

Warehouse Location Strategy

How can organizations determine the ideal warehouse location strategy to optimize business results?

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WAREHOUSE LOCATION STRATEGY: HOW CAN ORGANIZATIONS DETERMINE
THE IDEAL WAREHOUSE LOCATION STRATEGY TO OPTIMIZE BUSINESS
RESULTS?

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OPTIMIZE BUSINESS RESULTS?

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OPTIMIZE BUSINESS RESULTS?

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Under the Supervision of Wendy Brooke

Statement of the Problem:

Many organizations face the problem of how to optimize their warehouses to fully support organizational objectives. Single-site versus multi-site warehousing strategies play a part in the overall business strategies of an organization, making it pertinent that organizations fully assess how each strategy impacts the bottom line.

Various factors impact the outcome of the discussion around warehouse location strategy. It can become a tedious process to sort through all the data to make an informed decision, but there are multiple aids that can be used to help ensure that the decision fully supports what the organization intends to accomplish.

Warehouses will continue to play a key role in the success of supply chains. Organizations should work towards creating a warehousing strategy that supports long-term objectives, while satisfying short-term customer demands. It can become a balancing act, but when balance between supply and demand is achieved, the organization will be one step closer to meeting objectives.

Methods and Procedures:

Research of journal articles, books, and other publications was the main procedure used to aid in writing this paper. A thorough analysis of each source in conjunction with previous educational courses helped to support ideas and theories that were presented in the paper.

Information about a company, SC, and its warehousing plans was also analyzed and included in the paper. SC is looking to expand its warehousing and distribution network, and data gathered in voice of customer surveys helped to support theories regarding how customer expectations are used to develop warehousing strategies.

Summary of Results:

In reviewing various publications, it is clear that developing warehousing location strategies can be highly complex. Organizations must be aware of what is needed from their warehouse(s) to achieve profitability and growth. When organizations lose track of what they hope to accomplish, the supply chain can become out of sync.

When warehouses are used effectively, they can help organizations provide superior customer service. Whether operating a single-site or a multi-site warehousing network, meeting customer demand should be a primary focus. If customer expectations are not met quickly, they will look elsewhere to get what they need.

Although there hasn't been extensive research conducted regarding cost and warehouse location together, it is clear that operating a warehouse or a network thereof is a costly investment for the organization. Proper location is key, but resources must be dedicated to the warehouse to ensure that inventory is managed properly and handled and stored correctly to avoid unnecessary costs.

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Introduction

Today, because of growing economic pressures, organizations are constantly looking into ways to cut costs. Management feels that one way to do that is to reevaluate its warehousing and distribution strategy, such as outsourcing warehousing activities or consolidating operations into smaller, regionalized facilities. Organizations feel that if they operate out of fewer large facilities or outsource their activities, they won't only save costs, but they may also find ways to serve the customer better. One company that has taken similar action is Ford Motor Company. They now operate out of one large facility that handles a majority of operations, but they have many smaller facilities that support regional demands. (Hickey, 2003)

However, the mindset within many organizations has slowly begun to shift. Organizations are now more conscious of how important warehouses can be, and management has begun to look elsewhere to cut costs. Karmaker & Saha (2015) point out that "a key driver of supply chain performance is the warehouse," and less (or even none) doesn't always mean more. While warehouses often do come with high costs, it is important to consider much more than just that when companies try to solve the age-old problem that many warehousing systems still face today: what is the proper number and geographic location of warehouses to minimize costs while maintaining an ideal level of customer service?

While organizations look into ways to cut costs, they still must make sure they are meeting the basic principle of marketing, which requires them to have the right product at the right price at the time and in the right quantities available for the customer. Ronald Ballou (2004) points out that "products and services have no value unless they are in the possession of the customer when (time) and where (place) they which to consume them." (pp. 13)

Globalization has added complexity to meeting customer demands, and the expanding

marketplace has forced organizations to focus even more on how they manage their supply chain, because each step in the process adds value for the customer. With many products being imported from throughout the world, lead-times are often extended. Warehouses, therefore, play an even bigger role in receiving products and holding them to help organizations get products to the customers in a timely manner.

Organizations also work to meet the basic marketing principle through effective supply chain management, which involves properly locating their warehouses to meet existing customer demands as well as to drive new demand. Some experts may even go as far as saying that location is everything, so it becomes vital to make sure warehouses are located to optimize business results by solving the business equation of minimizing “the cost of satisfying some set of demands (of the customer) with the respect to some set of constraints” (Farahari & Hekmatfar, 2009). The science of perfecting this equation is challenging, but it is gaining the attention of more and more companies, both large and small, as it has become an important part of their long-term strategic business objectives. The determination of warehouse location, as well as the number of warehouses within the network, can have a profound influence on operations within organizations, but if not planned correctly, it can also create a number of costly implications.

Many factors play into the decision about where to locate a company’s warehousing facilities, so it must be determined what is important to the organization before making any location decision, as well as any other decision affecting warehousing operations. It is pertinent to make a decision that generates revenue for the organization, but one that also helps to create growth while remaining true to strategic plans to achieve profitability over the long term. These factors may change over the years because objectives, rules, and regulations change, so the task

of locating warehouses continues to challenge organizational decision-makers due to the fact that future events tend to be extremely difficult to predict and plan for.

Because of the need for organizations to cut costs, especially in the supply chain, the trend has been towards operating out of one central warehouse instead of a few smaller ones; yet, there are is a trade-off that these organizations must consider. One central location may not be able to reach all customers in an expected service level time frame. On the other hand, while many smaller warehouses allow companies to better serve customers, process and system complexity and high initial capital investment often bog organizations down. Service goals vary from organization to organization, so it must be determined what is best for that specific organization and the best course needed to meet those goals.

Supply chain networks are very complex, but it is this complexity that brings a number of opportunities. (Harmon, 1003) When looking to expand their distribution and logistics network, organizations often turn towards their warehouses. Doing so gives them many options to consider, especially the location of the warehouse in proximity to the customers. Although the location of warehousing facilities can shape how the entire supply chain operates, it is also important to look at the size and number of facilities as well. Whatever decisions that organizations make, they must be carefully planned and aligned to business objects in order to drive profitability and make the investment worth it.

There are numerous opportunities that organizations can take advantage of in their supply chain operations, and proper management can prove to be very beneficial for organizations while creating value for the customers. While we, as consumers, do not want to wait for our goods or services, we also want products that will provide us with some sort of value, even if the cost is

higher. Warehousing is the step in the supply chain that has allowed organizations to help meet both of these demands by providing shortened lead-times and services that the direct supplier may not provide. Warehouses will continue to be an integral part of the supply chain long into the future, especially if they are located in areas that optimize business results.

Because warehouses are such a large capital investment for organizations, management must pay close attention and closely monitor them to confirm they are helping to meet the strategic and business objectives of the firm. It is important that the warehousing strategy is developed with the entire organization in mind because everything that happens within the warehouse has an impact on the operations in the rest of the departments throughout the organization.

What is a warehouse?

Discussing what organizations should consider when determining the proper location of their warehouse(s), it is important to understand exactly what a warehouse is. The basic definition that Price & Harrison (2015) give in their book *Warehouse Management & Inventory Control* is “that a warehouse is a place to receive, store, and issue inventory.” A more formal definition from the same book states that “a warehouse is a facility or an area within a facility in which an organization may receive, inspect, store, pick, pack, and ship any of a variety of materials needed for manufacturing, distribution, maintenance, and packaging within the organization.” (Price & Harrison, 2015, pp. 2)

The importance of supply chains continue to evolve warehouses into a core function within organizations. These value-adding facilities can greatly impact how successful organizations are, especially their extended supply chain. The activities that warehouses perform

often come from an understanding by management of what customer expectations are. These expectations continue to grow, so it will be up to the warehouse to be able to give customers exactly what they want in perfect working condition.

Warehouses vary in size from small rooms to huge distribution centers that receive and store a large quantity and variety of goods. No matter the size, a warehouse that operates efficiently within the supply chain can help create a competitive advantage for the organization. Additionally it is here that organizations often look to seize opportunities to improve and find better ways to reduce costs. Through continuous improvement efforts and the drive that many organizations have to be better than their competition, warehouses can help organizations become world-class industry leaders.

Within the walls of the warehouse is the single largest investment that most organizations make – inventory. Inventory includes everything from raw materials to work in progress to finished goods. It also includes the tools and equipment used to process the raw materials to their finished state, items often forgotten about. It is imperative that all of the inventory is properly managed to avoid high costs, especially through the repair of tools and equipment. Improper management of inventory is what, in the past, has given many management a negative view of warehouses and their purpose.

Inefficient warehousing systems are often hindered by the unnecessary task of double handling. This refers to “the practice of handling materials more times than necessary, primarily due to inefficiencies within the entire logistics management system.” (Price & Harrison, 2015, pp. 80) Materials that are brought into and shipped out of the warehouse should be touched and moved a minimal number of times in order to prevent damage and disruption to the product flow.

When material is handled multiple times, costs in the form of increased labor, fuel, and space are increased, and if processes are not managed and maintained to prevent double handling, material will soon be triple and quadruple-handled. If measurements are put in place to control redundant handling, costs are reduced and labor and space freed up. (Harrison, 2015)

The advantages and disadvantages that warehouses bring to organizations will be discussed next. Operating a warehouse or network thereof is a balancing act in which organizations must find a fulcrum that allows them to achieve the best of both. This isn't an easy task, as it can become a situation of give and take to find the balance. Management must be willing to sacrifice certain things in order to make the whole stronger. Successful organizations are those that take advantage of as many benefits as they can while minimizing the disadvantages as much as possible.

Advantages of Warehouses

With the help of technology, forecasting is becoming more accurate, but it will never be 100% correct, especially when working within a market that is highly seasonal or demand is volatile. It is almost impossible to plan for every event that has an impact on the demand of your products. Perfectly matching supply to demand requires some help, and that is where warehouses can help the organization. If items are not available for the customers, they will go elsewhere to get what they want, costing the organization money now and in the future. Inventory can be sent and stored at the warehouse to help create a buffer against the peaks and valleys and unpredicted demand that has a way of arising in the marketplace. Having the ability to deliver products when needed can provide differentiation and set your organization ahead of others in the marketplace.

“One of the most important trends (in warehousing) is the changing role of distributors as they move from being stock keepers and order fillers to single point-of-contact suppliers, providing both products and value-added services.” (Ross, 2004, pp. 576) Customers now rely on warehouses to provide much more than they previously had to, and heading into the future, the request for personalized services and tailored products will only increase. Warehouses will need to continue to tailor their services to meet and exceed specific customer demands if they are to drive profitability and revenue growth for the organization. By providing value-added services that are required by the customer, warehouses help to make products more marketable and create a competitive advantage for the organization.

Negotiations in regards to component pricing happen daily within organizations, and pricing is constantly looked at as an area that offers opportunity to save the organization money. Suppliers can often provide discounts based on the size of orders that are placed or amount of business that is done with them over a specified time period, and warehouses allow for organizations to achieve these cost savings. Without warehouses, there would not be space available to hold the additional inventory on-hand when large quantities of a specific material or product are purchased to receive the volume discounts suppliers offer.

Suppliers may also have minimum order quantities in place. It may not be cost effective for the supplier to run small batches of products, so larger quantities must be ordered at one time. Supplier minimum order quantities are not quite as painful when organizations have warehousing space available to store the material.

Another advantage that warehouses provide is a reduction in transportation costs, both for the organization and its customers. Because of the large selection of parts that are stored within

a warehouse, the warehouse becomes a consolidation point for customers. The customer can place an order for a large number of items using consolidated shipments versus shipping many smaller shipments. This results in a transportation cost savings. Organizations can also realize a reduction in transportation costs by placing larger orders with their suppliers. Fewer orders placed result in fewer freight charges. Organizations can do this because the warehouse provides space to store the larger quantities of products.

Disadvantages of Warehouses

While companies understand that warehouses can provide a buffer against the discontinuity of demand, many still feel they are a negative business function which can interrupt the flow of goods up and down the supply chain. Although their need within the supply chain continues to grow in importance, warehouses do pose some downfalls for organizations. (Ross, 2004) It is important to take these disadvantages into consideration when developing a warehousing strategy.

The main reason that companies invest heavily in operating and maintaining warehouses is to keep the customer happy. However, sometimes that investment is more than organizations are willing to commit to, which makes cost the biggest disadvantage of warehouses. Not only is it costly to run and maintain equipment, but the cost of holding inventory can reach excessive amounts, depending on the size and number of warehouses that are operational within the network. It becomes even more important for management to put the needed resources, creating more costs, in place to ensure the warehouse is properly managed, and that the customer is in fact, kept happy.

Cost is the obvious disadvantage of warehouses, as the inventory investment is one of the largest investment organizations will make, but there are various other reasons that some organizations are hesitant to invest large amounts of capital into opening and maintaining them. Warehouses are large operational systems that present a large number of safety hazards, both to the inventory in the warehouse and shipping yard and to the employees. This means that it is extremely important that warehouses are properly maintained and inventory correctly stored in order to keep everyone and everything safe. Without checks in place to ensure this is done, inventory could get damaged, material handling equipment may breakdown, and employees could be hurt, all of which cost the organization even more valuable time and money.

When all inventory is kept in one location, there is a risk that it may be lost all at once. Large threats to the functionality of a warehouse and those working inside of it are fire and a wide variety of other natural disasters that can strike at any time depending on the physical location in which the warehouse is located. It is up to the warehouse manager to ensure that the staff is properly trained how to react in case of a disaster. Whether preventable or not, fires and other disasters can destroy all inventory and equipment within the warehouse, creating a complete loss. If there is no inventory to meet customer demand, there will be no customers. They will go elsewhere to get what they need, preventing the organization from meeting its strategic goals in terms of revenue.

A third disadvantages of warehouses is deterioration. Eventually, at some point in time, inventory will deteriorate. It will not perform as it is expected to, and it will not be able to be sold to the customer. This inventory will need to be disposed of, many times it may be thrown away or scrapped, resulting in a loss for the organization. Disposal and loss of sales are not the only additional costs that an organization can face when items deteriorate. Additional

administrative and operational costs are incurred when new items need to be ordered and brought back into inventory to replace the old inventory. Deterioration of inventory cannot be prevented, but it can be slowed through proper storage and handling. (Price & Harrison, 2015) That should be part of the standard processes that are taught to all employees of the warehouse.

Obsolescence is another potential disadvantage of stocking items within a warehouse. While material planners work closely with other departments throughout the organization to ensure that what they bring into the warehouse is what the customers want, they are not always correct. Trends change, and products that were thought to sell may sit on the shelves for extended periods of time. Eventually, items may no longer be used continue to sit on the shelves taking up valuable space. Again, these items may be scrapped, creating additional costs for the organization.

Proper ordering, handling, and rotation of inventory is important to help ensure inventory is used in a timely manner and items are shipped to the customer as quickly as possible. Most items stored within warehouses should be date-coded, which can help warehouse managers plan accordingly to avoid deterioration and obsolescence. To help create awareness, it is important for the warehouse management team to have documentation and training sessions in place, so all employees are aware of the appropriate way to handle and store the inventory that passes through their hands. These training sessions may also be used help prevent injuries that could have easily been avoidable. While inventory is important, people are even more so, and keeping them safe is as vital to the organization as the inventory itself. (Price & Harrison, 2015)

Warehouse Location Strategies

Since the downturn in the economy, many organizations have taken a hard look at their long-term strategic plans to determine ways that profits can still be achieved. One way to achieve profitability and growth is to properly utilize warehouses. Warehouses have become such a huge part of the organizational plans to generate revenue, it is important that strategies developed to support the distribution network are properly planned and executed. The strategic development involves determining the ideal number and best location of warehouses that will allow the firm to best serve the organization's customers.

While location is important, an organization must first fully understand what its warehouse is intended to do and in what timeframe. Some location strategies cover a single period or span over multiple years, but it is all dependent on the organization's business plans. If an organization loses track of its fundamental purpose, its distribution strategy starts getting pulled in multiple directions. It soon becomes out of sync, and it does not meet the demands it was designed around. A first step in the organization's distribution network makeover should be determining how many facilities are needed, but equally important is determining what regions they will serve.

Determining the location, number, and size of warehouses is a fundamental issue many organizations still struggle with today. There is no "one size fits all" solution, so a lot of time, effort, and resources are put in to any decision that is made. Many questions must be addressed, and only after making sure the answers lead to a result that closely aligns with the firm's strategic objectives can organizations implement a successful warehousing network. However, no matter the size or location, each warehouse must be considered as a separate, integral part of the value-added, customer-driven supply chain and planned as such. (Ross, 2004)

Andrew Ruffler (2008) points out that the product that companies are trying to sell does not matter. However, what is important is “the physical location of a company’s warehouse and logistics facility.” Direct, faster access to key markets, as well as potential new customers, may be just what organizations need to have a profound impact on the overall success of their supply chain. Some firms think that high levels of service and customer satisfaction can be achieved through the use of a single, centralized warehouse while other organizations feel that smaller regionalized warehouses are the answer. No matter the decision, the warehouse location needs to maintain the targeted customer service levels and cost objectives. (Harrington, 2007) Because the service level targets and cost objectives differ in every organization, it is important that each strategy is tailored towards the individual objectives.

Inventory is the single largest investment that most organizations make, it becomes critical that organizations properly place it to optimize business results. Little research has been conducted combining inventory costs and warehouse location together, but they have a profound impact on each other. (Drezner, Scott, & Song, 2003) Organizations cannot have one without the other, so warehouses that are strategically located and have properly managed inventory help drive success.

Ideal location goes well beyond the exact physical location. Many other factors and criterion must be used and evaluated before any decision is made. These factors vary greatly from company to company. In order to gain a competitive advantage against other industry members, management must know exactly what will affect the long-term business plans and success of the organization.

Location is important because location is what organizations use to get their products closer to its customers. Location has a profound impact on lead-time, which is a key driver in any business. As a society that is growing more and more impatient, proper warehousing strategy development is even more important. Proper location warehouses can greatly reduce lead-times (Harrington, 2007), which are becoming greatly impacted by increased global competition. Organizations must properly utilize their network of warehouses to prevent the extended lead-times from hindering products from getting into the hands of their customers.

Lead-time plays a role in the decision of facility location, but equally important is cost. Many models have been developed and utilized to aid in making a decision that meets service and lead-time objectives while minimizing costs. “The choice of a warehouse (or channel of warehouses) will affect every aspect of a firm’s financial well-being: fixed assets, cost of labor, materials and services, size of marketplace available, customer service and pricing, transportation requirements, supply chain efficiencies, and customer perception of the company.” (Ross, 2004, pp 578) Determining the ideal strategy becomes somewhat of a puzzle. You have to make all the pieces fit in order to get the product from the warehouse to the end customer the fastest, beating the competition, reducing the travel time, and minimizing the overall costs.

Cost and lead-time considerations cannot be the sole determinants when designing the ideal warehousing network. A warehouse cannot be fully operational without employees, so warehouse location is also greatly influenced by quality of life factors, such as community and education, as well as all the organizational driven factors. When an organization decides to locate its warehouse, there must be community support. If the community is not supportive, they may challenge every move that is made by the warehouse, making it difficult to conduct business on a day-to-day basis.

Often times, criteria used in determining ideal location conflict with each other. It is important to evaluate these trade-offs when making any decision, as each choice may lead to a different outcome (Karmaker & Saha, 2015). When trying to decide ideal warehouse location, judgement can come into play. Organizations may not know how to put a quantitative measurement on judgement calls, but it is pertinent to ensure that they, as well as subjective opinions, are backed with facts and not allowed to sway the outcome of the decisions without proof. (Ballou, 2004) Judgement, when used alone, may influence management to pursue a path that is not fully supportive of the organizational goals, setting the warehouse up for failure.

Driving Factors

An organization's warehousing and distribution network should strive to find a balance between supply and demand. This is not an easy task, as demand is constantly changing. An efficient strategy is one that accounts for a number of factors, which is a necessity in order to develop an optimized network. However, the two biggest factors that come into play are labor and transportation and the costs associated with each.

Distribution centers tend to be in locations in which logistics and labor are plentiful. These regions tend to be located just outside the major hubs. (Trunick, 2006), and knowing the land and labor markets will help organizations make an informed decision that will be more successful than decisions that are made solely on organizational characteristics. Understanding the market also helps organizations choose a location that is supported by the community and the customers that they serve.

Labor

As previously stated, when developing a warehousing strategy and locating one's facilities, it is important to make sure there is a capable workforce. Whether an organization operates out of a single facility or multiple sites, people are often an overlooked element of an organization's warehousing strategy. Everyone within the warehouse contributes to meeting customer service levels in some way, shape, or form. An employee may not work directly with the customer, but those involved in receiving, put-away, picking, packing, shipping, or any other number of functions have a hand in how quickly product gets into the hands of the customer.

Not only does one need to ensure there is an adequate supply of labor, but as supply chains continue to evolve, the workforce will also need to be educated and skilled. All supply chain jobs, including those within the warehouse, continue to increase in complexity, and the jobs are no longer strictly manual labor. Employees need to fully understand how their job impacts the profitability of the organization and how to use advanced technological tools that aid in supply chain efficiency. Employees are now also being exposed to continuous improvement efforts, so they must be ready and comfortable coming up with solutions to problems and inefficient processes. By giving employees the training and means to be successful, they are able to perform their job more effectively as well as be more receptive to changes that are put in place to make the organization more successful as a whole.

Transportation

A major customer service objective is on-time shipping and delivery. This makes accessibility to logistics providers and solid logistics infrastructure a must-have. Without the means to access third-party logistics providers or highway and airway transportation systems

quickly, products will never get to the customer in the required time frame. Traffic patterns also have an impact on warehousing strategies. Major markets are often larger cities, which have high volumes of traffic. While one wants their distribution center to be near major markets and customers, traffic is not an advantage of doing so. It is for this reason, that many warehouse and logistic hubs are located on the outskirts of major cities.

When utilizing logistic networks now and in the future, it will be more beneficial to minimize transportation costs by locating warehousing facilities in close proximity to key markets as opposed to trying to optimize long-distance transportation methods. American consumers are tired of paying for products that travel across the country, or even the world, so organizations are trying to minimize transportation costs by utilizing suppliers that are within the same region as the warehouse. Long routes from suppliers to the warehouse raise the overall price of products, which is often times passed on to the end customer. To avoid these costs, Harmon (1993) suggests to use clusters of suppliers near the warehouse.

Customers

The objective of a warehouse or distribution network is a simple one and is the same as all other departments within the organization. Warehouses must “provide a service valued by customers at a minimum cost and at a service level that meets or exceeds customers’ expectations.” (Price & Harrison, 2015, pp. 227) This involves consistently getting the right products to the customer at the right time and within his or her cost requirement. This is important because customers are the key driver of the organization’s warehousing strategy.

Customers are a main focus of many organizations, and if they aren’t, they should be. They play a major part in the organizations warehouse strategy and location decision; however,

if customers are spread over a large distance, it becomes difficult to maximize service while minimizing costs. Wherever an organization decides to locate its warehouse or network of warehouses, the customer and the service the organization provides to them should be a major part of the conversation.

The term customer is rather vague, and it can mean something different depending upon whom you are talking to. Regardless, it is important to meet their demands consistently in order for the organization to achieve profitability and growth. The warehouse's customers may either be internal or external to the organization, and while warehouses and distribution centers do supply parts directly to the end consumer, it must be noted that they may also have a number of internal organizational customers as well.

An example of this would be a company working in the service parts industry. While its distribution center supplies service parts directly to the final customer, a majority of its customers are company-owned parts centers located throughout the country or world. These stores purchase parts from the DC to put stock on their own shelves, which they then turn around and sell to their customers, which are external to the organization.

While a customer is a customer, sometimes the warehouse needs to have service policies in place for both external and internal customers. It is possible to have policies in place that sufficiently meet external customer demands while failing to meet internal customer requirements, or vice versa. If an organization is striving to be superior to its competition, it must have policies in place that adequately address both types of demands.

Within the warehouse, service levels are set to help make sure customer demands are met. However, "as activity levels are increased to meet higher customer service levels, costs

increase at an increasing rate.” (Ballou, 2004, pp. 109) There is a point on the continuum in which profits are maximized, and it is this service level that the warehouse strives to achieve. Organizations need to be careful that they don't cross that point and service starts to become a constraint.

It is difficult to determine the proper levels to effectively measure customer service because of the number of dimensions and activities that impact it, but organizations need to do their due diligence. Customer service helps to maintain customer patronage, resulting in them remaining loyal. A majority of a firm's business comes from existing customers, so it is important to ensure their expectations are being met. It is expensive for organizations to lose current customer and try to develop relationships with new ones.

Supply Base

Another major component of an organization's warehousing and distribution strategy is its supply base. A complete and thorough analysis should be done of all suppliers that are used and whether or not they are meeting expectations. If not, the time when the organization is looking into revamping or expanding the distribution network is the perfect opportunity to find new, quality suppliers, possibly within close proximity to the new warehousing locations.

One way to ensure that suppliers are meeting expectations is to have a vendor compliance program in place. To determine quality suppliers, performance must be measured through compliance programs to ensure that specifications are being met. Time and money are wasted when rework has to be done if the incorrect parts are received or parts arrived damaged or packaged incorrectly. If there is no compliance program in place, suppliers will not be held accountable for their errors, which means nothing is preventing them from repeat offenses in the

future. As we head into the future, one in which customers will not wait for products and services, organizations will not be able to afford late or incorrect shipment after late or incorrect shipment from their suppliers.

It will take a collaborative effort from all parties within the warehouse to make a vendor compliance program work. While it is often the procurement group that works directly with the suppliers, they rely on the distribution center staff to relay any non-compliant shipment or quality issues to them. Two-way communication must happen at every step within the supply chain to ensure issues are raised to the correct level, and problems are corrected to prevent the same error from happening time and time again.

A concept that is becoming more popular is the use of vendor managed inventory (VMI) programs. VMI allows for the supplier to manage the product inventory levels within the distribution center. This requires a high level of visibility and shared communication between the two, but VMI enables the supplier to monitor demand patterns and inventory levels to forecast and set delivery schedules. (Price & Harrison, 2015) Vendor managed inventory helps to keep stocking levels where they need to be to meet demands, but the inventory holding costs are reduced for the organization because the supplier still owns the inventory. In vendor managed inventory programs vendors do not get paid until the inventory is picked. It gives them incentive to make sure the inventory is there and is of high quality.

Single vs. Multi-Site Warehouse Strategies

In regards to actual physical location of an organization warehouse or network of warehouses, “a problem commonly faced in the management of distribution systems is that of determining a set of geographical warehouse locations such that demand is satisfied and a

satisfactory level of customer service is maintained with a minimum total distribution cost over a relatively long planning period with varying levels of demand over the period.” (Sweeney & Tatham, 1976, pp. 748) One could say that location means everything. The location of the warehouse has an impact on the overall success of the supply chain. It is important that organizations locate their warehouses to best meet organization objectives because “how one chooses a site should depend on what the warehouse or distribution center will do for the company.” (Hickey, 2003).

There are many different types of location strategies that organizations can utilize, but two contemporary ones that are often used are single facility location, in which the organizational operations are out of one “central” warehouse, or multi-site, where there are multiple warehousing sites, each facility has its own set of demand requirements. What makes designing and implementing either strategy so complex is the fact that demand is never fixed. It is almost impossible to correctly predict demand to 100% accuracy, so when determining the ideal location for a central warehouse or network of warehouses, many factors must be taken into consideration. As mentioned previously, the main factor is cost and placing the facility in a location that minimizes transportation and fixed facility costs, whether that is at one location or multiple locations.

Many books and articles have been written about facility location. Although these publications have been used to help guide organizations, a nagging question for many organizations continues to be single location versus multiple-site strategy. Many organizations choose to operate out of a centralized warehouse, and while this can help organizations realize a cost savings of up to 50% over regionalized warehouses, customer service levels and numerous other factors must be considered. (Tompkins Publications, 2009) To help make this

determination, organizations need to stick to the strategic operating plan regarding how fast they want products in the hands of their consumers.

Single-Site Facility Location

The organization must stay true to its stated objectives when determining a single-site location. The ideal location may differ greatly depending on metrics and criteria that it uses during the decision making process, but when discussing and determining the site of a single warehousing facility within the supply chain, it is desirable to select a location that minimizes the distance between the warehouse and the majority of the organization's customers. If customers are located throughout the entire country, this becomes a difficult task for the organization. Locating warehouses in a position that allows the organization to shorten the average time to the customers helps them remain competitive in a marketplace that is saturated with competitors, both domestically and internationally.

While a single-facility location problem may be looked at as one of the simplest of location problems to solve, it still presents challenges to organizations. Many factors impact and influence the location decisions, and it is up to the organization to determine what is important to them. An easy tool used to aid in determining location is the 5-Step Location Scoring Method. While it is subjective, it is an easy and cost effective approach to determine the ideal facility location. This method involves five steps, as stated in Figure 1.1 below.

Step 1: List all the factors that are important and have an impact on the location decision.

Step 2: Assign an appropriate weight (typically between 0 and 1) to each factor based on the relative importance of each.

Step 3: Assign a score (typically between 0 and 100) to each location with respect to each factor identified in step 1.

Step 4: Compute the weighted score for each factor and each location by

multiplying its weight by the corresponding score.

Step 5: Compute the sum of the weighted scores for each location and choose a location based on these scores.

Figure 1.1: The 5-Step Location Scoring Method

Source: Farahani, R.Z. & Hekmatfar, M. (2009) Facility Location: Concepts, Models, Algorithms & Case Studies. New York, NY: Springer-Verlag Berlin Heidelberg.

Step 5 states to make a decision based on the subjective analysis of the weighted scores; however, it is important that the organization justifies these scores with quantitative measures. Organizations do not always know how to quantify subjective decisions, but in doing so, they will have a solution that will more closely align with what they are hoping to accomplish with the use of the warehouse.

It sometimes does not make sense to make location decisions based strictly on qualitative or quantitative factors, or a hybrid thereof. Sometimes a third set of factors, known as critical factors, have the biggest influence on warehouse location decisions. (Farahani & Hekmatfar, 2009) Critical factors are those that will determine if a location will be chosen for further consideration or not in the location decision process. While a factor may be a combination of two different classifications, Farahani & Hekmatfar (2009) state that at least one factor in every facility location decision is a critical factor.

The 5-Step Location Scoring Method is quick method that can be used to determine warehouse location, but numerous other mathematical approaches have been developed to aid in solving single facility location problems, such as center-of-gravity. The degree of difficulty and speed in computing solutions these methods varies, but computer applications and technology can be used to fine the optimal solution faster. However, management must know that basing a solution strictly on the output of a computer program may not always be what is best. These

models cannot incorporate all required organizational features, and while they do provide meaningful solutions, they also will also have some shortcomings. This does not mean that the output from computer applications will not be meaningful, but they should be used as more of a guideline for management. (Ballou, 2004)

Multi-Site Facility Location

A single facility warehousing strategy can become inadequate in meeting customer expectations, but a whole new level of complexity is placed on the organization when they decide to open additional warehouses. The decision to operate out of multiple sites is a strategic one, with hopes to better serve customers in predetermined regions. The challenge for the organization comes through sorting through the enormous number of possible configurations that may be developed with determining the best possibilities for new locations.

“Facility location problems locate a set of facilities (resources) to minimize the cost of satisfying some set of demands (of the customers) with respect to some set of constraints.” (Farahani & Hekmatfar, 2009, pp.1) It may be more cost-effective for certain organizations to operate out of a single location, but it is difficult to meet all customer demands from one facility. Multiple sites allow organizations to tailor services and provide a specific mix of products to certain regions, depending on their distinct needs.

Multiple site warehousing strategies require data to be transferred between locations. It is imperative that each site is connected, in real-time, to the others. Many negative consequences affect the network performance when communication doesn't happen between facilities, and without taking into account how the events at one location can impact the operations at the

others, true network optimization will never be achieved. Excess inventory or stock outs, poor supplier performance, and service failures are just a few of the potential network failures.

As mentioned above, excess inventory is a pitfall of multiple warehouse locations, and it is a problem that can get out of control quickly if inventory is not managed correctly. This excess inventory usually sits in the safety stock levels at each location, and thus goes against the objective organizations hope to achieve with a multi-site strategy. “The objective of multi-echelon inventory management is to deliver the desired end customer service levels at minimum network inventory, with the inventory divided among the various echelons.” (Lee, 2003, pp. 2)

When multiple tiers are added to the distribution strategy, system and inventory management complexity increases. Planners not only have to worry about planning and managing inventory at one location, but they are responsible for the inventory at all locations owned by the firm. The organization no longer has just one distribution center that is replenished to meet customer demands, there are multiple sites that need to be stocked appropriately. To determine appropriate stocking levels, organizations need to start by addressing some common planning questions. Ronald H. Ballou (2004) points out that a few of these questions to be as follows:

1. How many warehouses should there be in the supply chain network? How large should they be, and where should they be located?
2. Which demand points should be assigned to a warehouse? Which warehouses should be assigned to each plant, vendor, or port?
3. Which products should be stocked in each warehouse? Which products should be shipped directly from plants, vendors, or ports to customers?

As with single warehouse location problems, many statistical aids have been developed to help organizations make decisions about multi-site location problems. The various multi-site location models provide managers assistance when looking to expand their distribution network to help drive results. These models are inexpensive to apply and the data needed to run these models is easily accessible, making them an attractive resource for management. (Ballou, 2004) Output can be used to provide support to any decision that is made regarding multiple facility location problems.

Procurement

Inventory planning in multiple sites vs. single site warehousing strategies will change significantly. More warehouses not only add complexity to systems requirements, but they also add complexity in regards to the procurement function within the organization. The procurement group are responsible for properly planning SKUs and stocking levels at each location, and when organizations operate out of multiple warehouses, it is important for all the SKUs to be properly managed at each individually warehouse location. Customers in different regions may require and/or need a different set of SKUS than another. For additional warehouses to be truly effective, the proper product mix must be determined and deployed at each location.

Another change between strategies is around ordering frequency. Material planners are not just purchasing materials for one location anymore. They are purchasing for multiple sites, resulting in an increase in the ordering frequency. Quantity requirements may also be different at each location. These requirements make it even more challenging for planners to correctly manage orders while minimizing transactional costs. An increase in the number of orders means and increase in the number of shipments, leading to higher transportation costs.

Finally, material planners will need to be more cognizant of supplier lead-times and the transit time needed to move products to the warehouses. The transit times may vary depending on the proximity of the warehouse to the supplier. If these times are not properly added to the items lead-times, warehouses may experience a shortage, delaying products from getting to the customer.

The number of sites in a distribution network is not important. What is important are the many factors that must be considered when trying to determine the ideal location of the organization's warehouse(s). A few determinate factors include proximity of the warehouse to markets and customers, as well as access to transportation and labor resources. Another important factor that should be evaluated in great depth is the supply base.

When redesigning the network, firms may find that it is a perfect time to also reevaluate their current suppliers or find a new supply base. Opportunities may exist to find new, quality suppliers who offer the same products at a lower price, or suppliers that can be used to replace current suppliers who tend to be non-compliant shipment after shipment. Looking into other options is worth pursuing, especially if these new suppliers are closer to the distribution centers. When the supply base is located closer to the DC, transportation costs are reduced, and these cost savings can be passed on to the customer.

Additional Warehouse Options

When determining to expand the warehouse and distribution network, an additional decision must be made: to lease, buy, or build the warehousing space. Each option has its own set of benefits and pitfalls. No matter the path chosen, management must be aware of what

products are to be stored within the warehouse, and the facility must have the capabilities to store and handle the products that are to be housed there.

Lease: Leasing provides organizations with the space needed to support the expanding warehousing network, but it also provides them the opportunity to find a more suitable location after a specified period of time if the current facility is not working as expected. Locations may be limited to where warehouse space is available, and prime real estate may be expensive to rent.

Buy: Buying warehousing space provides organizations with the opportunity to renovate the facility with what is needed to meet the organization's specific objectives. However, these renovations can be expensive, especially new technology and equipment that may be needed to be installed within the facility in order to support organizational requirements. The number of warehouses that are available to purchase may be limited, and again, real estate may be expensive.

Build: When building a new warehouse, organizations have the opportunity to design and build a facility to its exact specifications, which may help meet organizational goals and customer needs. As with leasing, the opportunity to build may be limited, as there may not be space available to build in the determined ideal location. Also, building and implementing state of the art facilities with the latest and greatest technology and equipment is a large capital investment.

In summary, warehouse location and the strategies used to manage these locations can be thought of to be one of the most important strategic planning decisions that organizations can make in regards to its supply chain. Proper location selection has an impact on all other aspects of the warehousing strategy, from inventory levels to transportation costs, to customer service

levels. This decision is difficult for management to make on their own, so a number of aids are available to help make an optimal solution to single-site or multi-site location decisions as well as whether or not leasing, buying, or building is the best course to take.

SC Case Study

Background

The Subject Company (SC) is a world leader in HVAC heating and cooling solutions. While they are best known for their residential and commercial products, a very successful part of their organization is their service parts business. In order to aid in having the right parts in the right place at the right time, SC operates a distribution center out of Southwestern Tennessee. This large facility is one in which service parts are stored for a short period of time before being shipped to customers, most often the SC retail stores located throughout the United States and Canada. While the DC is not centrally located in the United States, it is a hub for many logistics providers, which made it an appealing location for a distribution center. Access to logistics providers allows for shipments to get out the door and on their way to the customers quickly.

While SC does hold a large share of the HVAC heating and cooling systems market, the executive management team wants and expects much more from all members of the organization, especially within the service parts business. Management wants to achieve high levels of growth, both in revenue and market share. During a value stream analysis (VSA) that was done at the beginning of the 2015, it was determined that availability was the key performance indicator that will help them to do just that. The role of the distribution center would play a huge part in meeting availability goals. After the value stream work was completed, a considerable amount of research and studies were conducted in order to determine

the best way(s) to improve availability. If organizations do not have the right parts available, customers will look elsewhere for them and growth they are aiming for will never be achieved.

After the VSA, the management team determined the first place to start was the retail part store locations. It was made clear by the management team that while whole organic growth was expected within the current stores, growth in the form of new stores was also to be realized. Management enacted a stretch goal of 10 percent organic growth, and this would be attained by revamping or relocating existing parts stores to better set them up and position them to meet customer expectations and hopefully, take market share. The marketing team developed a new footprint that helped create a consistent layout and design for the remodeled or newly opened stores, making it easier for customers to find what they are looking for regardless of which parts store they went to.

Additionally, new stores would need to be opened to aid in reaching revenue and growth objectives. Traditionally, opening new stores took anywhere from 18-24 months, but with a new streamlined process, that was developed by the marketing team, this process was reduced to nine months. Opening stores faster has helped to get parts into the hands of customers faster. Consistency is key. These new stores had the same layout that many of the existing parts stores were updated to. This was a very exciting time for the retail teams, culminating with 14 new stores were opened in 2015. Management plans an additional 27 new stores to be opened to help realize an additional \$23 million in revenue.

Management had committed to improving availability this year and the years to come. The distribution planning team would need to take actions to guarantee these targets would be met. The first step was to make sure safety stock levels had been closely evaluated to ensure that the items were adequately stocked and available when customers would need them. In some cases additional parts were brought into the warehouse. The increased inventory dollar

investment was approved by management, but the distribution team still must ensure there will be space available to stock products at the higher levels.

Problem Statement

As mentioned above, warehouses are facilities that often ship the products they store to one business, but distribution centers on the other hand ship the products they store to multiple locations within a specified region (Price & Harrison, 2015). Some organizations operate out of regional facilities that serve particular areas, but in SC's case, their centralized distribution center serves the entire country. This has sparked quite a debate among management. Some think that SC needs to expand their distribution network to better serve their customers that are not located within close proximity of the distribution center in southwest Tennessee.

From the distribution center, the customers on the east coast receive their products much faster than the customers located on the west coast. In order to drive an increase in availability of parts at all stores, management is not only looking at whether or not the DC is the proper location to serve all markets, but also whether or not additional distribution centers need to be added to the network. Additional DCs would add costs and complexity to the entire system, but it may be what needs to be done to achieve the desired growth.

If SC plans to keep pace with the current rate of growth and go forward with opening the intended number of new stores throughout the United States and Canada, it must take a step back and reevaluate its distribution support system holistically. At the current rate of expansion, the distribution center will not be able to support the demand and meet customer expectations. The sheer volume of SKUs that are stocked in the 625,000 square foot facility has filled the space quickly, which has created a space concern for management. Reserve storage is at full capacity

much of the time, and the DC management team has also resorted to storing some of the larger items in trailers in the yard. Ideally, facilities want to operate at about 85% capacity to allow for smoother flow of goods throughout the facility and easier accessibility to all products. (Forte Industries, n.d.)

Another issue at the southwest Tennessee is labor resources. Many times additional shifts, usually over the weekends, are required from employees to support the DC's value-added services (VAS) department as well as shipping and receiving. The volume of orders that are moved through each of those departments make it difficult for the current staff to keep up with demand. These issues, coupled with the organization's plans for future growth, has forced management to reevaluate its long-term operational plans and warehousing strategy.

Solution

From voice of the customer surveys, it was determined that the key priorities for SC's customers are availability and lead-time, but they are closely followed by price and delivery expectations. With delivery expectations rising in importance, management is exploring the possibility of opening additional distribution centers to better serve all customers, internally and externally, by offering better availability, lower costs (predominately transportation), and faster delivery. In a service parts market that does not have a clear industry leader in availability, speed of delivery to the customer, and best lead-times, SC management feels this is the proper business strategy to pursue in order to secure additional market share and differentiate themselves as a premier service organization.

Management knows additional operational capacity and space is needed to obtain market share in these categories. This increase in capacity can come in the form of an expansion, a new,

bigger facility, or additional warehouses added to the network. However, SC cannot just assume that their need for additional capacity means they have to pursue one of these three options.

There are other options as well. Another path would be to thoroughly evaluate all item parameters to determine if the correct parts are being stocked within the distribution center, or process improvements can be made to help with capacity constraints. While most of these solutions work great for short-term gains, steps towards a long-term solution must be taken soon because it is not certain how long the current DC and associated resources can support the current and anticipated demand.

Research has been initiated to determine the best course of action to sustain long-term business results, and it has been determined that in SC's case, adding additional warehouses is the solution to best meet organizational objectives. However, determining the proper number of distribution centers to add to the network is not all SC has to decide upon; if SC pursues adding additional capacity through distribution centers, they must also determine where to locate them. There are various ways to determine ideal location, but the decision should be based on the best way to serve the customer. A major reason that organizations invest large amounts of capital into their warehousing and distribution networks is to meet their customer service goals. As shown in figure 1.2, Ronald H. Ballou (2004) points out in his logistics planning triangle that the organization's inventory, transportation, and location strategies are all designed based on its customer service goals.

The Logistics Planning Triangle



Figure 1.2: The planning Triangle in Relation to the Principle Activities of Logistics/Supply Chain Management

Source: Ballou, R.H. (2004) *Business Logistics/Supply Chain Management* (5th ed.). Upper Saddle River, NJ: Pearson Education.

Understanding the customer and his or her needs should always be a priority when any organization is designing the ideal warehousing network. It is imperative that the right questions are asked in order to determine what those needs are, so time and money are not wasted pursuing an incorrect and non-beneficial path. (Harrington, 2007) This is exactly what SC did during the initial stages of exploring the possibility of expanding their warehousing network. Through voice of customer surveys, the management team and the designers were able to identify what SC's customers expected, as well as the opportunities that are available to gain additional market share. By focusing on a healthy mix of both what they do well and improving upon areas that offer numerous opportunities, SC can emerge as an industry leader.

It is still early in the project, so an actual plan to solve its distribution problems has not been made. Management has taken steps towards opening an additional one to three warehouses, but no official decisions have been made regarding their locations. It will be important, though, to remember that although the DC in Memphis has been a successful part of the organization, all involved in the project must not simply take the policies and procedures that are being done there

and copy them within the new distribution centers. Mimicking what is done in one location will not ensure success at another, but SC cannot lose focus on the areas that has made them successful in the first place. In order to do that, SC will need to standardize its processes and determine what its best practices are. While one cannot take what is done at one warehouse and move it to another, a best practices program does help to understand core competencies that can be leveraged at all locations. (Harps, 2005)

Analysis

Distribution centers help to make supply chains more effective, which is what SC is hoping to accomplish by expanding into new locations. “The strategic placement of DCs allows the position of products and services to be close to major markets and customers (the economic principle of place utility).” (Ecklund, 2010) Moving the source closer to the customer not only reduces costs, but it also helps to shorten the delivery time, often with lower inventories (Drezner, Scott, & Song, 2003) This will give SC the advantage over its competitors that management has wanted since looking to expand its distribution network.

With new parts supply stores opening throughout the United States and Canada, the availability of parts becomes even more critical. More stores help to drive results by having the service parts closer to the customer in efforts to meet expected delivery times and customer expectations. This means that the stores, new and old, must be properly stocked. Currently, this is done through replenishment from SC’s service parts distribution center; however, with only one distribution center, it makes it difficult to deliver upon the lead-time expectations at all stores.

Additional distribution centers can help to provide an optimized network and logistics design that can better prepare itself to meet customer demands. This optimized network will allow SC to adapt more quickly and adequately to its internal and external environments in order to create a competitive advantage. Developing this competitive advantage in a marketplace that does not have a leader is what SC is hoping to accomplish. Karmaker and Saha (2015) state that when “encountering an ever-changing competitive and quickly changing environment, companies (are) required to reorganize their supply chain management strategy to harmonize with external environments by integrating the organizational resources, data, and activities so as to maintain a competitive advantage.” (Lange et al., 2009) In order to achieve this, SC will remain flexible to changing demand, especially with their high cyclical business.

Adaptability and flexibility are characteristics that separate successful warehousing organizations from those that have to close their doors. When designing the perfect warehousing network, the ability to change and keep pace with unpredicted events is a must. (Tompkins Publications, 2009) Customers are more willing to work with organizations that have the ability to get their orders to them on time, and a flexible distribution network will help organizations to do just that.

Additional warehouses add complexity to any distribution network, but in today’s world, technology is available to help organizations share information quickly. When expanding SC’s distribution network, the key to success will be the ability to share real-time information throughout the supply chain. Per the journal article from Tompkins Publications (2009), information systems of today must be real-time, paperless, and standardized. Real-time information allows for customers to see the exact status of their orders, or warehouse personnel to know the current inventory levels at each location. Paperless systems help to minimize errors

that are bound to happen within any manual process, as well as maintain accurate records for an extended period of times, while standardization allows the organization to access industry-tailored software that provides more system capabilities.

Conclusion

SC is going to need the ability to compete in the “NOW” marketplace that the economy is progressing towards. This becomes more important as the marketplace continues to grow and the number of competitors increases. There will be plenty of options for customers to get what they need, and if SC does not have the ability to supply products almost instantaneously, they will lose that business, but potential future business as well. Therefore, SC must have the correct distribution strategy in place, and they must have their facilities properly stocked to support the new fast-paced environment.

Perhaps one of the most important decisions an organization can make, particularly a service organization, is the actual, physical location of its warehouse(s). Management within the organization must determine what markets they hope to serve and what level of service they want to provide. As companies develop their strategies to compete in the world economy, they will need to rely on warehouses to shorten lead-times and provide customers with the products that they need in the desired time frame.

Because of the growing importance and need for warehouses, organizations (SC included) have begun to look at “warehousing” as a core business function, one that is called upon to give the customers exactly what they want and to achieve results. (Price & Harrison, 2005) Many organizations focus their business strategies on sales and marketing as the way to drive revenue, but as companies move into the future, Ross (2004) points out, “the sheer size of

the asset and operational investment necessary to run warehousing functions requires firms to closely define the strategic role of warehousing in the organization as well.” (pp. 550) No strategy can be developed in a vacuum and without consideration of other business functions. Therefore, it is important to make sure that SC’s warehousing strategy is closely aligned with its other business strategies to ensure all are working together to drive bottom line results.

Best-in-Class

Best-in-Class organizations that have mastered the art of managing a network of warehouses have figured out what needs to be done to provide high levels of customer service while minimizing costs. (Aberdeen Group, 2007) This is not an easy feat to master, and many organizations still have not figured out how to achieve Best-in-Class status. The management team at SC would confirm it is not as easy as it may seem.. As much as they want to achieve Best-in-Class status, they are nowhere close to being there yet.

SC previously operated out of a warehouse in Southaven, Mississippi, eight miles from their current location in Memphis, Tennessee. The Southaven facility was outdated and no longer able to meet the objectives of the organization, so SC decided to lease new warehousing space in Memphis. Within the four walls of the new facility, they installed state of the art equipment, including high-tech conveyance mechanisms, voice-pick technology, and a full suite of Oracle software. The idea behind this investment was to help SC become a Best-in-Class service parts provider, as well as help them to support the growth planned for the next 10 years.

However, shortly after moving to the new facility in Memphis, the organization started to see metrics trending in the wrong direction. They were experiencing a backlog in the value-

added services departments, which often times delayed shipments to customers, a lag in the shipping orders out of the distribution center, again delaying products from getting to the customer, and inaccuracy in the data, most often due to human error. Along with higher costs and lower levels of service, these problems left management with a new urgency. If they didn't correct the problems within the distribution center, they were going to lose customers, which would result in lost profits.

SC needed to come up with a plan that steered them back to the Best-in-Class track. "Companies that are best in class share certain attributes. One of the common denominators is the effective use of learning and change as a route to improvement." (Vitasek & Manrodt, 2006) Realizing they needed to create an environment of learning and employee empowerment, SC started to deploy the use of MDI (managing for daily improvement) boards in each department within the warehouse.

These boards display key performance metrics, and the department's performance level for the day against the metric. If the department did not meet the standard, the entire group discussed solutions to improve performance. These MDI boards were not met to point fingers, but instead to make processes better. If a solution or process improvement is developed within one functional department, it may also be leveraged in other departments to improve their processes as well.

Performance Metrics

A final step towards getting a warehouse to a Best-in-Class status is detailing a set of performance metrics to ensure that the organization is working towards meeting objectives. Variances in demand can come from a number of events, such as rush shipments, equipment

capacities, or special requests, but having performance measurements in place equips organizations with the means to plan against these disruptions in activities in the warehouses.

To measure performance, metrics must have three important things, as pointed out by David Frederick Ross in his book *Distribution Planning and Control* (2004):

1. Clear, concise standards that are to be achieved that are used to monitor day-to-day activities in the warehouse. These standards are also used as a tool to initiate continuous improvement, making the warehouse better.

2. The entire organization relies on the warehouse to get products to the customers. By measuring performance, management has the capabilities to pinpoint activities that are not performing to the standard, enabling them respond more quickly when issues arise.

3. Also, with the ability to pinpoint problems, corrective steps can be taken immediately and preventive measures can be put in place to ensure that they do not happen again in the future.

When variances from the standard are recorded and analyzed, the results can be used to make improvements. However, when improvements are made and/or standards are changed, they must be communicated. Management cannot make a change to how operations are performed and not let the employees know, as they are the ones performing the work. Proper communication and training needs to be conducted, so everyone is on the same page as to how the work is to now be performed. Without this communication and adherence to the new standard, the change will never become permanent.

It is important to communicate metrics, not only so all employees have a common understanding, but also so all employees know why the metrics exist, as well as why it is important to adhere to them. When performance metrics are clear and easy to understand,

employees are more likely to realize what their role is in achieving them. It also becomes important that the metrics are consistent. Yes, there will be changes through continuous improvement efforts, but when metrics are constantly changing, they lose their integrity. Employees will start to stray from the standards and resort to old habits because they feel the new processes have no meaning.

However, companies should not use performance metrics as a way to punish employees. This is a fundamental principle that management should follow within the warehouse. Employees are the ones performing activities, so it is important that they are supportive of the metrics, not rebellious. If metrics are used as punishment, employees begin to only report data that is favorable for them. This will skew the data, hiding issues and hindering improvements.

In order to meet stated objectives, it is important to measure performance. Without having base measurements to benchmark against, the distribution center will never know how well it is actually performing. “Fundamental to achieving and sustaining (these) objectives is measuring performance.” (Ecklund, 2010) However, customer requirements are constantly changing, so it is important that organizations continually reevaluate these measurements to ensure they continue to drive bottom line business results.

Benchmarking

Continuous improvement efforts that organizations use to make changes to internal processes are very beneficial, no matter if the change is large or small, but how do organizations know that the change they make is helping to improve processes and meet objectives? This is where benchmarking becomes important. It is vital to know what the baseline measurements are

to provide a starting point, therefore, when organizations reorganize their supply chains, they know if the new processes are improving.

Officially, benchmarking is “the process of improving performance by continuously identifying, understanding, and adapting outstanding practices and processes found inside and outside the organization.” The article by Vitasek & Monrodt states (2006) that “benchmarking [seeks] to improve any given business process by exploiting “best practices” rather than merely measuring best performance... Studying best practices provides the greatest opportunity for gaining a strategic, operation, and financial advantage.” (pp.2) Benchmarking has recently gained popularity, and today it is given top priority within organizations because of the benefits it can provide.

Benchmarking can be classified two different ways. Performance (quantitative) benchmarking measures the organization’s performance and then compares it to outside companies, while process (qualitative) benchmarking takes a look at the organization’s processes and then finds ways to improve them. When organizations use process benchmarking, they are searching for ways to reach a higher level of performance internally. The two forms of benchmarking can be used together to give the organization even more guidance on how to improve and provide superior service.

An important aspect of benchmarking is the standard of comparison that is used to measure performance. This standard may either be external or internal to the organization. When looking at an external standard of comparison, industry leaders are used, which can be an individual organization or a group of leaders. Setting internal standards for benchmarking forces

the organization to look closely at itself to determine what its best practices are. These can then be leveraged throughout the rest of the organization. (Vitasek & Manrodt, 2006)

External benchmarking may also include measuring the organization's performance against customer expectations. This is often a good place to start the benchmarking process because customers are the key drivers within any organization. Sometimes it comes as a shock to learn that the organization is failing to provide customer satisfaction, especially when management feels that they are doing a good job meeting demands. It becomes important to understand exactly what the customers want and if the organization's performance is meeting and exceeding those expectations.

Benchmarking helps create a culture among employees that encourages continuous improvement and innovation, but it sometimes becomes a challenge to implement best practices and maintain the standard to drive improved performance. Benchmarking will not be beneficial if it does not identify areas for improvement, and the company can execute the changes needed to achieve a higher level of performance. Getting buy-in to and participation in the benchmarking process from all employees, especially senior management, is key to its success within the organization.

The importance of benchmarking has gotten a lot of recognition and has even become a major requirement of quality awards such as the Malcolm Baldrige Quality Award. (Vitasek & Manrodt, 2006) Benchmarking and best in class practices separate quality and superior performing companies from those that will get lost in the competitive marketplace.

Warehouses of the Future

Operations

Organizations have already started to feel the heat of the expanding global marketplace. The pressure from competitors worldwide will only continue to grow, so organizations must be willing to change their business strategies, including their warehousing and distribution strategies, to accommodate this growing trend. If they cannot adapt and become a global competitor, the organization will never be successful.

Globalization has forced warehouses to undergo a fundamental change that is pulling them away from their long-standing role of proving a buffer against unpredicted fluctuations in demand. They are becoming much more than a room that is used to store product, and heading into the future, warehouses will offer a wide variety of value-added services that open doors to additional opportunities. Technology and better management practices within the warehouse, such as lean and just-in-time, are aiding to turn these opportunities into revenue.

Ross (2004) states that “a warehouse strategy cannot be developed in a vacuum, but can only have meaning in relation to and support of the strategies of the firm’s other business functions.” (pp. 552-553). Technological advancements have aided in forging alliances between these business functions. Real time vision up and down the supply chain creates a strong network in which all partners are in congruence, and therefore have the ability to align strategic goals. Collaboration is key in creating fully integrated, successful supply chains. Technology not only helps to create the needed visibility of products throughout the supply chain, but it also helps to free labor resources. Automation within the warehouse is a large initial investment, but over the long-term, it can help save the organization money. Because people are not required to

continuously monitor, report, expedite, etc... activities within the warehouse, they can focus on other activities that add value to the organization.

There are a wide array of planning and control methods that are used to manage inventory correctly. In a time where lean ideology is predominant within manufacturing organizations, one control that is put into place within the walls of the warehouse is just-in-time inventory management. Just-in-time, or JIT, essentially means zero inventory.

While the just-in-time philosophy can help to dramatically lower inventory costs and encourage continuous improvement initiatives, many feel that it cannot be used within service parts organizations that rely on warehouses and distribution centers to supply parts to customers as quickly as possible. David Frederick Ross (2014) points out that inventory is only a small part of the overall JIT philosophy, and to date, JIT has become more of a business management approach that focuses on the elimination of wastes. Again, that does not necessarily mean strictly the reduction of inventory, but as all wastes are removed and the flow throughout the supply chain is improved, less inventory may be needed to complete the same tasks as before.

Finally, just-in-time management practices help organizations focus on those activities that provide value, not only for a specific department, but also for the entire organization. "JIT attempts to solve this problem by providing an approach to inventory management that not only shrinks wastes in the form of excess lead-times, channel stocks, and related distribution costs, but also provides for the establishment of increasingly agile and flexible supply chains capable of achieving dramatically higher levels of customer service than the competition." (Ross, 2004, pp. 336) In essence, this means that by keeping the correct levels of inventory in warehouses as a buffer against unpredicted and unplanned variations in demand, organizations utilize JIT to

create a competitive advantage. Organizations do not need to always treat warehouses and inventory as a waste, but rather as an instrument that can be used to help get products to the customer before their competition.

The growing popularity of e-commerce will also change how warehouses of the future operate. E-commerce allows consumers to search and order products any time of the day. They have the ability to determine how quickly they will get the product and what price they are willing to pay to get it, due to the large number of merchants available in the marketplace. “Warehouses, especially distribution centers, must now design or re-examine their picking, packing, and distribution methods to accommodate for more complex omni-channel distribution in the future.” (Price & Harrison, 2015)

Environment

In the future, organizations cannot focus solely on improvements that will impact their warehouse and the operations within its four walls. They must also take the environment into consideration and ways they can conduct business that will not cause harm. Organizations are becoming more “green” and are developing solutions to reduce costs, such as investing in high efficiency machines and equipment, as well as taking advantage of abatement and incentive programs offered by energy providers. It is important that firms are fully aware of energy cost implications involved in any distribution network, particularly organizations that are looking to expand. Not enough weight is given to energy costs when making decisions, especially since operational costs can be extremely high.

Going green has become more common as it continues to gain traction throughout the world. Warehouses, with the amount of energy consumed and equipment used during daily

operations, will continue to be under scrutiny. Warehouses of the future will need to find ways to reduce wastes that affect the environment and air quality. Some warehouses have already implemented greener technology in day-to-day activities. Electric vehicles have been utilized within the walls of the warehouse, and high efficiency equipment has been installed. Both cases are capital intensive investments initially, but often show profitable return on investment.

Government

Warehouses of tomorrow are also going to be affected by increasing governmental involvement. New rules and regulations are being imposed and enforced on shipments made around the world. Acts, or at least the threat, of terrorism have forced the government to put added security measures in place, which can cause delays in shipping and receiving goods. The warehouse then becomes an even more integral part of the supply chain, as it becomes a buffer against trade disruptions.

When determining new warehousing locations, it is important that the organization stays true to its ethics. This means taking all the city and state rules and regulations into account. For example, if a company does not want to force its employees into joining a union, they must look for locations in states that have right-to-work laws that prevent such events from happening. (Hickey, 2003) Rules and regulations can vary state to state, which makes managing multiple locations even more complex, but each facility must be managed according to state laws.

Information Technology

“Information is truly the lifeblood of efficient and effective warehouse management.” (Price & Harrison, 2015, pp. 217). No matter the location of the organization’s warehouse or network of warehouses, the information regarding what is happening within the warehouse’s

four walls must be visible, accurate, and easily communicated to all members of the supply chain. Without information, the warehouse will not be able to support its day-to-day operations, let alone help support organizational growth.

Information technology is quickly changing supply chains, and every part of the supply chain involves some form of information technology. Price & Harrison (2015) define information as “data that has been received and understood by the recipient of the message.” (pp. 216) Information is one of the most crucial components of the decision-making process, and the decisions that are made are only as good as the information used to make them. If there is garbage coming in, there will be garbage heading out.

When making decisions regarding the physical location of warehouses and distribution centers, information about customer demands, local laws and regulations, and the type of inventory held at each location are pertinent. This information is important to make proper decisions and to ensure that the correct parts are in the correct place at the correct time. With the help of information technology and systems, this information can flow quickly back and forth between all members of the distribution network, not only DC to DC all also the individual departments within each DC.

The marketing principle of the right goods in the right place at the right time must be balanced with the costs associated with holding that inventory. Safety stock is an important inventory investment that is used to help prevent item shortages, but too much can be detrimental to the organization. Information systems can be used to help ensure the correct information is readily available to make proper decisions regarding stocking levels at each warehousing location based on inventory on-hand and in the pipeline. Urgency in today’s marketplace and

need to satisfy customer demands as quickly as possible has made inventory visibility a crucial part of any warehousing strategy. Visibility and communication are key to help prevent shortages, as well as overstocking each facility, both of which cost the organization money.

Conclusion

“In today’s world, the selection of warehouse location has become one of the most imperative and strategic decisions in the optimization of logistic systems.” (Karmarket & Saha, 2015) It’s location is a power decision that can make or break organizations because warehouses house the largest investment that an organization will make, inventory. While warehouse locations problems can be quite complex, it is imperative that the organization get it right. Organizations cannot just deploy short-term solutions that influence how their warehouses operate, they must make location decisions that are carefully evaluated, reevaluated, and made based on their compatibility with long-term business plans.

When designing a warehousing network, it is important for the organization to leverage its own strengths, but it is also essential that they are aware of information regarding its competitors. By making informed decisions, organizations can provide higher levels of customer service, as well as gain insight about what is required of them to gain market share. When information is properly analyzed, warehouses are more likely to be run effectively, and there should no question as to whether or not they are creating benefits for the organization and its customers. It is up to management to ensure this success and have the proper tools in place to monitor progress towards meeting objectives.

A lot research is put into developing the location strategy for an organization because “proper decision paves the way for inclusive growth and ultimate profit of a company.”

(Karmaker & Saha, 2015, pp. 331) SC has put considerable time and research into developing their warehousing in order to improve availability, which in turn will drive growth and profitability. Availability will help SC to meet their customer service targets, and a proper warehousing strategy will help SC ensure that the right products at the right time will be available for the customer.

Although they are often thought of as a business within a business and growth and profits are key success indicators, organizations cannot only be concerned with those indicators when developing their strategies. The benefits warehouses provide should also work to help the organization achieve its overall customer service objectives. It is these objectives that often help give the organization the competitive advantage they are after, within a shorter time-frame, giving them a higher rate of customer satisfaction.

In depth research has been conducted and sophisticated models have been developed to help organizations solve their warehouse location issues. However, many of these models are static in nature and do not account for demand and cost pattern shifts over time. (Ballou, 2004) Demand is always changing, and as hard as organizations try, they will never be able to predict future demand with 100% certainty. This can make a solution that works today suboptimal in the future. It makes it even more important for management, as stated above, to align their warehousing and distribution strategy with the long-term strategic goals and objectives of the organization. Warehouses can help protect organizations against spikes in demand in the short-term, but organizations need to be careful how they plan their long-term warehousing strategy if they intend to continuously meet the objectives throughout the entire planning horizon.

Warehouses continue to evolve, and will need to find ways to be more efficient as supply chains become more important in the future. Automation and innovation will play key roles as warehouses lay new foundations in order fulfillment that will be needed to get the products to customers as quickly as possible. E-commerce and a growing global economy are driving changes in the way warehouses conduct business, and as the economy continues to recover from a recession, many automation and growth initiatives that were put on hold are being revisited. While companies want to realize growth, they have multiple strategies to choose from to achieve growth. No two strategies are the same, but an organization's warehousing and distribution strategy will become a large part of the solution.

References:

- 11 Key Questions When Adding a Distribution Center. (n.d.). Retrieved April 18, 2016, from [http://www.fortna.com/whitepapers/Article_11 Key Questions Adding DC_FINAL_EN.pdf](http://www.fortna.com/whitepapers/Article_11_Key_Questions_Adding_DC_FINAL_EN.pdf)
- 15 Key Factors That Impact Your Distribution Network ... (n.d.). Retrieved April 18, 2016, from <https://www.siam.org/journals/plagiary/tompkins.pdf>
- Ballou, R. H. (2004). *Business Logistics/Supply Chain Management* (5th ed.). Upper Saddle River, NJ: Pearson Education.
- Drezner, Z., Scott, C., & Song, J. (2003). The central warehouse location problem revisited. *IMA Journal of Management Mathematics*, 14, 321-336.
- Ecklund, D. K. (2010, October 15). Warehousing Efficiency and Effectiveness in the Supply Chain Process. *Supply Chain Management Review*.
doi:http://www.scmr.com/article/warehousing_efficiency_and_effectiveness_in_the_supply_chain_process
- Farahani, R. Z., & Hekmatfar, M. (2009). *Facility location: Concepts, Models, Algorithms & Case Studies*. New York, NY: Springer-Verlag Berlin Heidelberg.
- Feldman, E., Lehrer, F., & Ray, T. (1966). Warehouse Location Under Continuous Economies of Scale. *Management Science*, 12(9), 670-684.
- Hansen Harps, L. (2005, May). Best Practices in Today's Distribution Center. *Inbound Logistics*.
doi:<http://www.inboundlogistics.com/cms/article/best-practices-in-todays-distribution-center/>

Harmon, R. L. (1993). *Reinventing the warehouse: World class distribution logistics*. New York: Free Press.

Harrington, L. (2007, May). *Designing the Perfect Warehouse*. *Inbound Logistics*.

Hickey, Kathleen. (2003). *Location, Location, Location: Transportation looms large when choosing a warehouse or distribution site*. (*Distribution & Warehousing: Site, Selection*). *Traffic World*, 267(17), 22.b

Karmaker, C., & Saha, M. (2015). *Optimization of warehouse location through fuzzy multi-criteria decision making methods*. *Decision Science Letters*, 4, 315-334.

Lee, C. B., Ph.D. (2003). *Multi-Echelon Inventory Optimization*. *Evant White Paper Series*, 1-13.

My Ingersoll Rand. (2016, May 17). *Growth Initiative*. Accessed on

<https://home.ingerrand.com/Pages/Home.aspx>

Neff, J., & Garrison, B. (2004, June 1). *An adage meets the new age: Warehouse design and location strategies adapt to meet a changing business climate*. *The National Provisioner*, 50-55.

O'Reilly, J. (2013, May). *DC Automation: Sorting It Out*. *Inbound Logistics*.

doi:<http://www.inboundlogistics.com/cms/article/dc-automation-sorting-it-out/>

Planning, Designing & Implementing Distribution Center Improvements. (n.d.). Retrieved April 18, 2016, from http://www.forte-industries.com/media/16704/planning__designing_and_implementing_dc_improvements.pdf

Price, P. M., & Harrison, N. J. (2015). Warehouse Management & Inventory Control (2nd ed.).

Access Education.

Ross, D. F. (2004). Distribution planning and control: Managing in the era of supply chain management. New York City: Springer Science + Business Media, LLC.

Sweeney, D., & Tatham, R. (1976). An Improved Long-Run Model for Multiple Warehouse Location. *Management Science*, 22(7), 748-758.

Trunick, P. (2006). Don't oversimplify site selection. *Logistics Today*, 47(3), 28-30.

Vitasek, K., & Manrodt, K., PhD. (2006). Benchmarking - Prerequisite for Building Best-in-Class Supply Chains. *ProLogi Supply Chain Review*, 1-11. Retrieved April 27, 2016, from http://www.werc.org/assets/1/workflow_staging/Publications/674.PDF