjusted)

**Test Cases**

The base case for Amazon.com is to keep the current demand levels at each FCs. Using Amazon.com's Y2006 volume, a series of test cases were developed to evaluate the previous four scenarios. Essentially, these test cases were created to find the optimal distribution of demand amount FCs. The following scenarios (labeled A-1, A-2, ... , E7) were tested:

Scenario	Fulfillment Center				
	FC-A	FC-B	FC-C	FC-D	FC-E
75% of natural volume off peak	A-1	B-1	C-1	D-1	E-1
50% of natural volume off peak	A-2	B-2	C-2	D-2	E-2
25% of natural volume off peak	A-3	B-3	C-3	D-3	E-3
0% of natural volume off peak	A-4	B-4	C-4	D-4	E-4
125% of natural volume off peak	A-5	B-5	C-5	D-5	E-5
Straight ramp week 35-47	A-6	B-6	C-6	D-6	E-6
Straight ramp week 44-49	A-7	B-7	C-7	D-7	E-7



- 75% of natural volume off peak – An FC's volume is reduced by 25% during the off-peak season and redistributed to the other FCs.
- 50% of natural volume off peak – An FC's volume is reduced by 50% during the off-peak season and redistributed to the other FCs.
- 25% of natural volume off peak – An FC's volume is reduced by 75% during the off-peak season and redistributed to the other FCs.
- 0% of natural volume off peak – An FC's volume is completely reduced during the off-peak season and redistributed to the other FCs.
- 125% of natural volume off peak – An FC's volume is increased by 25% during the off-peak season by taking volume away from the other FCs.
- Straight ramp weeks 35-47 – The FC ramp during week 35 to week 47 is increased by allowing the FC to have a straight ramp by removing demand from the other FCs.
- Straight ramp weeks 44-49 – The FC ramp during week 35 to week 47 is increased by allowing the FC to have a straight ramp by removing demand from the other FCs.

For simplicity, only 35 test cases are discussed in this paper, although several other tests were carried out. The test cases mentioned in this paper are created to specifically test one FC change at a time. Any data obtained from the other test cases did not affect the relevance of the results discussed below.

### ***5.3 Model Findings***

The model's outcomes can be divided into three different categories for comparison: no change, increased cost, and decreased cost. All results were compared to the base test case (where Amazon.com keeps its' current distribution of demand). The findings are grouped into three different categories related to total variable cost savings. In the figures that follow, total savings was defined as the sum of variable and transportation savings. In the figures below, it depicts either additional cost or potential savings.

The groupings only took into account potential labor savings. There are outcomes that yielded total savings based solely on transportation cost. Since this paper is on variable cost savings, transportation savings skewed the results and are not discussed as viable solutions.

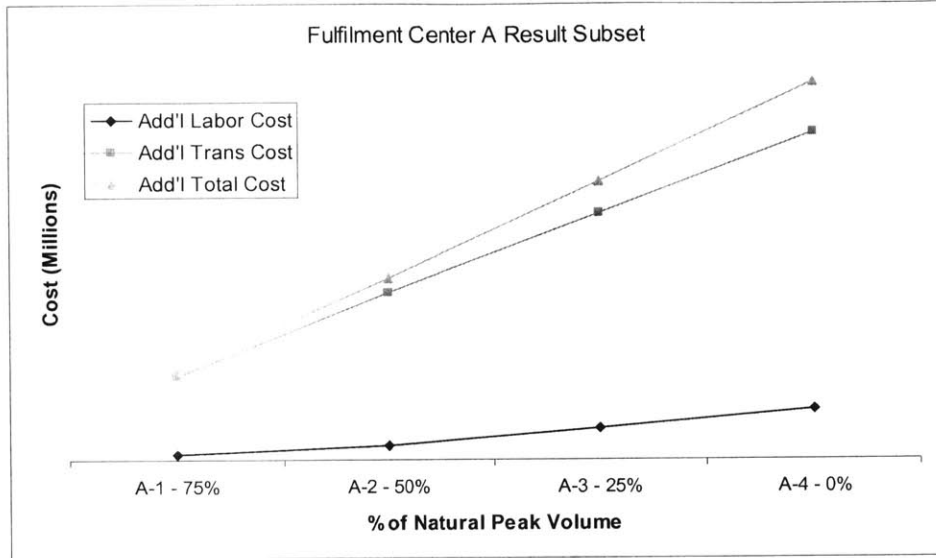
**Category 1 (No Change from the Base Case) –**

The scenarios that mainly fell into this category typically were associated with a ramp adjustment (Test Cases A-6, A-7, B-6, B-7, C-6, C-7, D-6, D-7, E-6, and E-7). The best ramp change scenario resulted in minor savings of ~100K. This decrease in cost is considered negligible. The ramp adjustment’s goal is to allow a FC to bring on more labor at a steadier pace than before. Since the chosen FC was located in a market that was not labor constrained, this FC did not need adjustments to its labor ramp. Any savings may result in increased costs for other FCs by hampering their recruiting efforts. The recruiting efforts at other FCs during off-peak periods may be affected when demand is removed because they would have less available positions with which to attract labor. This, in turn, may lead to a steeper ramp up to peak for those FCs, offsetting any gains from smoothing out the peak at the other FCs.

**Category 2 (Increased Variable Cost) –**

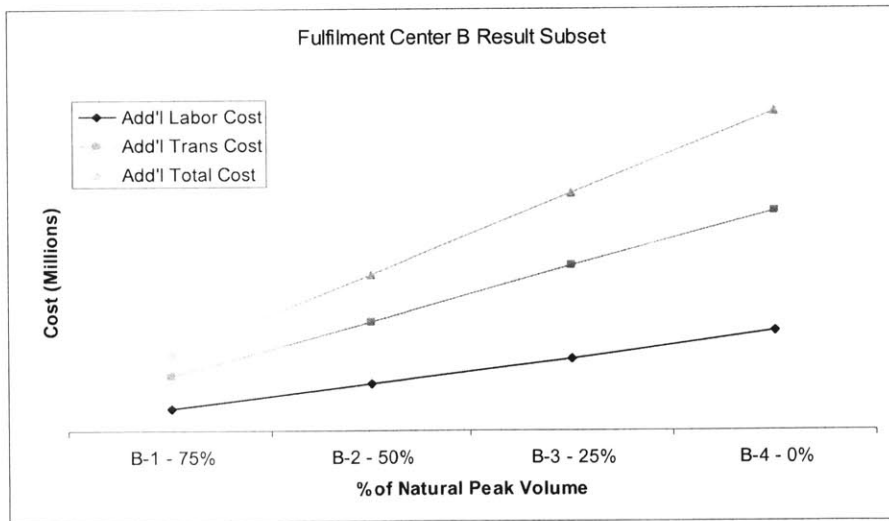
Decreasing off-peak demand in FC-A or FC-B: Reducing off-peak demand in FC-A and FC-B has negative labor and transportation implications (Test Cases A-1, A-2, A-3, A-4, B-1, B-2, B-3, and B-4). Additional labor cost increases ranged from 0.8% - 4.2% of the base value. As a result, Amazon.com should not pursue these options.

Figure 22: Fulfillment Center A Result Subset depicts the increased additional costs if demand from FC-A were redistributed to other FCs. Test Cases A-1, A-2, A-3, and A-4 are depicted in the figure. The additional transportation costs are 6 – 14 times the additional labor cost. For FC-A, the increase in transportation costs increases at a faster rate than labor costs.



**Figure 22: Fulfillment Center A Result Subset**

Figure 23: Fulfillment Center B Result Subset shows that the additional transportation costs are 2 times the additional labor cost. Test Cases B-1, B-2, B-3, and B-4 are depicted in the figure. Similar to the previous figure, these values represent additional costs and are not worthwhile for Amazon.com to pursue.



**Figure 23: Fulfillment Center B Result Subset**

Between FC-A and FC-B, FC-B's labor cost and transportation cost both drive the increased overall costs. Whereas at FC-A, the overall cost is mostly due to transportation costs.

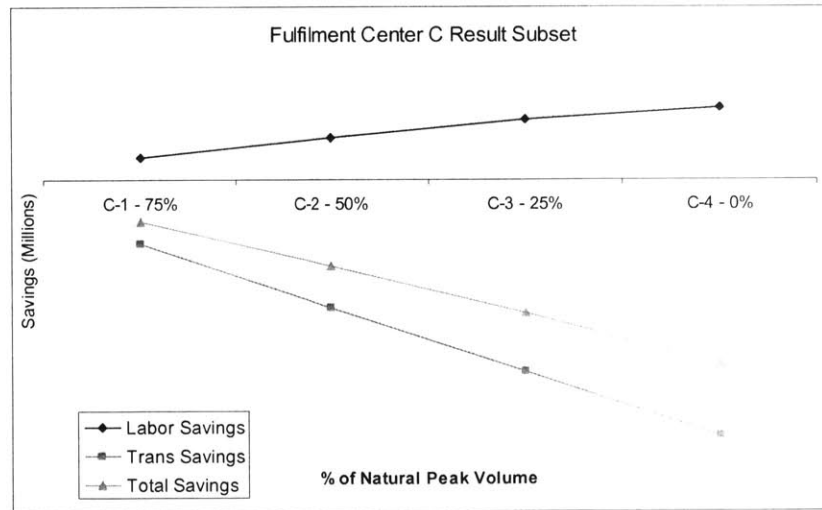
Increasing off-peak demand 25% in FC-A, FC-C, FC-D, or FC-E: Test case A-5 yields variable cost savings of 0.06%, but combined with transportation cost nets at 0.3% total savings.

Although this yields variable cost savings, the estimated increase in transportation cost does not make this case worthwhile for Amazon.com to implement. FC-B was not included in this category since increased demand yields labor and transportation savings.

Test cases C-5, D-5, and E-5 increased variable cost between 0.1% and 1.4%. This suggests that increasing demand at FC-C, FC-D, and FC-E is not beneficial to Amazon.com.

**Category 3 (Variable Cost Savings) –**

Decreasing off-peak demand in FC-C: This change incurs labor savings, but results in additional transportation costs that are 3 times – 4 times the labor savings (Figure 24: Fulfillment Center C Result Subset). Test Cases C-1, C-2, C-3, and C-4 are depicted in the figure. These test cases increase the overall cost between 0.4% – 1.9% from the Y2006 base case. Since the increased transportation cost outweighs the labor savings, these test cases are not worthwhile for Amazon.com to implement.



**Figure 24: Fulfillment Center C Result Subset**

Decreasing off-peak demand in FC-D or FC-E: These changes result in both labor and transportation savings (Figure 25: Fulfillment Center D Result Subset and Figure 26: Fulfillment Center E Result Subset). Between FC-D and FC-E, FC-E gains more savings in both labor and transportation. The best option for Amazon.com is Test Case E-1 which yields labor savings

0.2% from the base case and overall savings of 0.3% from the base case. The savings from FC-E is mainly due to transportation savings. FC-D's labor savings decrease as more demand is removed. The overall savings ranges from .08% - .2% of the base case.

If Amazon.com were to implement Test Case E-1, then it will put strain on this FC's ability to staff for labor for the seasonal season. If Amazon.com's labor is strained in a particular area, it may necessitate raising hourly wages in order for employment at FC-E to be attractive to the labor pool. This wage rate increase may offset the expected savings from Test Case E-1.

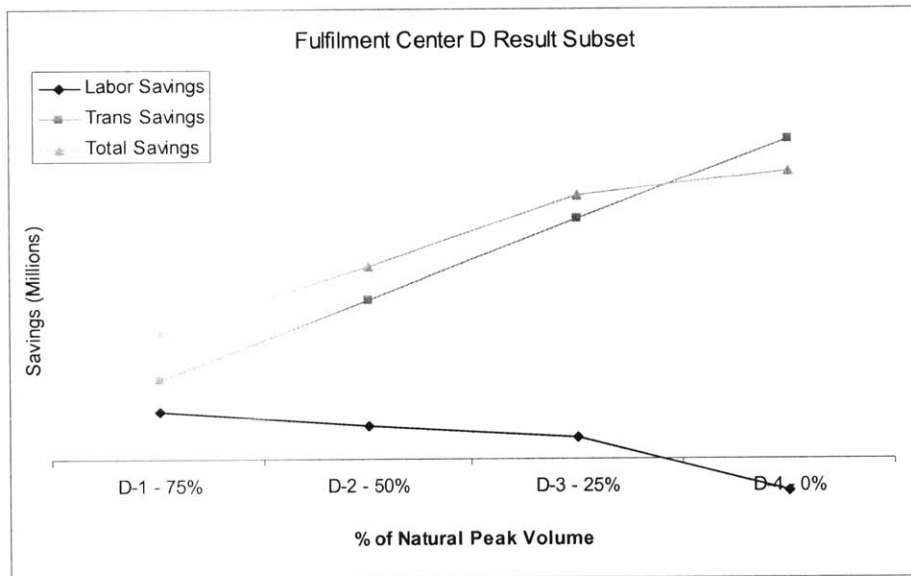


Figure 25: Fulfillment Center D Result Subset

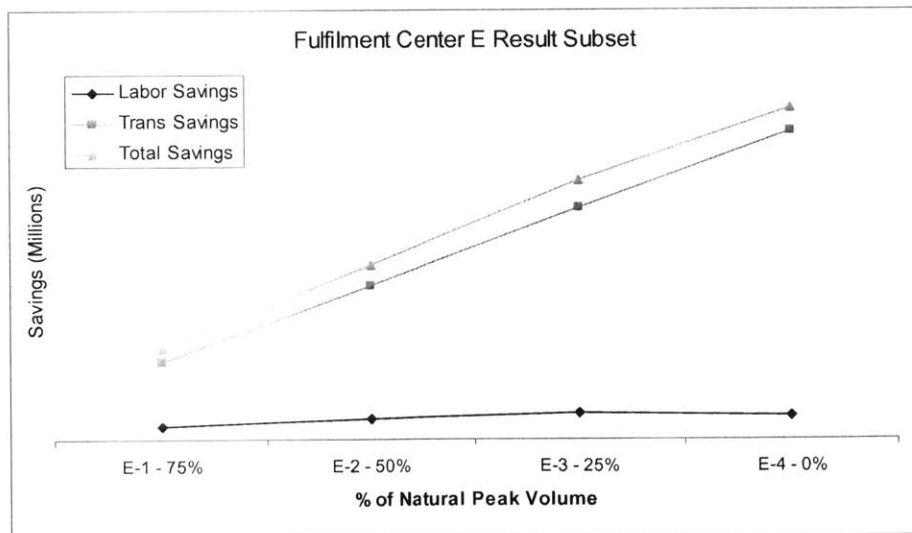


Figure 26: Fulfillment Center E Result Subset

### **Best test case scenario for Amazon.com**

Increase off-peak demand in FC-B (Test Case B-5): This test case results in both labor and transportation savings. With Test Case B-5, FC-B would experience a variable cost decrease of 0.8% from the base case and an overall transportation cost and variable cost decrease of 0.4% from the base case. This translates into VCPU savings of 0.9% from the base case and TCPU savings of 0.4% from the base case. To model this demand for FC-B, 3%-5% of total outbound demand was shifted from the other fulfillment centers to FC-B, an amount which should not significantly impact the labor ramp for peak for the centers servicing less demand.

The projected transportation savings are minimal, but with optimization there could be additional transportation savings. FC-B currently serves 17.7% of total demand, but 27.8% of the customer orders are in the area surrounding FC-B, suggesting an opportunity for this scenario to result in noticeable transportation savings.

These results indicate that increasing demand at FC-B should be taken into serious consideration. Increasing demand at FC-B will potentially result in increasing wages at labor constrained fulfillment centers. The cost to increase wages may exceed these savings. Besides labor cost, Amazon.com must also consider other costs such as inventory holding costs and capital expenditure costs. Inventory holding cost may increase due to the change in the inventory algorithm. Potentially more inventory is needed to achieve this optimal level. Capital expenditure cost may arise from the need to expand FC-B to be able to store more inventory. In the end, these strategic drawbacks suggest this solution is not feasible for Amazon.com, mainly due to the negative impact on labor costs.

### ***5.4 Potential Savings Opportunities***

Throughout the various scenarios tested, shifting the demand allocation across FCs during off-peak periods had minimal effect on variable costs. This suggests the current volume at each FC is optimal. Labor savings do exist when decreasing demand at FC-C, FC-D, and FC-E or increasing demand at FC-B. However, in the case of FC-C, the increase in transportation cost

outweighs the variable cost savings. Decreasing demand at FC-D had a greater potential transportation savings than labor savings. The savings seen by increasing demand FC-B in Test Case B-5 had associated labor and capacity costs which would require further studies to fully understand. Thus, the viability of this option is still in question.

Amazon.com had four options, as predicted before. Option D (adjusted ramp), using Test Cases A-6, A-7, B-6, B-7, C-6, C-7, D-6, D-7, E-6, and E-7, was proven to not be worthwhile for Amazon.com to implement. Option B (shut down FC during 9 months of the year) using Test Case A-4, B-4, C-4, D-4, and E-4 demonstrated this option was also not feasible. Although Option C is feasible under test case B-5, the estimated cost of making this change shows a strong potential to outweigh the benefit. Therefore Amazon.com should operate with Option A (no change). Therefore instead of using demand reallocation to achieve variable cost savings, FCs should achieve variable cost savings by continuing to improve processes and effective labor management.

A discussion of potential cost savings for Amazon.com is discussed in the following chapter. It highlights some of the labor and transportation studies that were investigated during the course of the internship.

## Chapter 6: Cost Saving Opportunities

The model suggests that cost savings are not realized through demand allocations. This chapter discusses ways to reduce variable cost and transportation cost.

### *6.1 Potential Variable Cost Savings*

Internal Labor Improvements: Lands' End, a seasonal retail catalog company, like Amazon.com has excellent customer service. Amazon.com can develop similar programs to Lands' End in its distribution center. Lands' End utilizes the customer letters written to their employees and posts these letters for everyone to view as a sign of recognition. In addition, Lands' End has a Team Squared process-improvement program where employees can share ideas on how to improve things for its customer service, all in relationship to Land's End's vision statement.<sup>24</sup> Appendix A.3 details other key points in Lands' End's seasonal strategy.

Flexible Staffing Arrangements: "In a study of scheduling a multi-skilled workforce in service organizations where demand varies throughout the day, 7 days a week, downgrading can lead to considerable cost savings as seen in the USPS. Savings can also be realized by increasing the level of flexibility available to management when specifying weekly scheduling rules. These may take the form of wider starting time windows, the relaxation of the requirement that each worker be given two consecutive days off, and an increase in the number of permissible shift starting times. However, as schedules become more flexible it is more difficult for supervisors to keep track of their employees. This burden decreases as the number of shift starting times decreases, and when each employee is required to report to work at the same time each day of his tour."<sup>25</sup>

Annualized Hours: In Europe, annualized hours have been used in service and manufacturing industries as a way to meet fluctuating demands. "Under annualized hours, workers are contracted to work for a certain number of hours (say, 1800 hours) per year (or another duration) for a certain amount of money. Typically, overtime is paid only when workers have worked

---

<sup>24</sup> Laabs, Jennifer J. "Strategic holiday staffing at Lands' End." Personnel Journal. Santa Monica: Dec 1994. Vol.73, Issue 12; pg. 28, 3 pgs

<sup>25</sup> Bard, Jonathan F. "Staff Scheduling in High Volumes service facilities with downgrading". IIE Transactions 2004



beyond their contracted annual hours. Employers can ask workers to put in more (fewer) hours during busy (slow) periods. Thus, AH allows employers to vary labor availability according to demand level without incurring much hiring/hiring/training/overtime costs.<sup>26</sup>

Annualized hours allows for aggregate planning for the seasonal business. This strategy allows for a large labor pool and will allow a company to use labor only when needed. Given the United States labor laws, it is unclear if Amazon.com can apply this strategy in the United States, but may be able to apply this strategy in its international locations such as in Europe and in China.

Importance of Screening Workers: “Studies have shown that employees are 10 times more likely to stay on the job 30 or more days. An accurate job preview that sets realistic job expectations has been provided along with the administration of pre-screening. When companies explain the ‘seasonal’ job offering and carefully screen for motivational and skill match, turnover is reduced, leaving more time for training and retaining seasonal employees. This is key, considering that in training expense alone, conservative estimates put the comprehensive costs of replacing a lost employee at 25 percent of the employee's annual compensation amount. Given the need to train an additional 40 to 60 percent of new hires to replace 30-day turnover, it's clear that seasonal hiring can be even more costly to organizations.”<sup>27</sup>

Retain seasonal employees: Many catalog companies aim to have a returning seasonal workforce. As a source to identify and retain seasonal workers, sample exit interview are included in Appendix A.2. Through their pool of seasonal workers, companies can reduce labor training cost with returning workers. In addition, these workers can be a source of referral for additional employees during the seasonal year. Companies should aim to have a communication channel with these seasonal workers throughout the year to give these employees the sense of belonging with the company inspiring loyalty.

---

<sup>26</sup> Hung, R. “Scheduling a workforce under annualized hours.” International Journal of Production Research 1999, vol. 37, no. 11, 2419± 2427

<sup>27</sup> Denise Foy. “Hiring & Training For The Peak Season.” Training. Minneapolis: Sep 2004. Vol.41, Iss. 9; pg. 50, 1 pgs

Outsource seasonal demand: Amazon.com may consider outsourcing some of its seasonal demand to retailers that do not experience a seasonal peak during this time. Companies such as Staples and Office Max do not experience a December seasonal season and maybe able to handle this volume. As a result, partnering with a company that can benefit from additional volume may remove some of the seasonal demand potential reducing costly overtime.

Preplanned gift-wrap: Highly demanded seasonal gifts can be pre-gift wrapped to gain economies for scale. Currently gift wrapping associates have to use various sized paper throughout the day to handle the current gift-wrapping items. By removing highly demand items from the current process path, an associate may be able wrap similar sized items quicker than to switch different sized papers.

Results-only work environment:<sup>28</sup> In a surprising move, Best Buy has eliminated their time clocks and has moved to a result only work environment. In departments where this has been used a 35% average increase in productivity has been measured. In Amazon.com's culture it may be difficult to implement this type of change, but Amazon.com may take lessons from this example. Although it is too early to tell if this program will be successful in the Best Buy retail stores, Amazon.com may examine the incentive structure to motivate its associates.

## ***6.2 Potential Transportation Savings***

The following is a list of strategies in used by various other companies. Since this thesis' focus was not on transportation, there is no indication of the savings that Amazon.com may incur through these changes.

Delayed Allocation: Delayed allocation will allow Amazon.com to continue to receive savings from buying large quantities and also able to separate inventory into smaller quantities. This can be conducted by receiving large quantities of inventory and redistributing various quantities to other FCs. This will also work with cross docking techniques.

---

<sup>28</sup> Brandon, John. "Rethinking the Time Clock." Business 2.0 March 2007, Vol. 8, Issue 2

Transshipments:<sup>29</sup> Transshipment is similar to delayed allocation and can be applied on the outbound side. Inventory is moved to other FCs based on customer demand. This method allows for risk pooling since inventory can be seen as one large pool. Transshipments enable a firm to obtain statistical economies of scale. These have been defined as advantages that result from the pooling of uncertainty, and the principal potential benefits are fewer stockouts and lower safety stock levels. Transshipment allows a firm to meet unexpectedly high demand by pooling inventory from various locations. Holding the level of aggregate inventory constant, a transshipment policy improves overall inventory availability because a location's stock can be used to meet not only its own demand but also excess demand from other locations. Such a policy also enables the firm to reduce inventory levels (specifically, safety stocks), since the two are complements. Potential disadvantages include increased transportation costs due to the increased inventory flow.

Cross-docking:<sup>30</sup> Warehouses function as inventory coordination points rather than as inventory storage points. In typical cross-docking, goods arrive at warehouses from the manufacturer, are transferred to vehicles serving the retailers, and are delivered to the retailers as rapidly as possible. Goods spend very little time in storage at the warehouse- often less than 12 hours. This system limits inventory costs and decreases lead times by decreasing storage time.

Of course, cross-docking systems require a significant start-up investment and are very difficult to manage:

1. Distribution centers, retailers, and suppliers must be linked with advanced information systems to ensure that all pickups and deliveries are made within the required time windows.
2. A fast and responsive transportation system is necessary for a cross-docking system to work.
3. Forecasts are critical, necessitating the sharing of information.
4. Cross-docking strategies are effective only for large distribution systems in which a large number of vehicles are delivering and picking up goods at the cross-docking facilities at any one time. In such systems, there is enough volume every day to allow shipments of fully loaded

---

<sup>29</sup> Evers, Philip R. "Hidden Benefits of Emergency transshipments." *Journal of Business Logistics*. 1997.

<sup>30</sup> Simchi-Levi, David et al. *Designing and Managing the Supply Chain*. McGraw-Hill Publishing Co. 2002 page 134

trucks from the suppliers to the warehouses. Since these systems typically include many retailers, there is sufficient demand so that item can be delivered immediately to the retail outlets and still fully utilize shipping capacity.

Increased Storage Capacity: The ability to fulfill an item from the closest FC will always depend on the inventory stocking of that FC. Increased storage capacity will allow Amazon.com to carry more inventory in its network. The additional cost of capital needed to expand and the increased holding cost need to be measured against potential transportation savings gained from shipping from a closer facility.

Wal-Mart's Remix:<sup>31</sup> Remix is the new distribution strategy Wal-Mart is rolling out to address stock-outs of popular, fast-moving items, from paper towels and toothpaste to laundry detergent and fresh food. Wal-Mart plans to transform its distribution system of 120 company warehouses fed by thousands of vendors moving 2 billion cases of food and 2.7 billion packages of other merchandise to 3,700 U.S. stores annually. The Bentonville, Ark.-based chain is forging a two-track inbound logistics system that will separate high-turnover goods from slower-selling products to reduce stock-outs, especially in its fast-growing grocery stores.

To do that, Wal-Mart is leaning on its vendors to work with transportation and logistics providers to consolidate less-than-truckload deliveries into truckload freight before it reaches a store. If successful, the system will change the way vendors and supply-chain partners move goods to Wal-Mart, and because of the company's size and reach, set an example other high-volume competitors will be hard-pressed not to follow.

The shipper asserts more control in this case by encouraging vendors to coordinate their LTL shipping schedules with logistics providers and carriers so shipments arrive as full truckloads at stores. Inventory management becomes more the responsibility of the vendor and logistics provider. Investments may have to be made in technology to support a much more complex loading of trucks and other transport modes.

---

<sup>31</sup> Hoffman, William. "Mixing it up; Wal-Mart's latest strategy for delivering goods promises to shake up other supply chains." Journal of Commerce. Commonwealth Business Media. May 26, 2006.

There are many different ways to reduce variable and transportation costs. Each company should examine its organization and determine what methods would be best. When implementing any system, one must also consider the effects on the system as a whole.

## Chapter 7: Conclusions

Amazon.com is unique among retailers in its use of technology to organize and improve its supply chain. Its excellence in customer service, operations, and management allows Amazon.com to continue to hold an edge over other retailers in this competitive industry. The seasonal nature of the retail business is not new. Amazon.com's 2005 Annual Report eloquently states the effects of seasonality on its operations:

### **The Seasonality of Our Business Places Increased Strain on Our Operations<sup>32</sup>**

We expect a disproportionate amount of our net sales to be realized during the fourth quarter of our fiscal year. If we do not stock popular products in sufficient amounts or fail to have sources to timely restock popular products, such that we fail to meet customer demand, it could significantly affect our revenue and our future growth. If we overstock products, we may be required to take significant inventory markdowns or write-offs, which could reduce gross profits. A failure to optimize inventory in our fulfillment network will harm our shipping margins by requiring us to make long-zone shipments or partial shipments from one or more locations. Orders from several of our internationally-focused websites are fulfilled primarily from a single fulfillment center, and we have only a limited ability to reroute orders to third parties for drop-shipping. We may experience an increase in our net shipping cost due to complimentary upgrades, split-shipments, and additional long-zone shipments necessary to ensure timely delivery, especially for the holiday season. If the other businesses on whose behalf we perform inventory fulfillment services deliver product to our fulfillment centers in excess of forecasts, we may be unable to secure sufficient storage space and may be unable to optimize our fulfillment centers. If too many customers access our websites within a short period of time due to increased holiday or other demand, we may experience system interruptions that make our websites unavailable or prevent us from efficiently fulfilling orders, which may reduce the volume of goods we sell and the attractiveness of our products and services. In addition, we may be unable to adequately staff our fulfillment centers during these peak periods and third parties that provide fulfillment services to our customers may be unable to meet the seasonal demand. Finally, we, along with our customer service co-sourcers, may be unable to adequately staff customer service centers.

The problems Amazon.com raises in its annual report are problems that all retailers must face. Retailers will be continually plagued by the seasonality of their businesses. The holiday shopping season has been extending each year, occasionally even encroaching onto Halloween. Online

---

<sup>32</sup> Amazon.com 2005 Annual Report page 12

retailers such as Amazon.com may benefit from a longer holiday season.<sup>33</sup> A longer holiday season may allow e-commerce sites to have a slower inventory buildup and steady labor ramp.

Besides seasonality, all companies have a limited number of resources. How these resources are allocated will determine not only how well these companies survive, but whether they survive at all. A company like Amazon.com is built on excellent operations. However Amazon.com cannot rest on its laurels. It must, like other companies, continue to adapt its operations to be agile and flexible to the changing environment.

Macroeconomic issues have a profound affect on the health of all businesses. The consumer price index, GDP growth rate and the housing index all are key factors in maintaining strong consumer spending. Furthermore, the rising cost of oil will cause some businesses to reevaluate their transportation strategies. Many supply chains are multi-national operations that must understand both the global and local environments in order to succeed.

Problems of the past, such as forecasting and inventory levels, will continue to persist in the landscape of the future. Supply chain analysts will now need to maximize profitability of the whole supply chain, not just selected areas. They must consider the whole supply chain and all its interconnections. It is no longer acceptable for Amazon.com to optimize only for transportation cost, but it must also consider the staffing ability within a distribution center. Often companies evolve and change their product mix, leaving their supply chains unfit to deal with the change. Regardless of the operational challenges, any efficient operations strategy must work well with financial, marketing, and product strategies, all of which must serve to further the overall strategic goals of the company.

---

<sup>33</sup> “Christmas Creep: The Shopping Season Is Longer, but Is It Better?.” [Knowledge@Wharton](http://knowledge.wharton.upenn.edu) (<http://knowledge.wharton.upenn.edu>)

## References

- Alexa.com Internet homepage: Alexa.com Traffic Rankings  
([http://www.alexa.com/site/ds/top\\_500?qterm=](http://www.alexa.com/site/ds/top_500?qterm=))
- Amazon.com, Press Release
- Amazon.com Internet homepage: [www.amazon.com](http://www.amazon.com)
- 2005 Amazon.com Annual Report
- Arlen, Jeffrey. Why is Target So Cool? DSN Retailing Today. April 2, 2001. (Retailing Today)
- Bard, Jonathan F. Staff Scheduling in High Volumes service facilities with downgrading. IIE Transactions. 2004
- Brandon, John. Rethinking the Time Clock. Business 2.0 March 2007, Vol. 8, Issue 2
- Cassidy, William B. Realigning warehouses. Logistics. Gulf Shipper. October 23, 2006.
- Christmas Creep: The Shopping Season Is Longer, but Is It Better?: Knowledge@Wharton  
(<http://knowledge.wharton.upenn.edu>)
- Dowling, Melissa. Catalog Age. New Canann: Aug 1996. Vol. 13, Iss. 8.
- Evers, Philip R. Hidden Benefits of Emergency transshipments. Journal of Business Logistics. 1997.
- Foy, Denise. Hiring & Training For The Peak Season. Training. Minneapolis: Sep 2004. Vol.41, Iss. 9; pg. 50, 1 pgs
- How Do Your Turnover Rates Compare. HR Focus. Institute of Management & Administration. August 2006.
- Hung, R. Scheduling a workforce under annualized hours. International Journal of Production Research, 1999, vol. 37, no. 11, 2419± 2427
- Hoffman, William. Mixing it up; Wal-Mart's latest strategy for delivering goods promise to shake up other supply chains. Journal of Commerce. Commonwealth Business Media. May 26, 2006.
- How to Retain Seasonal Workers. Restaurant Hospitality, Penton Publishing December 2006 pg 18-19
- Hoovers.com, Amazon.com Fact Sheet



Medina, Alison Embrey. Love your job. Display & Design Ideas; Oct2006, Vol. 18 Issue 10, p34-36, 3p, 2 charts, 5c

Mongelluzzo, Bill. "The human factor; Labor availability is a growing issue for operators of distribution center." Journal of Commerce. Commonwealth Business Media. January 22, 2007..

Laabs, Jennifer J. Strategic holiday staffing at Lands' End. Personnel Journal. Santa Monica: Dec 1994.Vol.73, Issue 12; pg. 28, 3 pgs

PR Newswire Issues – Combination Jan-Dec 2006.

Retailers in Jeopardy of Employees Quitting This Holiday Season; New Survey Finds That Employees Will Walk out If They Don't Receive What's on Their Wish List. Business Wire. Business Wire. November 22, 2006

Simchi-Levi, David et al. Designing and Managing the Supply Chain. McGraw-Hill Publishing Co. 2002

Staff Management and Amazon.com Offer \$100,000 Prize to Seasonal Workers Hired for Holiday Shipping Rush. BusinessWire. October 27, 2006

Sterman, John D. System Dynamics: Systems Thinking and Modeling for a Complex World. McGraw-Hill Publishing Co. 2000

Trebilcock, Bob. Building the Real Time Supply Chain. Modern Materials Handling. September 1, 2006.

United Parcel Service: <http://www.ups.com/content/us/en/shipping/cost/zones/index.html>

United States Postal Service: 3-Digit ZIP Code Prefix Groups—SCF Sortation  
<http://pe.usps.com/text/dmm300/L005.htm>

US Census Bureau, 2006 estimates, <http://www.census.gov/popest/states/NST-ann-est.html>

US Department of Commerce: Census Bureau, "Retail and Food Service Sales"

## **Appendix A: Labor Management**

The following is a collection of selected research on various labor topics. Labor topics were chosen as a way to address some of the seasonality effects at Amazon.com.

### ***A.1: Catalogs Advice on Finding Seasonal Labor***<sup>34</sup>

Several catalogers offered the following tips for finding good seasonal help:

1. Advertise. Most catalogers place ads in local newspapers; other options include TV or radio spots, and online postings.
2. Hire-a-friends programs. Offer an incentive to employees who recommend a seasonal hire (payable after a probationary period).
3. Contact previous employees who left in good standing. Keep in touch with last year's seasonal workers through letters, company announcements or newsletters.
4. Post notices. To reach people with flexible schedules, post flyers in day-care centers, schools, military bases and senior centers.
5. Temporary agencies. Although temps cost more- the agency bill rate adds up to 24% of the temp pay rate- catalogers save on recruiting and advertising cost, and on employee benefits, worker's comp premiums and payroll taxes.

### ***A.2: Exit Interview Questions***<sup>35</sup>

- What did you enjoy most about working here?
- What made you take the job? (If they came from referrals, use the info to build a referral program)
- How did you hear about this job? (Use this for marketing next year)
- What could we have done better?
- How would doing that have helped you do your job more easily?
- What problems could have been avoided?
- How can we avoid those problems next year?
- Was the training you received sufficient?
- Would you come back to work for us in the summer or at this time next year?
- Who was the best fellow employee you worked with over this holiday?
- Do you have any friends you would recommend?

---

<sup>34</sup> Dowling, Melissa. *Catalog Age*. New Canann: Aug 1996. Vol. 13, Iss. 8.

<sup>35</sup> "How to Retain Seasonal Workers." *Restaurant Hospitality*. Penton Publishing December 2006 pg 18-19

### ***A.3: Lands End***<sup>36</sup>

The following is from an interview with Lands' End. It illustrates one company's approach to the seasonality issue.

#### **How does your company staff up for the holidays?**

We really plan for it. We start in January looking at the projections as far as the amount of orders that we're planning on having, and then based on those numbers we're able to determine how many people it will take us to get the orders out the door. Managers turn in their projections for temporary hire needs by about the first of March. By that time, we have our ad plan in place, we work with a budget, then we determine where we want to place our ad, and then look at any other special recruitment programs that we might want to do for the year. And it's not as if those of us in HR make all of the decisions. The managers and myself develop those plans so everybody has a buy-in and everybody feels committed to what we're going to be doing for the holiday season.

#### **When you say you start in January, you're talking about planning for the following November and December?**

We start in January looking at what we're planning on having for sales the following November and December. Actually, [the managers] have already prepared their budgets prior to that and have made changes in their plan as far as how many regular [employees] they will have in their departments and that impacts how many temporaries we need to hire. Are there new centers starting up? Are we going to be implementing any new programs that might impact the number of temporaries that we are hiring? How is the work going to change going forward? They submit their plans to me by about March 1 as to the number of people that they need. Then what we try to do is work with them to see if there are any other options as far as getting the work done rather than just hiring a lot of people. We're committed to having the people that work here have the potential to earn as much money as they can during the holiday season without having them get overly exhausted, rather than hiring a lot of people. A lot of companies just hire so many people and do they really need all those people?

---

<sup>36</sup> Laabs, Jennifer J. "Strategic holiday staffing at Lands' End." Personnel Journal. Santa Monica: Dec 1994. Vol.73, Issue 12; pg. 28, 3 pgs

**In which areas of the business do you hire people during the holidays?**

In the telephone ordering area, we call it customer sales. We have packers and order fillers. We also have a department that takes care of our mail orders. We also do customization of items, like hemming and monogramming and those areas also need to staff up. We do gift boxing, that has to staff up. And the number of catalogues that we send out from our Dodgeville location increases during our holiday season, so the majority of areas need to staff up.

**How many locations does your company operate from?**

We have our Dodgeville location, which includes our main distribution center, our customer sales area and all of the support departments. That's where you would find our merchandising group and our creative group and a large portion of our HR group. We have our cross-claims forms center [there]. And we just added a new distribution center in Reedsburg.

**Is Dodgeville a small community?**

It's a small community. There are about 4,000 people here. It's very friendly. We have a nice downtown area with nice shops and stores. When people come to visit Lands' End, I think that they feel like our community really welcomes them. I think of Dodgeville as Lands' End's home, yet my recruitment really is within a 30-mile radius. All of the small communities around us have the same friendly, nice people.

**What's the number of core workers?**

We have temporaries all year long. During our holiday season, about half of our employees are regular employees; that would include all of our salaried staff also. Then about half are temporary employees. We keep temporaries all year because our business fluctuates within the year, within the month and also within a given week. We really need to have ongoing temporary employees to help with those peaks.

**Do you have difficulties recruiting the large numbers of people you need?**

I would say that every year it's a challenge. But I believe that every company that's trying to hire a lot of people would consider it a challenge. Somehow or another, we're always able to meet our need. We've always gotten the people that we need to get the work done and it's never in desperation, it's always planned. And as we get near to the end of the hiring season, then people start to get to be a little bit more concerned, because it does take a lot of effort on the part of the managers and supervisors to interview all of these people and then train them.

**How do you recruit these temporaries generally?**

Well, we have several different areas that we look at for recruitment. We have what we call our internal recruitment programs, and that would be things such as our referral programs, where employees can earn dollars for referring people that they feel would be good employees here at Lands' End. That's a very strong program here. Then we also have programs such as job share and extended schedules. Job share is where a person is trained to work in more than one department. So let's say, for instance, a customer-sales rep might do customer sales three days a week and then work in customer service for two days a week, so they're actually working in more than one department. That way, we're able to maximize the use of our employees and not have to hire as many, plus the employee can maximize his or her earning potential to the best of their ability. I think that's important. When you have a business that has all these peaks and valleys, how do you help people have a steady income? Also during our holiday season, some departments use what we call extended schedules where a person can work up to 12 hours in a given day, but they cannot work in one department for 12 hours. It allows our employees to have an additional part-time job.

**Do you have a big influx of temporaries that you've never worked with also during the holidays?**

Yes. We have our internal recruitment that we were talking about, and then we have our external recruitment program. We develop a very nice ad program [each year] and our ad programs focus on our vision statement and customer service here at Lands' End. We try to highlight the different jobs so people have the opportunity to say to themselves as they're looking at the ads, "Well, I think I can do this job." We do a smattering of radio ads, and those are only when we're really

hiring at our peak. We also try to partner with the local high schools, universities and the technical colleges. One of the things that we're trying to do is make sure that we help make the students successful in their studies as well as working here. We have a strong commitment that we don't want to see our [seasonal] employees [who are students] fail in their other commitments such as other jobs that they might have or their studies. So we've started to meet with the local high schools, universities and technical colleges on a more regular basis to talk about how we can recruit their students as employees and [ask them] about some of the things that are happening with their students. I think we offer some really nice schedules. The commitment is a six-hour shift in the evening if you're trying to go to school, vs. trying to work an eight-hour shift after you've finished with a full day of school. We only ask for a commitment of three shifts a week. Most students are able to handle 18 hours a week and still maintain their study schedule.

**So you give them an opportunity while also trying to not overburden them?**

Absolutely. Some of the schools are a fair distance away and transportation might be a roadblock. We've started to do some busing from those locations. We just pick up students at the school and then bring them here for a six-hour shift and then take them back. That's working really well. We've just started that this year.

**How many of the seasoned employees return each year?**

About one-third.

**Is that high for your industry?**

I consider that about average. The reason that I think it's average is that we do lose some of our rehires because we hire a large student population for our second shift. Then once they graduate, many of them move out of the area, so they're not available. But what we do find is that employees might work for us two or three years, then stop for some reason and come back two or three years later. They always seem happy and excited to come back. So we don't just look at our rehires as people who have just worked the previous season. Anyone who has worked for us in the past, we consider to be of extra value to us.

**What have you learned about recruitment and how to find the right kind of people for your organization?**

At Lands' End we have always had the philosophy that every hire is a potential regular employee. So when we're doing our interviewing and we're looking at people, we take the same interest in that person as we would in someone who's going to be a regular hire because my intention is that they'll work for us for more than just the holiday season. Our intention is that they will be an ongoing temporary or come back to us season after season. I look for people with a good customer-service attitude--no matter what job you do at Lands' End, you're going to be impacting the customer.

**Can you describe the orientation and training that you put you temporaries and seasonal workers through?**

All of our new employees receive a six-hour orientation. Then as a rehire, we update them on new things that have happened at the company. That's usually a two-hour program. Each department has very specific training programs.

**Do rehires go through training every year?**

If their break of employment has been less than a year, then the training would be minimal. But if it has been more than a year, then they would go through what we call a rehire training program, so it's more formal. It's pretty much categorized by how people come back [to us]. We have our new-hire groups, we have our rehire groups and then we have those people who just continuously come back every year, because you certainly don't want to have someone who is ready and anxious to get on the job spending a lot of time reviewing information that they don't need.

**How do you make it fun during the holiday times for all of the employees?**

We have an activity center here at Lands' End and they have a lot of different programs that are going on there. As a company, we have the kids from Wisconsin come for an evening and they do two shows and we have cookies and it's very festive. Our whole Lands' End [campus] is decorated to a tee for our holiday season. We also have, as a company, a Christmas Choir that employees can volunteer to participate in. It's just gorgeous. And they go around from

department to department caroling. We ask one of the local high schools to come in each year and do a mini concert during our lunch breaks. Those are things that we do as a company.

**What do you do in each department to make it fun?**

Each of the departments has the freedom to do things that they want to do--a department like customer sales has a whole calendar of events that they're doing. One of the events that they might do would be to play a states game. As the telephone operators are taking orders, they keep track of which states have called and they check them off. Then at the end of the day or whatever the timeline is, everyone turns theirs in and then there's a drawing for a prize. The order-filling department in the distribution center had an order-filler appreciation day. Everyone who was working that day put their name into a hat and they drew every half hour and then they had this little Hawaiian [island] all set up--with the lawn chair and palm tree--and they gave the winner a Hawaiian shirt and a Hawaiian hat to put on and took their picture. Then that person could draw out of a hat for a prize. The prize might be getting to select which particular job they would be doing in that department for the next couple of days. We also had a holiday sweater day where everyone wore holiday sweaters.

We also have wellness ambassadors here--they link the activities center to the departments. We often take advantage of the wellness ambassadors for help in planning some of these fun events in the departments. And we try to get a group of employees together and let them come up with a plan rather than just having it be the supervisors who are doing the planning. It's more fun that way.