Customer Segmentation in the Medical Devices Industry

By

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Submitted to the Engineering Systems Division in Partial Fulfillment of the Requirements for the Degree of

Master of Engineering in Logistics
at the
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Abstract

This thesis addresses Company X’s concerns about its product shipment options. The company ships over 70% of its products to its customers using the primary service provider that ensures that the product is at the customer site by 10.30AM next day. As per the understanding with its customers, the company, absorbs the cost of premium shipping and does not pass it on to most of its customers. The company believes that this priority service is a source of competitive advantage that helps it get customer loyalty and thereby increases sales. However it is not a normal industry practice to provide this service free to the customers. Keeping in mind this enormous cost burden, Company X wants to minimize this cost.

Medical device sales are non-seasonal and do not show promotional effects. We analyzed data for the months of June and October, 2006 as a part of our research. The objective of our data analysis was to validate the proposed approaches we reviewed as a basis for proposing ways to segment customers for improving service while reducing cost. We proposed three types of segmentation: by region, by order method and by division. Segmentation by region looks at dividing the customers by into 4 regions based on their location. Segmentation by ordering method splits the customers in terms of whether they order using phone, fax or EDI while segmentation by division breaks up the customer base in terms of the various divisions the company has.

Our study revealed that the company can expect to save over 3 million dollars annually by not offering this service free of charge to its customers. If customers are not convinced that the lower level of service meets their needs, they may pay for use of premium shipping. We demonstrate that the lower level of service will likely be just as effective and hence the company can guarantee that the product would reach the customer on time. Given the criticality of the parts that the company ships, it is advised to take its customers into confidence before making major policy changes.

Thesis Supervisor: Larry Lapide

Title: Director, Demand Management, MIT Center for Transportation and Logistics
Acknowledgements

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Many people from Company X have lent their wonderful support and guidance during the project. We are particularly grateful to our project manager for having helped us in facilitating most of the meetings with other company officials and customers. We also greatly appreciate the help provided to us by the manager of customer service, the vice presidents of sales for Interventional Cardiology and Endoscopy and the vice presidents of supply chain operations and supply chain engineering.
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1 Introduction

This thesis is about a real challenge faced by a specialty medical device maker to segment its customer base from a logistics standpoint for differential service offering. We analyzed this problem by talking to the representatives of the company, by referring to various sources for literature and by gathering thoughts from the different lectures given by prominent people from the industry.

This thesis can broadly be divided into four main sections. It opens with a brief background about the company and its products. It discusses the competitive environment of the business and the terminology used by the FDA in defining such specialty products. It then discusses the research problem at hand and talks about some aspects about the challenges hospitals in the US face.

The next section discusses in detail the thoughts of various people who have studied this problem of customer segmentation. The document then narrows down to focus on some of the common ways suggested by the various writers about segmentation of logistics services.
The third section of the thesis gives a preview of the data gathered from the company. This section presents the data in different forms. The analysis tries to determine how best to segment the customer base from a logistical perspective.

Finally, the document discusses some of the savings that the company can get by segmenting the customers suggested in the previous section. This section includes both monetary savings and some novel ways of looking at the customer information.
2 Industry Challenges and Company Background

This chapter describes the challenges hospitals face, the business of company X, the market for medical devices in the US and the research problem at hand.

2.1 Challenges Hospitals Face

Some of the key challenges hospitals face today according to Dr. Daniel Z. Aronzon, M.D., F.A.A.P., President of the Medical and Dental Staff at Vassar Brothers Medical College in New York are:

1) Accountability: The Center for Medicare and Medicaid Services conducts a survey in which hospitals are graded on the basis of various aspects of their performance. Most of these relate to the quality of healthcare provided by the hospitals measured in terms of fatalities, wrong treatments, mismanagement of individuals’ health etc. The objective is to generate a database of online information that can be accessed by patients to decide the type of hospital to go to.
2) Transparency- It would mean full disclosure of all patient records and making it online when requested for. Transparency could also relate to issues in inventory management of products stocked at the hospitals. This would help them streamline the process of ordering products when required.

3) Safety- Mistakes in administering the correct medicine is often a major factor in patient fatalities. Most often this happens on account of negligence on the part of the doctor, the nurse or even the pharmacist. Hospitals are adopting technology to reduce the incidence of such fatalities by using bar-coding and RFID technology.

4) Capacity- As the baby boomers age, it is going to put up an enormous pressure on medical facilities in the US. Hospitals are ramping up their facilities to take care of such a burgeoning aging population.

5) Cost- 16% of the total GDP in the US is spent on healthcare. Statistics shows that 30% of the cost of any hospital is due to wastage that can be avoided. Wastage is not just the wastage of products, but can include unnecessary procedures and multiple procedures of the same type. Often nurses are a source of wasteful expenditures incurred by hospitals as they hoard critical products.
2.2 Company X and Its Products

Company X is a worldwide developer, manufacturer and marketer of medical devices whose products are used in a range of medical specialties that include life threatening surgical interventions.

For more than 25 years, Company X has advanced the practice of less-invasive surgery by providing a broad and deep portfolio of innovative products, technologies and services across a wide range of medical specialties. These less-invasive medical technologies provide alternatives to major surgery and other medical procedures that are otherwise traumatic to the human body. In less-invasive procedures, devices are usually inserted into the body through natural openings or small incisions and are guided to most areas of the anatomy to diagnose and treat a wide range of medical problems.

Company X is delivering on its promise of less-invasive procedures to treat a range of diseases spanning a range of symptoms that afflict the body. The company is a market leader in almost every segment they serve. It is also a leading innovator of break through medical and surgical products that are used by numerous patients world wide.
2.3 *The Market for Medical Devices*

A medical device as defined by the Food and Drug Administration (FDA) is:

"An instrument, apparatus, implement, machine, contrivance, implant, in vitro reagent, or other similar or related article, including a component part, or accessory which is:

- recognized in the official National Formulary, or the United States Pharmacopoeia, or any supplement to them,

- intended for use in the diagnosis of disease or other conditions, or in the cure, mitigation, treatment, or prevention of disease, in man or other animals, or

- intended to affect the structure or any function of the body of man or other animals, and which does not achieve any of its primary intended purposes through chemical action within or on the body of man or other animals and which is not dependent upon being metabolized for the achievement of any of its primary intended purposes."


In the past few years, the market for medical devices has seen a period of explosive growth. The market is currently valued at over $100 billion and is expected to grow at an accelerated pace as demographics and market drivers increase their pressure for new and innovative devices to cure human ailments. The current growth rate of the market is around 8-10% per annum with some segments growing at over 15-20%. The market is very fragmented with over 6000 large and small manufacturers that employ close to over
300,000 people. The US is a net exporter of medical devices with over $16 billion worth of goods exported with a net surplus of $8 billion.

Some of the key market drivers that are forcing market growth include:

a) An aging population

b) Advances in new and emerging technologies

c) Active lifestyles of people that prolong life

d) Greater market penetration and the emergence of countries like China and India

2.4 Research Problem and Description

Company X is faced with a curious problem. While on the one hand, it has products that are widely received in the market, on the other, it is faced with intense competition. In order to improve company profitability, company X believes, one approach could be to segment the customer base from a supply chain perspective and serve them differentially. In order to help them achieve this goal, they approached MIT with this thesis topic. In doing so the company is trying to resolve two key problems as given below.

Company X is trying to understand if it is overshooting customer expectations and paying too much for service delivery? The company currently ships products using a primary service that ensures overnight delivery of the products at the customer doorstep at 10.30 AM next day. 71% of its total domestic shipments are done using this service.
The company clearly wants to know if it is appropriate to serve all customers using this service as it comes at a cost premium.

**Company X is also keen to know how to segment the market from a logistics standpoint.** Different methods of segmentation include, by customer location, the divisions within the hospital, the types of product ordered, the ordering method used or the volume of the business the customer generates for Company X. The objective is to estimate the best method that delivers value to the customers that creates efficiency for the company? The company is keen to establish decision-making processes and procedures that customize service levels and optimize transportation costs, delivery frequency, and all other aspects of customer service.

### 2.5 Data Requirements and Methodology

For the purpose of the analysis we used the sales and shipment data for the months of June and October of 2006. Since the sales of medical devices do not show any major seasonality, we agreed that the analysis of two months of data should be sufficient to understand the nature of the customers and their ordering patterns.

Some of the key data elements that we received include:

1) Order number
2) Customer ID
3) Customer name
4) Customer type
5) Ship-to location
6) Ship-to-Zip code
7) State
8) Product type
9) Quantity Shipped
10) Dollar value of the shipment
11) Shipping mode as per contract
12) Shipping mode actually used
13) Ship to receiving location within the Hospital
14) Order placed by
15) Time of shipment
16) Date of Shipment
17) Mode of order taking
3 Literature Review

This chapter describes some of the literatures available on the topic of market segmentation. It also has a brief on the common practices used in logistical segmentation and addresses some of the ways this is achieved as suggested by various researchers in the past.

3.1 Market Segmentation

3.1.1 What is market segmentation?

"Market segmentation" has been defined by various researchers in different literatures. Wendell Smith defines market segmentation as “a rational and more precise adjustment of the product and marketing effort to meet consumers or users requirements. It consists of viewing a heterogeneous market (one characterized by divergent demand) as a number of smaller homogenous markets”[26,36]. Recently, McDonald defines market segmentation as “a group of customers or consumers who share the same or similar needs” in his book entitled “Marketing plans. How to prepare them. How to use them” (Fourth edition, Oxford, Butterworth Heinemann. 1999).
Market segmentation has been used by many companies since Wendell Smith (1956) introduced it as a potential marketing method that is different from product segmentation. Market segmentation became one of the most popular concepts for targeting and positioning in marketing studies. Nowadays many companies across industries use market segmentation in their marketing and strategic planning processes. In today’s industries, a mass marketing method is no longer effective for customers’ various needs [12]. This is why businesses use market segmentation as a way to solve marketing problems. The main goal of market segmentation is to identify and find profitable groups of customers with certain products and services to meet the needs of customers in each segment. In other words, the goal of market segmentation is to use “familiar protocols for the division of markets in a variety of ways, into homogeneous groups of buyers, to form differentiated targets for marketing strategies and programs”[33].

Daniel Yankelovich mentioned early that market segmentation analysis has started from “two main premises” [40].

- First, each brand is effective in sales only to a certain segment, not to all segmentations in the market.
- Second, to know how segments differ in needs of different customers in term of contribution to company’s revenue is the prerequisite for healthy marketing strategy.

Afterward, many scholars and practitioners introduced various market segmentation methods. Among these, we can find several studies focusing on application of market
segmentation as given in Table 1. Many companies use these methods to get a competitive edge in planning, sales and marketing strategy.

Studies focusing on application of market segmentation

Table 1 Studies focusing on application of market segmentation

<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Research Question</th>
<th>Study's Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cross, Belich, and Rudelius (1990)</td>
<td>How do marketing managers use market segmentation?</td>
<td>Quantitative (Telephone Interviews); Exploratory, Descriptive; n = 32</td>
</tr>
<tr>
<td>Danneels (1996)</td>
<td>How is market segmentation applied in apparel retailing in Belgium?</td>
<td>Qualitative (Interviews); Exploratory; n = 22</td>
</tr>
<tr>
<td>Meadows and Dibb (1998)</td>
<td>How is market segmentation applied in the financial service sector in the UK and which implementation barriers exist?</td>
<td>Qualitative (Case Studies); Exploratory; n = 4</td>
</tr>
<tr>
<td>Dibb and Simkin (2001)</td>
<td>What infrastructure barriers, process issues and implementation barriers exist in market segmentation in industrial marketing?</td>
<td>Qualitative (Case Studies); Confirmatory; n = 4</td>
</tr>
</tbody>
</table>

Source: Sausen, Tomczak, and Herrmann [34]

As mentioned above, market segmentation is often an important factor for companies to achieve competitive strength in markets. Thus, it is very important for businesses to understand the logic of market segmentation. Piercy and Morgan point out that building marketing strategy according to market segmentation will help a company maximize usage of available resources and obtain customers' loyalty by meeting customers' expectations effectively [33]. The basic logic of market segmentation is that customers can be divided by their preferences and behavior. In other words, customers who have similar preferences and behavior are apt to show a similar response to a certain service or product. Therefore, companies which have a market segmentation strategy can meet
various customer needs by focusing their marketing efforts on separated segmentations with differentiated marketing methods. This can provide many benefits to companies. Among these benefits, Dibb and Simkin insist that the most important is that companies concentrating on market segmentation are forced to conduct more precise analysis on customers and competitors [12]. With this analysis, they can get more information about their customers and competitors. This can make them understand what customers really want and what the company can offer, thereby allowing them to provide a faster and an exact response to their customers [12].

Moreover, a precise analysis of a market situation also can provide companies information about other marketing methods such as targeting and positioning. These serial procedures of market segmentation make companies good at forecasting and planning with enhanced knowledge of customer needs by segments.

3.1.2 Taxonomy of market segmentation

There are various methods and theories to segment markets as given by the different researchers.

(1) Demographic segmentation

Demographic segmentation is a basic way to segment markets according to gender, age, income level, education level, number of family members, family life cycle etc.
Demographic segmentation is a popular method in market segmentation. However, demographic segmentation has been criticized by many scholars. In today’s marketing practice, demographic segmentation is still a basic method but is considered a relatively poor indicator of customer behavior.

1.a) Segmentation by Gender
Markets can be segmented by dividing the population into males and females. Most representative cases of use of this method would be for selling clothes, cosmetics or magazines. In case of magazines, often certain magazines are targeted for specific gender groups.

1.b) Segmentation by Age
Each different age group of consumers has different buying behaviors. For example, drug companies basically divide the consumers into two groups; adults and children, and for each group, different marketing strategies are conducted. For example, packaging or advertising are differentiated by age segments.

1.c) Segmentation by Number of family members
These days, families that have only one or two members are becoming more and more common, and market segmentation strategy is also influenced by such a trend. That is to say many single-member families have different buying patterns, when compared to multi-member families. Frequency of consumption and type of products consumed varies
according to number of family members. Companies have to reflect upon such aspects while designing marketing strategies.

1.d) Segmentation by Family life cycle

Family life cycle is defined by seven steps and buying behavior differs in each step. These seven steps consist of the pre-marriage step, childless couple, couples with newly born children, couples with growing children, couples with graduated children, old couples with married children, and retired old couple. Market segmentation by family life cycle is defined by different needs at each step.

(2) Psychographic segmentation

Psychographic segmentation is one of the non-demographic methods in market segmentation. Psychographic segmentation is subdivided into the following three groups.

2.a) Segmentation by Social class

Consumers show different usage patterns according to the social class they belong to, especially in cars, clothes, electronics, and leisure. Consumers in different classes are influenced by reference groups that belong to that class.

2.b) Segmentation by Lifestyle

Life style is complex and relates to the desire, motive, attitude and philosophy of an individual. As consumers’ demands became more diverse, companies have made efforts
to segment the market in order to satisfy the demands as well as minimize the cost. Lifestyle often is also influenced by the prevailing trends and segmentation using such a practice has plenty of possibilities.

3.c) Segmentation by Consumers’ characteristics

It is a difficult job to divide and group consumers’ various characteristics according to a set standard, but classifying consumers of similar characteristics into one group could be a great way to segment markets. Such method is often applied in markets in cosmetics, cigarettes, jewelry, and liquor.

(3) Segmentation by Benefits from the Products

When consumers purchase a product, they have different expectations of the benefit from the product. A market can be segmented with such characteristics. According to Daniel Yankelovich, when consumers buy a watch, 23 percent of them care about price the most, 46 percent care about “durability and quality” and 31 percent care about “symbols of some important occasion” [40].

3.1.3 Market segmentation for various industries

For a long time, conventional demographic segmentation had been considered as the only way to segment markets. However as markets became bigger and more sophisticated, demographic method could not explain all factors in market segmentation. Many
companies have experienced that their customers have become complicated in preferences and buying patterns.

As Yankelovich and Meer mentioned, customers’ preference and buying patterns no longer has great correlation with their demographic characteristics such as age, gender, and family types [41].

Yankelovich and Meer suggest some insights about different segmentations for different purposes in non-demographic segmentations in their recent research ‘Rediscovering Market Segmentation’ [41]. They also contend that “effective segmentations focus on just one or two issues, and they need to be redrawn as soon as they have lost their relevance”.

Table 2 Two types of segmentation exercises

<table>
<thead>
<tr>
<th>Segments to develop advertising</th>
<th>Segments to develop new products</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Populations studied</strong></td>
<td>Users of related products or services that already meet similar needs; partners such as distributors and retailers</td>
</tr>
<tr>
<td><strong>Data sources tapped</strong></td>
<td>Attitude surveys</td>
</tr>
<tr>
<td><strong>Analytical tools used</strong></td>
<td>Statistical analysis of survey results</td>
</tr>
<tr>
<td><strong>Outputs</strong></td>
<td>Segments that differ in their purchasing power, goals, aspirations, and behavior</td>
</tr>
</tbody>
</table>

*Source: Rediscovering Market Segmentation [41]*
In today’s industries, non-demographic market segmentation can be widely used to set up effective marketing strategy. However one market segmentation strategies does not always fit all purposes. This is why we need to differentiate segmentation methods by different purposes.

As mentioned above, one of the possible ways to segment a market is by industries to which a company belongs. There can be various ways to define industries. Daniel Yankelovitch investigates ten different markets for consumer and industrial products to show how seven different modes of non-demographic segmentation affect different markets in his early research ‘New Criteria for Market Segmentation’.[40]

Table 3 Example of segmentation in different industries

<table>
<thead>
<tr>
<th>MARKET</th>
<th>VALUE</th>
<th>SUSCEPTIBILITY TO CHANGE</th>
<th>PURPOSE</th>
<th>AESTHETIC CONCEPT</th>
<th>ATTITUDES</th>
<th>INDIVIDUALIZED NEEDS</th>
<th>SELF-CONFIDENCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>WATCHES</td>
<td></td>
<td></td>
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<tr>
<td>AUTOMOBILES</td>
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<td>PERFUMES</td>
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<tr>
<td>BATHING SOAPS</td>
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<td>HAIR CARE</td>
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<tr>
<td>OTHER PACKAGED GOODS</td>
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<tr>
<td>RETAIL FOOD GOODS</td>
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<tr>
<td>ADDING MACHINES</td>
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<tr>
<td>COMPUTERS</td>
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<td></td>
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<tr>
<td>LIGHT TRUCKS</td>
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</tr>
</tbody>
</table>

Source: New Criteria for Market Segmentation [40]

The seven modes that Yankelovich uses are “value, susceptibility to change, purpose, aesthetic concepts, attitudes, individualized needs and self confidence”[40]. The ten markets that Yankelovich investigates are “watches, automobiles, perfumes, bathing
According to this research, the automobile market shows more segmentation factors than watches, perfumes or the bathing soap market. With the non-demographic segmentation modes Yankelovich provided, we can consider three segmentation modes to classify the automobile market.

The first mode of segmentation is by "value". There are people who buy a car for economy. There are people who are willing to buy the best car they can buy within their budget. There are also people who are interested in "personal enhancement". Along with the size of these three groups of people, automobile companies can set up their market strategy focusing on each group separately.

The second mode is related to "aesthetics". "Aesthetic concepts" mean appearance preferences. Aesthetic concepts became various and sophisticated as the automobile industry grew. Automobile companies have been trying to meet consumers' different style preference by diversifying colors and materials needed to decorate external and internal appearance.

The third mode is "susceptibility to change". This includes identifying the "relative susceptibility of potential car buyers to changing their choice". Along with susceptibility to change, we can divide customers into three groups; people who are not willing to
change, people who are very open to change with no prejudice, and people who are attracted to a specific product. Using this segmentation, automobile companies can decide their advertising, promotion, and other marketing programs for specific segments.

The implication of this research is meaningful. This research suggests that we need to consider differences in buyer behavior, values, motivations, preferences, changeability and usage patterns to segment markets for different industries.

3.1.4 Implementation and obstacles of market segmentation

The implementation of market segmentation is important as well as challenging. Before implementing market segmentation, companies should thoroughly investigate exiting customer tiers, available company resources and profitable customer characteristics. Companies also need to consider some information as shown in the table below.
### Table 4 Considerations for market segmentation

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Definition</th>
<th>Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relative spend</td>
<td>A measure of the total amount spent on flavours and the proportion of that spend captured by Belmay</td>
<td>Revenue captured as a proportion of total spend expressed as low or high</td>
</tr>
<tr>
<td>Service requirements</td>
<td>The requirement for product support services seen as order fulfilment, development support, and advice on legislation</td>
<td>Low – medium – high</td>
</tr>
<tr>
<td>Buying style and processes</td>
<td>The degree of formality and structure of the buying process</td>
<td>Low, high, or high centralized formality of buying process</td>
</tr>
<tr>
<td>Commercial approach</td>
<td>Traditional (so transactional) all relational attitude to business and supply chain</td>
<td>Relational or transactional</td>
</tr>
<tr>
<td>Technical support</td>
<td>The level of technical support required</td>
<td>Low – medium – high</td>
</tr>
<tr>
<td>Future orientation</td>
<td>Attitude and commitment to industry leading innovation and business growth as defined by R&amp;D, capital investment and new customer gain</td>
<td>Low – medium – high</td>
</tr>
</tbody>
</table>

*Source: Segmentation: Identification, intuition, and implementation [32]*

Companies should address the issues of market segmentation including standards of segmentation, duration of marketing strategy, and possible obstacles.

Palmer and Miller summarize the segmentation process shown as below [32].
Implementation of market segmentation has many obstacles. Among them the most basic and critical obstacle is the fact that customers may not be willing to cooperate with a company which tries to implement market segmentation [3]. Dibb and Simkin point out ‘infrastructure barriers’, ‘segmentation process issues’, and ‘implementation barriers’ as the three obstacles in implementing market segmentation [12].

By Dibb and Simkin’s own account, all market segmentation can be interrupted by infrastructure if it is not ready for process [12]. Infrastructure barriers consist of organizations’ structure, culture, resources or poor communication between people [16].

Sally Dibb provide several practical questions to identify process issues in their research, “The Market Segmentation: Strategies for Success.”[13] as given below:

- “Is there a process that I can follow?”
Dibb and Sirkin suggest that "some qualitative research has to be considered as a factor that contributes to segmentation success at the beginning of a segmentation project" [12].

When a company tries to implement market segmentation, it is not easy to change a company's business process. This change can evoke a lot of resistance within a company. This makes implementation of market segmentation very difficult. There are many issues related to finance and operations which interrupt implementation of market segmentation. Thus, the implementation of market segmentation needs a strong cooperation between every function within the company.
3.2 Service differentiation in logistics

3.2.1 Components of logistics service quality

Logistics capability has been a strong source of competitive edge in various marketing strategy used by many global companies. Many companies are aware of the importance of logistics capability within the company’s whole value chain.

Further, many companies begin to consider logistics as a key factor for success, and make efforts to equip advanced logistics systems.

Logistics as a method of customer segmentation has great potential. Literature which is closely related to our thesis includes the research; “Logistics Service Quality as a Segment-Customized Process.” by Mentzer, Flint, and Hult [29].

Mentzer, et al. point out that if every customer group expects different logistics services, it can be possible to provide differentiated logistics service to different customer segments thereby enabling a company to improve its efficiency. On the other hand, if all customers have similar needs for logistics services, a company can have an edge in by concentrating and reinforcing its existing logistics system with economy of scale.

Mentzer, et al. emphasize that it is very important to know whether different customer segments value logistics service differently to use logistics as a method of service...
differentiation. Then, to leverage logistics excellence as a competitive advantage to customers, a company should coordinate with all departments in the company.

According to Mentzer, et al. logistics service quality is concerned with nine concepts that include: “Personnel contact quality, Order release quantities, Information quality, Ordering procedures, Order accuracy, Order condition, Order quality, Order discrepancy handling, and Timeliness”.

These nine concepts can be summarized as below;

- “Personnel contact quality” means the guidance which is provided to a customer by the supplier’s logistics contact people. In practice, the people who contact customers are very important to maintain long lasting relationship with customers. Therefore, it is necessary for the contact people to know about the whole logistics process, to deal with unexpected problems, and to support their customer on logistics issues.

- “Order release quantities” mean “product availability”. Most customers want to get the right quantities when they need them. As we know, product availability has been believed as a key performance indicator of logistics performance.

- “Information quality” means customers’ awareness of the product information which is provided by a supplier. It is very important because this information is related to the customers decision making process. Thus, if a customer can get
correct information at the right time, the customer would be satisfied with the supplier.

• “Ordering procedures” is a measure of efficiency in ordering procedures. It is important that ordering procedures should be fast and easy to follow.

• “Order accuracy” means the right items and the right number of items should be shown in the order. Order accuracy has been a basic key factor of logistics performance.

• “Order condition” is related to the condition of the products delivered to the customers. If customers get damaged goods, customers will return the damaged goods and ask suppliers to ship other goods. This procedure would reduce customers’ satisfaction.

• “Order quality” means product quality. This includes the satisfaction of customers on the specific product.

• “Order discrepancy handling” includes suppliers’ capability in dealing with any problems during the order procedure. When a customer is aware of discrepancy in its orders and actual products it gets, the customer would need the supplier’s action to correct that discrepancy.
“Timeliness” is a measure of on-time delivery. In other words, “Timeliness” refers to length of lead-time between order issuing and order receiving.

Mentzer, et al. try to conceptualize these nine dimensions of logistics service quality in terms of a logical process. The framework is given in the figure below. First, it is broken down into “Order placement”, “Order Receipt”, and “Satisfaction”. Then the nine dimensions are put into each process. We can test customers’ reaction and satisfaction through the framework with the nine concepts. In this research, Mentzer, et al. suggest that the importance of focusing on developing services that address these nine components. Furthermore they insist that customer segments place their emphasis on different components of logistics service quality. However they also contend that there are strong similarities across segments, for example “personnel contact quality” is considered as a positive factor in all segments.
Mentzer, et al. suggest that “managers make their own assessments of the relative weight their customer segments place on each of the nine concepts. If results from their customer segments reveal similar relative emphasis, logistics services can be designed to address all these segments similarly, enabling suppliers to take advantage of scale efficiencies”[29]

3.2.2 **Logistics service expectation between customers and suppliers**

Partnerships are the critical factor in effective supply chain management. Thus, good relationships are the first step to build up a strong and effective supply chain. Further,
stable and solid relationships in supply chain can provide a competitive edge to the company since the company can act as an entry barrier against competitors using a strong partnership with its customer. This is why many companies are trying to make a tight relationship with their customers. However it is not easy for companies to understand whether their customers really value logistics services, and how to match their logistics service to customers’ expectations.

Predicting customer needs is getting more difficult. Many customers want to get diverse and enhanced services from their suppliers. The conventional logistics service indicators such as cycle time and on-time delivery are not the only considerations in customer satisfaction. Customers have started to ask for other logistics service such as “after-sales service, information handling and error correction” [11].

Among all considerations for matching the company’s logistics service to customers’ expectations, the most important is to align customers’ expectation with supplier’s capability in logistics services.

Davis and Mentzer[11] provide explanation of service expectation gap between customers and suppliers. They try to explain this service gap. This concept is shown in the figure below.
According to the research by Davis and Mentzer, the standard service is the service the customers desired to be provided. However, "customers are aware that this service is not always possible, so they also have a lower level expectation threshold that constitutes an adequate service, which is the service the customer will accept". With this insight, they conceptualize one very important term, "zone of tolerance". "Zone of tolerance" is the area between these two levels, representing the difference between service customers desire to get and the service customers actually get. Usually bigger customers expect more, and they receive more in some areas of logistics service and have narrow "zone of tolerance". Davis and Mentzer insist that in decision making about logistics services, managers should recognize that "standard logistics service may not be appropriate in some situations". Consequently, big customers may request a high level of logistics service to maintain a partnership with a supplier, on the other hand small customers may not request the same level of logistics service as big customers. Therefore, a company
should figure out this asymmetrical relationship based on the value of the customers, and then segment its customers by this relationship.
4 Company X Order fulfillment Process

Company X currently receives approximately 5,000 orders per day. They take orders mainly by three methods: EDI, fax, and phone. EDI orders account for 47% of total number of orders, and fax and phone orders account for 25% and 28%, respectively. Orders are taken by the customer service department until 8:00 P.M. In the main distribution center of Company X, around 200 pickers work to pick the products ordered.

A leading 3 PL is the main logistics service provider for company X. The sorting operations at the DC are conducted by the 3 PL representatives. Sorting typically happens between 2:00 P.M. and 9:00 P.M. The last shipment using trucks leave the main DC at 9:00 P.M.

4.1 EDI Ordering Process

The EDI Ordering Process is shown in Figure 4. When orders come through EDI, they are captured in the company’s IT system using an integration tool built between the ERP system and the EDI system. During the order process, the Customer Service department checks for any possible discrepancy such as customer information, order quantity and item number.
If any discrepancy is detected, the Customer Service department contacts the customer directly, adjusts the discrepancy and updates data on their system. Required documents, such as PO data, order confirmation and invoice, are generated and sent to customers electronically.

4.2 Fax Ordering Process

The Fax Ordering Process is shown in Figure 5. Orders through Fax are processed with an ERP system and a Fax Server. When a Fax order comes in, the Customer Service department inputs the order data into the system. If the data provided by the customer is not correct, the Customer Service department contacts customers by phone and resolves the problem. After resolving the data error, order confirmation is sent to customers. Picking lists are passed to the picking department. All orders that come in via fax are scanned and stored in the company’s database for easy retrieval when required.

4.3 Phone Ordering Process

The Phone Ordering Process is shown in Figure 6. Phone orders are taken in by the customer service representatives who key in the order in the ERP system when the customer calls. The customer is typically handed out an order number at the end of the call and also told about the date and time of shipment. In most cases the ERP system has the details of the contract that specify the shipment time agreed upon with the customer.
However if the system does not have this information, the agent checks with the customer what service he/she would like to have. The product is then shipped accordingly.
Figure 4 EDI Process Flow

Source: Company X
Figure 4 EDI Process Flow continued

Source: Company X
Figure 5 Fax Process Flow

Source: Company X
Figure 5 Fax Process Flow continued

Source: Company X
Figure 6 Phone Process Flow

Source: Company X
Figure 6 Phone Process Flow continued

Source: Company X
5 Sales Data Analysis

This chapter describes the analysis of the data that was given by company X. The objective of the analysis was to find patterns that could help us to segment the customer base.

5.1 Call Volume

We used the actual sales data from the company's Enterprise Resource Planning (ERP) system for our analysis. Data for the months of June'06 and October'06 was used as mentioned before. The objective behind using data for the two months was to mitigate any major trends or patterns that impact sales between midyear and year end and also between the beginning of the quarter and the end of a quarter.

As per the details given in the process mapping section, the customer service group within Company X acts as a front end where customers place orders. Customers have the option of ordering using multiple modes that include Electronic Data Interchange (EDI), E-mail, Fax, Telephone or postal mails. EDI is the most common method of placing orders. The customer service desk is handled by qualified agents who assist the customers in ordering the correct product. EDI and Fax orders are automatically taken into the ERP system. Only in case of a transmission failure, does the agent call up the
customer to get a clarification. For phone orders, the agent navigates through the ERP screen while taking the order and keeps giving information as asked for by the customer.

The following exhibits are representative samples that show the number of orders entered into the ERP system during the day for phone, EDI and fax orders. As can be seen from the figures, the orders start coming in early in the morning and continue throughout the day. In some cases, orders also come in very late in the night.

Figure 7 Call Volumes of Phone, EDI and Fax Orders
5.2 Order Intake Methods

EDI was the most common method of placing orders and it was observed that the number of EDI orders was slightly less than the combined total of fax and telephone orders.

Some key order statistics for the months of June and October, 06 are as given below:

- Total number of Orders received in June was 113,185 and October was 114,547
- Total number of order lines in June was 378,910 and October was 375,148
- Average number of lines per order is 3

The break up by order lines by method is as given in the table below.
Table 5 Statistics of Order Line Information

<table>
<thead>
<tr>
<th>Order Method</th>
<th>June</th>
<th>October</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDI Order Lines</td>
<td>165,265</td>
<td>172,897</td>
</tr>
<tr>
<td>Fax Order Lines</td>
<td>96,589</td>
<td>91,418</td>
</tr>
<tr>
<td>Telephone Order Lines</td>
<td>111,054</td>
<td>106,184</td>
</tr>
<tr>
<td>Other (E-Mail &amp; Mail Order Lines)</td>
<td>4,002</td>
<td>4,649</td>
</tr>
<tr>
<td><strong>Total Order Lines Received</strong></td>
<td>378,910</td>
<td>375,148</td>
</tr>
</tbody>
</table>

* An Order may have many Order lines

EDI orders constitute 43-45% of the total orders, Fax-22-23% and Tel-26-27% with the rest being other methods.

Figure 8 Percentage of Orders using various ordering methods

![Percentage of Orders Received](image)

For the purpose of our analysis we considered both primary service and secondary service 10.30am delivery as being equivalent and expensive. We kept the primary service and secondary service 8.00am next day delivery separate from this group as it is an
emergency service and used only in exceptional cases. They were put into the category of “Other Services”.

The data from the months of June and October showed that the customers have a clear preference in terms of the type of shipment mode used with around 70% of the orders shipped using the primary/secondary 10.30 AM service as shown in the figure below.

Figure 9 Percentage of Orders using primary versus other service modes

It was also observed that:

- Over 71% of all orders coming in via EDI were shipped out using the primary/secondary 10.30 AM service.
- When customers used fax as a mode of placing the order, 73-74% of the time the products were shipped out using the primary/secondary 10.30 AM
In contrast only around 57-58% of the time, an order coming in through phone was dispatched using the primary/secondary 10.30 service.

Figure 10 Percentage of orders shipped using the primary/secondary service

Within the different modes to taking orders, it appears that customers clearly have a distinct preference towards asking the primary/secondary 10.30 AM service when EDI and Fax as used for communicating. This could primarily be on account of the company having long term contracts with the customers or the systems used by the customers have this type of service being defined as a preferred mode of shipment for them.

5.3 Order Shipment Methods
Company X uses a number of different carriers to ship the products to the customers. These carriers are third party logistic providers who ship the products out to the customers. The primary service provider is the largest of all the carriers with whom Company X has a long term contract at negotiated prices. Prices are negotiated on the basis of the weight and dimensions of the package. Secondary services are used in case of emergency shipments or in some special cases. Each of these carriers provides a range of delivery services as given in the table below.

### Table 6 Different shipment methods used at Company X

<table>
<thead>
<tr>
<th>Type of Service</th>
<th>June</th>
<th>June Percent</th>
<th>October</th>
<th>October Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary next day 8:00am - Next day</td>
<td>403</td>
<td>0.36</td>
<td>438</td>
<td>0.36</td>
</tr>
<tr>
<td>Primary next day 10:30am - P1</td>
<td>76541</td>
<td>67.63</td>
<td>76935</td>
<td>68.92</td>
</tr>
<tr>
<td>Primary next day standard service - SOS</td>
<td>15676</td>
<td>13.85</td>
<td>15282</td>
<td>13.34</td>
</tr>
<tr>
<td>Primary SATURDAY next day delivery</td>
<td>219</td>
<td>0.19</td>
<td>146</td>
<td>0.13</td>
</tr>
<tr>
<td>Primary Economy, 2nd Day - EOS/BESTWAY</td>
<td>14840</td>
<td>13.11</td>
<td>14076</td>
<td>12.29</td>
</tr>
<tr>
<td>Primary Ground Service</td>
<td>1091</td>
<td>0.96</td>
<td>982</td>
<td>0.86</td>
</tr>
<tr>
<td>Secondary1 8am Next Day</td>
<td>220</td>
<td>0.19</td>
<td>210</td>
<td>0.18</td>
</tr>
<tr>
<td>Secondary1 10:30am Next Day</td>
<td>2069</td>
<td>1.83</td>
<td>2092</td>
<td>1.83</td>
</tr>
<tr>
<td>Secondary1 Noon 2nd Day</td>
<td>72</td>
<td>0.06</td>
<td>63</td>
<td>0.06</td>
</tr>
<tr>
<td>Secondary1 3rd Day</td>
<td>86</td>
<td>0.08</td>
<td>45</td>
<td>0.04</td>
</tr>
<tr>
<td>Secondary1 Saturday</td>
<td>4</td>
<td>0.00</td>
<td>3</td>
<td>0.00</td>
</tr>
<tr>
<td>Secondary1 3pm Next Day</td>
<td>8</td>
<td>0.01</td>
<td>3</td>
<td>0.00</td>
</tr>
<tr>
<td>Secondary 2 Airport stop</td>
<td>5</td>
<td>0.00</td>
<td>17</td>
<td>0.01</td>
</tr>
<tr>
<td>Already shipped</td>
<td>36</td>
<td>0.03</td>
<td>45</td>
<td>0.04</td>
</tr>
<tr>
<td>Secondary 3 Global</td>
<td>5</td>
<td>0.00</td>
<td>12</td>
<td>0.01</td>
</tr>
<tr>
<td>Secondary 4 Consolidated Freight Forwarder</td>
<td>1</td>
<td>0.00</td>
<td>1</td>
<td>0.00</td>
</tr>
<tr>
<td>Distn Cntr Pickup/Taxi/local/next flight</td>
<td>1898</td>
<td>1.68</td>
<td>2184</td>
<td>1.91</td>
</tr>
<tr>
<td>Freight Forwarder Service</td>
<td>1</td>
<td>0.00</td>
<td>0</td>
<td>0.00</td>
</tr>
<tr>
<td>Secondary 5</td>
<td>1</td>
<td>0.00</td>
<td>1</td>
<td>0.00</td>
</tr>
</tbody>
</table>

The above figure shows that over two thirds of the orders are shipped using the primary priority service. This is the most preferred service requested by the customers.
5.4 Analysis of Orders by Division

The figures given below show the order receipt pattern by division. As can be seen from the pie charts, Division F comprises well over 25% of all orders received.

Figure 11 Order percentages by Division

The table given below gives the correlation of the type of ordering method with the division. It can be clearly observed that the company shipped 98% of all orders received using fax in interventional cardiology and 83% of all orders in multi-division using the primary/secondary 10.30am. The percentages were 89% and 84% in case of the EDI orders for interventional cardiology and Multi-division, respectively. However for orders received using telephone, the percentages were lower with 79% of interventional
cardiology orders and 64% of all EP orders shipped using the primary/secondary 10.30 AM respectively.

Table 7 Orders shipped by primary/secondary 10.30 AM service by division

<table>
<thead>
<tr>
<th>Division</th>
<th>Total Fax Order</th>
<th>Fax Shipped 10:30am</th>
<th>Percent</th>
<th>Total Tel Order</th>
<th>Tel Shipped 10:30am</th>
<th>Percent</th>
<th>Total ED Order</th>
<th>EDI Shipped 10:30am</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Division A</td>
<td>5,659</td>
<td>4774</td>
<td>64</td>
<td>5,727</td>
<td>3,430</td>
<td>60</td>
<td>15,567</td>
<td>13,097</td>
<td>84</td>
</tr>
<tr>
<td>Division B</td>
<td>10,544</td>
<td>7066</td>
<td>67</td>
<td>16,455</td>
<td>7,120</td>
<td>43</td>
<td>15,255</td>
<td>10,980</td>
<td>70</td>
</tr>
<tr>
<td>Division C</td>
<td>1,317</td>
<td>839</td>
<td>64</td>
<td>1,262</td>
<td>803</td>
<td>64</td>
<td>2,626</td>
<td>1,610</td>
<td>61</td>
</tr>
<tr>
<td>Division D</td>
<td>2,731</td>
<td>1779</td>
<td>65</td>
<td>2,946</td>
<td>1,426</td>
<td>48</td>
<td>5,748</td>
<td>4,047</td>
<td>70</td>
</tr>
<tr>
<td>Division E</td>
<td>10,113</td>
<td>6971</td>
<td>69</td>
<td>12,826</td>
<td>7,133</td>
<td>56</td>
<td>17,707</td>
<td>11,831</td>
<td>67</td>
</tr>
<tr>
<td>Division F</td>
<td>14,900</td>
<td>14652</td>
<td>98</td>
<td>18,953</td>
<td>14,919</td>
<td>80</td>
<td>25,762</td>
<td>22,587</td>
<td>88</td>
</tr>
<tr>
<td>Division G</td>
<td>1,362</td>
<td>920</td>
<td>68</td>
<td>1,544</td>
<td>946</td>
<td>61</td>
<td>2,263</td>
<td>1,560</td>
<td>69</td>
</tr>
<tr>
<td>Division H</td>
<td>8,766</td>
<td>5632</td>
<td>64</td>
<td>11,991</td>
<td>5,359</td>
<td>45</td>
<td>13,341</td>
<td>9,140</td>
<td>69</td>
</tr>
</tbody>
</table>

5.5 Analysis of Orders by Division

When the correlation was studied between the ordering method used and the division, it was found that around 43-47% of the orders by dollar value received in June and October were in the interventional cardiology followed by 21-22% in Multi-division and 11% in Endoscopy.

As given in the table below, between 89-90% of all Interventional cardiology orders and 87% of multi-division orders were shipped using the primary/secondary 10.30 AM 10:30 am service.

Table 8 Percent of Orders shipped using primary/secondary 10:30AM in $
5.6 Analysis of Shipments by States and Region

For the purpose of the analysis the country was divided into four main regions. The following are the list of states in each region:


2) Midwest Includes- North Dakota, South Dakota, Minneapolis, Iowa, Wisconsin, Michigan, Ohio, Illinois, Indiana, Nebraska, Kansas and Missouri

3) South Includes- Texas, Oklahoma, Arkansas, Louisiana, Mississippi, Tennessee, Kentucky, Alabama, Georgia, Florida, South Carolina, North Carolina, Virginia, Delaware, Maryland, DC and West Virginia.
4) West Includes- Washington, Oregon, California, Nevada, Utah, Idaho, Montana, Wyoming, Colorado, Utah, Arizona and New Mexico

As shown in the figure below, a much higher proportion of shipments using the primary/secondary 10.30AM were to the mid-western and southern states. Also there was an increase in the percentage of the primary/secondary 10.30AM service in October over June.

Figure 12 Percentage of primary/secondary shipments by region

Some of the states that consistently received over 5000 shipments per month were California, Florida, Texas, New York, Illinois, Ohio and Pennsylvania. On analyzing further in terms of the states that had the highest number of shipments using the primary/secondary 10.30 am, it was found that certain states like Alabama, Arizona, Colorado, Florida, Kansas, Missouri, Ohio, Pennsylvania and Utah consistently ordered over 72% of all shipments using the priority service. Surprisingly not all of these were states that had highest numbers of total shipments going into them.
As an illustration we looked at Missouri, and found that well over 90% of all orders shipped into the state in Interventional cardiology and multi-division was using the primary/secondary priority service.
Table 9 Percentage of Orders shipped by states of the country

<table>
<thead>
<tr>
<th>State</th>
<th>Total primary/secondary 10.30 Shipments</th>
<th>Total Shipments</th>
<th>Percent of primary/secondary 10.30am Orders</th>
</tr>
</thead>
<tbody>
<tr>
<td>AK</td>
<td>227</td>
<td>352</td>
<td>64</td>
</tr>
<tr>
<td>AL</td>
<td>3217</td>
<td>4261</td>
<td>71</td>
</tr>
<tr>
<td>AR</td>
<td>1532</td>
<td>2226</td>
<td>71</td>
</tr>
<tr>
<td>AZ</td>
<td>3491</td>
<td>4598</td>
<td>64</td>
</tr>
<tr>
<td>CA</td>
<td>12526</td>
<td>19461</td>
<td>64</td>
</tr>
<tr>
<td>CO</td>
<td>2423</td>
<td>3219</td>
<td>63</td>
</tr>
<tr>
<td>CT</td>
<td>1822</td>
<td>2696</td>
<td>63</td>
</tr>
<tr>
<td>DC</td>
<td>3996</td>
<td>601</td>
<td>66</td>
</tr>
<tr>
<td>DE</td>
<td>254</td>
<td>519</td>
<td>49</td>
</tr>
<tr>
<td>FL</td>
<td>12081</td>
<td>16228</td>
<td>74</td>
</tr>
<tr>
<td>GA</td>
<td>3900</td>
<td>5636</td>
<td>69</td>
</tr>
<tr>
<td>HI</td>
<td>701</td>
<td>960</td>
<td>73</td>
</tr>
<tr>
<td>IA</td>
<td>1563</td>
<td>2584</td>
<td>60</td>
</tr>
<tr>
<td>ID</td>
<td>524</td>
<td>777</td>
<td>67</td>
</tr>
<tr>
<td>IL</td>
<td>7401</td>
<td>10399</td>
<td>71</td>
</tr>
<tr>
<td>IN</td>
<td>4454</td>
<td>6315</td>
<td>71</td>
</tr>
<tr>
<td>KS</td>
<td>1503</td>
<td>2011</td>
<td>73</td>
</tr>
<tr>
<td>KY</td>
<td>3172</td>
<td>4598</td>
<td>69</td>
</tr>
<tr>
<td>LA</td>
<td>3248</td>
<td>4475</td>
<td>73</td>
</tr>
<tr>
<td>MA</td>
<td>2951</td>
<td>4688</td>
<td>63</td>
</tr>
<tr>
<td>MD</td>
<td>2311</td>
<td>3196</td>
<td>72</td>
</tr>
<tr>
<td>ME</td>
<td>559</td>
<td>1105</td>
<td>51</td>
</tr>
<tr>
<td>MI</td>
<td>5450</td>
<td>7426</td>
<td>73</td>
</tr>
<tr>
<td>MN</td>
<td>2864</td>
<td>4092</td>
<td>70</td>
</tr>
<tr>
<td>MO</td>
<td>5120</td>
<td>6207</td>
<td>63</td>
</tr>
<tr>
<td>MS</td>
<td>1776</td>
<td>2446</td>
<td>73</td>
</tr>
<tr>
<td>MT</td>
<td>475</td>
<td>757</td>
<td>63</td>
</tr>
<tr>
<td>NC</td>
<td>4432</td>
<td>6342</td>
<td>70</td>
</tr>
<tr>
<td>ND</td>
<td>432</td>
<td>600</td>
<td>72</td>
</tr>
<tr>
<td>NE</td>
<td>1087</td>
<td>1580</td>
<td>69</td>
</tr>
<tr>
<td>NH</td>
<td>666</td>
<td>1227</td>
<td>54</td>
</tr>
<tr>
<td>NJ</td>
<td>4713</td>
<td>6566</td>
<td>72</td>
</tr>
<tr>
<td>NM</td>
<td>607</td>
<td>949</td>
<td>64</td>
</tr>
<tr>
<td>NV</td>
<td>949</td>
<td>1512</td>
<td>63</td>
</tr>
<tr>
<td>NY</td>
<td>7725</td>
<td>11914</td>
<td>65</td>
</tr>
<tr>
<td>NH</td>
<td>8154</td>
<td>10993</td>
<td>73</td>
</tr>
<tr>
<td>OK</td>
<td>1866</td>
<td>2563</td>
<td>73</td>
</tr>
<tr>
<td>OR</td>
<td>1461</td>
<td>2366</td>
<td>61</td>
</tr>
<tr>
<td>PA</td>
<td>9231</td>
<td>11979</td>
<td>73</td>
</tr>
<tr>
<td>RI</td>
<td>309</td>
<td>739</td>
<td>42</td>
</tr>
<tr>
<td>SC</td>
<td>2482</td>
<td>3464</td>
<td>72</td>
</tr>
<tr>
<td>SD</td>
<td>456</td>
<td>745</td>
<td>61</td>
</tr>
<tr>
<td>TN</td>
<td>5134</td>
<td>6999</td>
<td>73</td>
</tr>
<tr>
<td>TX</td>
<td>11159</td>
<td>16516</td>
<td>68</td>
</tr>
<tr>
<td>UT</td>
<td>1397</td>
<td>1688</td>
<td>66</td>
</tr>
<tr>
<td>VA</td>
<td>3633</td>
<td>5376</td>
<td>66</td>
</tr>
<tr>
<td>VT</td>
<td>192</td>
<td>336</td>
<td>57</td>
</tr>
<tr>
<td>WA</td>
<td>2437</td>
<td>3893</td>
<td>63</td>
</tr>
<tr>
<td>WI</td>
<td>3683</td>
<td>4879</td>
<td>73</td>
</tr>
<tr>
<td>WV</td>
<td>1349</td>
<td>2094</td>
<td>64</td>
</tr>
<tr>
<td>WY</td>
<td>192</td>
<td>352</td>
<td>56</td>
</tr>
</tbody>
</table>
Customers were analyzed into three main groups depending on the sales to them in the combined months of June and October. The following are some of the statistics we found.

- Of the total revenue of $567,235,921 for the two months, June contributed $293,443,924 and October $273,791,997.
- The top 187 customers contributed $187,222,444 (one third) in overall revenue for the two months.
- The next one third (461 customers) contributed $192,239,910 and the bottom one third (6586 customers) $187,773,567.
- The top one third of the customers constitute just under 3% of the total customer base, the next one third under 6%, and the bottom one third constitute over 90% of the total customers of Company X.
Figure 13 Percent of Revenues Vs Percent of Customers

Table 11 Orders from top one third of the customers

<table>
<thead>
<tr>
<th>Top One third Customers</th>
<th>Total Orders</th>
<th>Shipped primary/secondary 10.30 am</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDI Orders</td>
<td>25178</td>
<td>21008</td>
<td>83.4</td>
</tr>
<tr>
<td>Fax</td>
<td>7333</td>
<td>6292</td>
<td>85.8</td>
</tr>
<tr>
<td>Tel</td>
<td>9124</td>
<td>8880</td>
<td>75.4</td>
</tr>
</tbody>
</table>

- 79% of the orders shipped to the middle one third of the customers were shipped through the primary/secondary 10.30AM service for the two months.

Table 12 Orders from middle one third of the customers

<table>
<thead>
<tr>
<th>Middle One third Customers</th>
<th>Total Orders</th>
<th>Shipped primary/secondary 10.30 am</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDI Orders</td>
<td>23336</td>
<td>18706</td>
<td>80.2</td>
</tr>
<tr>
<td>Fax</td>
<td>13069</td>
<td>11315</td>
<td>86.6</td>
</tr>
<tr>
<td>Tel</td>
<td>11409</td>
<td>8047</td>
<td>70.5</td>
</tr>
</tbody>
</table>
A majority of the top one third of the customers was in the South and Midwest and tended to ask for the primary/secondary 10.30am priority service over 80% of the time.

Table 13 Location of top one third of the customers and the shipments

<table>
<thead>
<tr>
<th>Top one third customers</th>
<th>Total Shipments</th>
<th>Shipped primary/secondary 10.30am</th>
<th>Percent of shipments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Midwest</td>
<td>11768</td>
<td>9562</td>
<td>81.3</td>
</tr>
<tr>
<td>Northeast</td>
<td>10389</td>
<td>8078</td>
<td>77.8</td>
</tr>
<tr>
<td>South</td>
<td>16531</td>
<td>14131</td>
<td>85.4</td>
</tr>
<tr>
<td>West</td>
<td>3449</td>
<td>2596</td>
<td>75.3</td>
</tr>
</tbody>
</table>

Similarly most of the middle one third customers were also based out of the south and the Midwest.

Table 14 Location of middle one third of the customers and the shipments

<table>
<thead>
<tr>
<th>Middle One third customers</th>
<th>Total Shipments</th>
<th>Shipped primary/secondary 10.30am</th>
<th>Percent of shipments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Midwest</td>
<td>11891</td>
<td>9700</td>
<td>81.6</td>
</tr>
<tr>
<td>Northeast</td>
<td>8419</td>
<td>6571</td>
<td>79.0</td>
</tr>
<tr>
<td>South</td>
<td>17680</td>
<td>13904</td>
<td>78.6</td>
</tr>
<tr>
<td>West</td>
<td>9246</td>
<td>7237</td>
<td>78.3</td>
</tr>
</tbody>
</table>
6 Interviews With Company X Sales Personals

Interviews were conducted with the sales executives in order to get some perspectives from different divisions of Company X. Company X is organized around divisions and caters to the customer requirements within its group. The interviews broadly centered around 4 main questions:

a) How important was 10:30 A.M. delivery to their business

b) What kind of efforts can they make to reduce 10:30 A.M. delivery

c) What other services can they provide instead of 10:30 A.M. delivery

d) How do they segment their customers.

Division B

We were able to interview the Vice President of Sales for Division B. He believes that high service level and product quality are more important factors for their sales than 10:30 A.M. delivery. However, since medical devices industry is very competitive, it is also very important that their products should be at the customers’ site when their customers need it. He is of the opinion that the 10:30 A.M. delivery can be moved to a lower level delivery service like next day 3:00 P.M. service without serious problem. He
said that by working with the customers, it will be possible to make them accept a 3:00 P.M. delivery instead of 10:30 A.M. delivery. But he emphasized that emergency delivery is still important in a competitive business environment. He believes a segmentation policy based on sales volume of customers to be a good idea. This segmentation is applied with different pricing tiers to each customer. For example, a customer who buys 80% of products it needs from company X will be segmented as a priority customer and will receive free overnight priority shipment.

Division F

We interviewed the Senior Vice President of Sales from Division F. We began by asking him if it is possible to make his customer move from a high level delivery service to a lower level service. He thinks that it might not be possible. The main reasons are unpredictability and competitiveness in the market. For example, on any given day, the customers who use their products do not know what patients come in and what size of product they need to use. If, on any given day, more patients than expected come to their customers and all the customers need the same products, those products will easily go out of stock. To prevent this kind of event, their customer might need more inventory on their side. He agrees that some education processes can help them to make their customer accept changes in delivery service. In terms of segmentation, it seems that they consider frequency of ordering and density of population as possible segmentation methods. Consequently, the cardiovascular group has a very careful approach to changes in services.
From the interviews we can conclude that each group has different views about changes in service and customer segmentation. This difference is due to different market situations within their divisions. It is obvious that if a business has strong competitors in the market it is very difficult to change its service downward. Through the interviews, we feel do believe that it is possible to implement service changes in some parts of the company.
This chapter discusses some of the advantages of segmenting the customer base for Company X. It gives them several choices and discusses the potential savings expected from each.

The different methods of segmenting customers were given in chapter 3 before. It is proposed that Company X segment its customer group per the following criteria in order to develop programs that move different segments away from the next day 10.30 delivery

1) Segmentation by Division- The company produces products in interventional cardiology, endoscopy, peripheral intervention, neurovascular, urology and oncology. The savings expected if Company X were to adopt this policy for each division is given below. For example, if Company X stops sending out interventional cardiology orders using the priority service and sends it by the primary Next day service, it could have saved $162,416 in the process. The total savings for the two months could have been $494,080, almost two thirds of which are outside the IC division.
Table 15 Savings Matrix by adopting divisional segmentation ($)

<table>
<thead>
<tr>
<th>Division</th>
<th>June</th>
<th>October</th>
<th>Total Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Division A</td>
<td>32,412</td>
<td>33,846</td>
<td>66,258</td>
</tr>
<tr>
<td>Division B</td>
<td>37,995</td>
<td>40,554</td>
<td>78,549</td>
</tr>
<tr>
<td>Division C</td>
<td>4,668</td>
<td>5,377</td>
<td>10,065</td>
</tr>
<tr>
<td>Division D</td>
<td>11,479</td>
<td>11,087</td>
<td>22,566</td>
</tr>
<tr>
<td>Division E</td>
<td>40,318</td>
<td>40,349</td>
<td>80,667</td>
</tr>
<tr>
<td>Division F</td>
<td>80,549</td>
<td>81,867</td>
<td>162,416</td>
</tr>
<tr>
<td>Division G</td>
<td>5,131</td>
<td>5,635</td>
<td>10,766</td>
</tr>
<tr>
<td>Division H</td>
<td>30,916</td>
<td>31,877</td>
<td>62,793</td>
</tr>
<tr>
<td>Sum</td>
<td>212,572</td>
<td>218,715</td>
<td>431,287</td>
</tr>
</tbody>
</table>

2) Segmentation by Ordering method- Customers place orders with Company X using different means like EDI, Fax and Telephone. Customers can be segmented via their ordering method.

If Company X were to stop serving all its customers who placed orders using EDI, Fax or Tel, it could have saved $493,538 in June and October, 06 with slightly over half coming from phone and fax orders.

Table 16 Savings matrix by adopting Ordering method segmentation($)

<table>
<thead>
<tr>
<th></th>
<th>June</th>
<th>October</th>
<th>Total Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDI</td>
<td>110,663</td>
<td>121,990</td>
<td>232,653</td>
</tr>
<tr>
<td>Fax</td>
<td>66,548</td>
<td>65,033</td>
<td>131,581</td>
</tr>
<tr>
<td>Tel</td>
<td>65,944</td>
<td>63,350</td>
<td>129,294</td>
</tr>
<tr>
<td>Sum</td>
<td>243,155</td>
<td>250,373</td>
<td>493,528</td>
</tr>
</tbody>
</table>
3) Segmentation by Region- Customer can be divided by region to ascertain their ordering patterns. The country can be divided into 4 regions, Northeast, West, South and Midwest.

If Company X uses this method of segmentation, then it could have saved $553,232 during the two months. The maximum savings of $253,859 could come from the customers in the South.

Table 17 Savings Matrix by adopting segmentation by region

<table>
<thead>
<tr>
<th></th>
<th>June</th>
<th>October</th>
<th>Total Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Midwest</td>
<td>61,836</td>
<td>64,286</td>
<td>126,122</td>
</tr>
<tr>
<td>Northeast</td>
<td>43,120</td>
<td>44,479</td>
<td>87,599</td>
</tr>
<tr>
<td>South</td>
<td>98,611</td>
<td>155,248</td>
<td>253,859</td>
</tr>
<tr>
<td>West</td>
<td>42,572</td>
<td>43,101</td>
<td>85,673</td>
</tr>
<tr>
<td><strong>Sum</strong></td>
<td>246,139</td>
<td>307,114</td>
<td><strong>553,253</strong></td>
</tr>
</tbody>
</table>

4) Segmentation Type of Order- Another approach that is very common in the service parts business is the segregation of orders based on its type. Essentially orders are classified as emergency and stock orders. Emergency orders are placed for goods that are needed immediately and in their absence, there is a chance of significant loss. In contrast stock orders are typically replenishment orders and are placed to stock up the inventory of parts in anticipation of future use. Company X can think of segregating orders placed by customers using this scheme. They may set up different logistics polices around such types of orders. For example, the company can ship stock orders only free of cost to the customers, but may charge a price for emergency orders. Also for stock orders the company may try and
contract for a lower level of customer service like the Primary Ground service. This may also involve a change to the company’s ERP system where the order type would need to be stored.

In the analysis given below, we have estimated the net savings expected if the company decides to move all its non 10.30 am orders to the second day service @ $9 per order and moves its 10.30AM orders to the end of day next day service @ $10.73. As we can see, the company does have a huge potential to save significant amount of money if it can convince all its customers to adopt this service.

Table 18 Savings Matrix by adopting type of order segmentation($)

<table>
<thead>
<tr>
<th>Type Of Order</th>
<th>June</th>
<th>October</th>
<th>Total Estimated Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orders Other than 10.30</td>
<td>36,635</td>
<td>35,600</td>
<td>124,967</td>
</tr>
<tr>
<td>10.30 P1 Orders</td>
<td>76,541</td>
<td>78,935</td>
<td>483,530</td>
</tr>
<tr>
<td>Total Savings</td>
<td>350,619</td>
<td>114,535</td>
<td>608,497</td>
</tr>
</tbody>
</table>

5) Leverage Information Technology- The company currently uses ERP as its primary source for tracking sales and financial information. The company may think of setting up a terminal at each customer location wherein the customers could log in and place orders for themselves. It should be a web based application that will help the buyers to place orders directly with the company bypassing the need for an EDI, fax or a call center. This browser based application should be integrated with the company’s ERP system so that all orders are automatically recorded for transaction processing.
This thesis tries to address some of the concerns Company X has around the delivery options of its products. Our approach was to critically evaluate all aspects of the primary 10:30 AM service that the company provides to its customers and suggest changes. In doing so we went over current industry practices and reviewed the academic literature around this area. Our study led us to believe that it would be good for the company to not completely withdraw this service but offer it to customers selectively. In order to determine this selectivity, we undertook a customer segmentation study for Company X.

Customer segmentation is a topic that is widely dealt with in marketing where it is often also referred to as market segmentation. Various researchers have suggested different ways of looking at the profiles of the company’s customers. Demographic segmentation, Psychographic segmentation and segmentation by product benefits are some of the more commonly used strategies employed by companies. Researchers in logistics have used some of these strategies to suggest ways to segment customers based on the type of customer service that a company can provide. This choice often becomes very critical for companies who use logistics as a key competitive differentiator. Company X is one such company that believes that logistics provides a key source of competitive advantage.

During the early days of its product strategy, Company X designed a system that provided its customers free shipment options of its products using the primary 10:30 AM service.
However over time it became increasingly clear to the company that such an option was not economically viable and made very less business sense. But withdrawing this option now is challenging and hence the thesis was offered to us. Our analysis was based on segmenting the customer base into different categories to be served differentially. Since there is very little work that has been done in the area of customer segmentation in logistics for medical device companies, we had to build our analysis based on the information provided by the company. Some of the ways we felt that the company could look at segmenting the customer profile included segmentation by regions, segmentation by divisions and segmentation by the method of placing orders. We evaluated the savings the company can expect if they were to use some of the segmentation strategies suggested by us. Our study shows that the company can expect the best possible savings by offering this service to customer in only specific regions of the country. Apart from the likely savings, we have also suggested that the company should look at some other novel ways of looking at the customers. These include providing this service only for orders over and above a particular value, differentiating orders based on emergency and stock orders, and using information technology to better service the customers.

Given the highly lucrative savings potential, we believe that the company should actively pursue this case and design policies and practices to convince their customers to change their shipment options. However we do recognize that this would involve a significant shift that is bound to meet with resistance, both internally and externally. To implement any service changes, it is therefore advised that the company undertake a thorough cost benefit analysis to better understand the customer expectations.
Bibliography


