Author: Huberty, Daniel P.

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STUDENT:

NAME: Dan Huberty DATE: 4/3/2018

ADVISOR: (Committee Chair if MS Plan A or EdS Thesis or Field Project/Problem):

NAME: Dr. Jim Keyes DATE: 4/3/2018

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Committee members (other than your advisor who is listed in the section above)

1. CMTE MEMBER’S NAME: DATE:

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**Abstract**

SWS, a division of AB International is a company that designs, builds and installs over the top merchandising displays. SWS had inventory control issues within their countertop department and also racking shortages throughout their warehouse. SWS was receiving their order forms from Party City stores the week of shipment. This meant that SWS needed to carry bulk quantities of all countertop sizes and styles. To eliminate this, SWS transitioned to a just-in-time inventory strategy. To achieve this, they requested all order forms and floor plans to be sent to them three months prior to the ship date. This allowed SWS to order only the sizes and styles that we going to be used in upcoming stores. By making this transition it also freed up the necessary racking space that SWS needed for other displays.
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Chapter I: Introduction

AB International is the world innovator and leader in foil balloon manufacturing. Based out of Eden Prairie, MN, Anagram International is a subsidiary of ASN, Inc. AB International’s balloons are marketed in over 140 countries, with distribution facilities in the United Kingdom, Australia, Mexico, Germany, Japan, and also the United States. This has ensured that AB’s products can be found worldwide. The primary location for AB’s balloons in the North American is in Party City stores. Party City, also a subsidiary of ASN, Inc., is the sister company of AB International and therefore carries only AB International balloons.

SWS is the division of AB International that designs, builds, and installs over-the-top merchandising displays for Party City stores. Some examples of these displays include an 11 foot tall gumball machine, balloon wall, and also displays that feature Mickey Mouse, Minnie Mouse, Olaf from Frozen, Teenage Mutant Ninja Turtles, and Spiderman sculptures. SWS also designs and installs all of Party City’s cash and balloon countertops for customer check out. SWS is based out of Minneapolis and currently employs 23 fulltime employees and six temporary employees.

SWS displays are made of MDF wood, plastics, and molding resin. Every aspect of these displays are done in house with the exception of the production of the countertops. The countertops are manufactured by XYZ woodworking, based in Fridley, MN. SWS places a countertop order with all the different sizes where inventories are getting low and XYZ Woodworking fulfills the order with approximately a one month lead time. Every Party City is unique in shape, size, and volume of sales. This results in SWS needing to have over 50 different sizes of countertops available in stock. Higher volume Party City stores will need more
cash registers, while smaller stores might require more turns and L shapes in their counter setup to get the most out of their small square footage. SWS received an order form and a floor plan of each store about one week before the countertop is required to ship. The one week lead time between receiving the order and getting it ready for shipment meant that SWS had to make sure it had ample inventory to meet all the needs of the ordering stores. SWS has a 60,000 square foot facility with 10,000 square feet being offices which resulted in a manufacturing facility that had space and inventory issues.

**Statement of the Problem**

AB International needed to improve their efficiency on inventory control and warehouse space management. The carrying cost of the countertop inventory was over $250,000 and AB International implemented a goal for this to be less than $50,000 for this department.

**Purpose of the Study**

The Purpose of this study was to analyze the countertop inventory control of SWS. The organization had over $250,000 of on hand inventory, with over one third of that inventory never used. The intent of this study was to not only reduce the amount of money that SWS had tied up in inventory and space, but also improve the efficiency that the organization can forecast upcoming orders. The resulting free space will be very valuable to other departments that can store their displays. To accomplish these tasks a just-in-time inventory process was implemented. Obtaining the Party City floor plans three months ahead of time allowed SWS to order only the countertops that they know they needed. Previously operations allowed only one week notice between a stores purchase order and ship date, thus forcing SWS to order their countertops in very large bulk orders. This led to the overabundance of less used countertop sizes. Unused countertops that had been sitting in the warehouse racking were slowly becoming
damaged due to warping of the particle board or everyday wear and tear of the pallet that they were on being moved from one location to another. The amount of unused countertops had accumulated so much racking space that the warehouse was being overpopulated with displays that needed to be stored in pallet racking. With countertops taking up a vast majority of the racking other merchandising displays were forced to be stored in the warehouse aisles, leaving them subjected to damage from getting hit by forklifts or other pallets bumping into them. The overall objective for AB International was to not only reduce its countertop inventory, but also to free up enough racking space so each display would be properly housed in the warehouse racking shelves.

Assumptions of the Study

The assumptions of this study were the difficulties in gaining the needed floor plans to design the countertops three months ahead of time before the current one week ahead of time schedule. This assumption was made due to the uncertainty that the project managers for these stores would have the floor plans that far ahead of time. There are five project managers that go from one new Party City store to the next, and the assumption was that they would not even have the information on a store that was three stores in the future of the one they were currently working on. Another assumption of this study was that SWS may have to pay more for their countertops from a supplier due to the fact that they will no longer be placing large bulk orders every three months and instead doing very small orders every month or two depending on demand.

It was also assumed that SWS could work with XYZ Woodworking to rework some of their less popular sizes into more popular sizes. This would mean that SWS would have to pay to redo a countertop that they already paid money to get made, but it would deplete the current
inventory much faster and make the move to a just-in-time inventory system more
efficient. Another assumption would be that SWS would still be producing merchandising
displays for over 100 Party City stores per year. If that number were to fluctuate greatly one way
or another it would affect the inventory storage within SWS warehouse. The assumption would
be that SWS would continue to outsource their countertop needs to XYZ Woodworking. SWS
had previous talks of doing all the countertop production in-house, but when finances for new
machines were calculated and issues of space were realized, it was decided that for the
immediate future they would continue to outsource their countertops.

**Definition of Terms**

The following terms are defined to ensure transparency for this study.

**A3 document.** Refers to the size of the paper typically used. Contains steps for problem
solving and continuous improvement. First utilized by Toyota (Liker, 2003).

**Computer-aided-design.** The use of software systems or workstations to aid in the
creation, modification, analysis, or optimization of a design (Groover, 1983).

**Fishbone diagram.** Also referred to as a cause an effect chart. It resembles the skeleton
of a fish where the head is the problem and the back bones are the causes of said problem (Feld,
2000).

**Floor plan.** A scale diagram of the arrangement of rooms in one story of a building.

**Forecast.** An estimation of the future demand for a product. It is usually stated as
quantity over a specific time period. There are a number of inputs into forecast, such as:
historical data, market trends, marketing data and sales force feedback (Balle, 2012).

**Inventory management.** The practice overseeing and controlling of the ordering,
storage and use of components that a company uses in the production of the items it
sells. Inventory management is also the practice of overseeing and controlling quantities of finished products for sale (Wallace, 2004).

**Just-in-time.** An inventory strategy companies employ to increase efficiency and decrease waste by receiving goods only as they are needed in the production process, thereby reducing inventory costs (Liker, 2003).

**Laminate.** To cover something with a thin layer of plastic for protection.

**Outsourcing.** A business practice used by companies to reduce costs or improve efficiency by shifting tasks, operations, jobs, or processes to an external contracted third party for a significant period of time (O'Brien, 2014).

**Physical inventory.** The process where a business physically counts its entire inventory (Feld, 2000).

**Space utilization.** The measure of whether and how much area is being used. The rate is a function of a frequency rate and an occupancy rate (Booth, 2010).

**Limitations of the Study**

There were several limitations to this study. The first limitation was the availability of obtaining the Party City stores floor plan. This study was based off of getting the floor plan three months in advance to accurately forecast the stores countertop design and needed sizes. Lack of receiving the floor plan months in advance would have resulted in an inability to forecast countertop sizes. The floor plan was designed by computer-aided design operators in New Jersey, headquarters of Party City. From there they are sent to the project managers for the assigned store. Another limitation for this study was the unaccounted store that would pop up. Each corporate Party City is forecasted for the entire year, but often times there are franchise stores that turn in order forms a week before they need it shipped. Operating a just-in-
time inventory system will not allow for the stores that were not forecasted previously. Another limitation from this study was keeping the inventory accurate when shipping out replace parts. There are occasions where a countertop piece may get damaged in shipping or installing and the store will need a replace part. These replacement parts needed to be factored into the just-in-time forecast so there was always an extra piece that can be shipped out. The last limitation of this study was nailing down an exact lead time from the time SWS would put in their countertop orders to the time XYZ Woodworking manufactured the ordered countertops and delivered them to SWS.

**Methodology**

SWS needed to reduce their countertop inventory, free up racking space in their countertop department, and to eliminate displays that were getting damaged due to being placed in the warehouse aisle because racking space was not available. The designated project leaders of SWS deployed an A3 document to assist them in their transition to a just-in-time inventory strategy. This document stated SWS goals, current state of operations, cause and effect, brainstorming and checking on their processes. Fishbone diagrams, process flow maps, and trend graphs were also created to guide SWS in the transition.

Party City floor plans that were previously received one week prior to shipment were now collected three months in advance. This advancement accurately forecasted the countertop demands, thus eliminating the ordering of unused countertop sizes. Once floor plans were collected from Party City project managers and countertops designed, SWS put this data into an inventory spreadsheet. The spreadsheet not only contains data about when the countertop needs to be shipped out, what the upcoming stores were going to need for countertop sizes, but it also contained all current inventory levels and got adjusted appropriately for when countertops got
shipped off to the stores. Along with the inventory spreadsheet, a physical inventory was done every week. Implementing a just-in-time inventory strategy relied heavily on the inventory numbers being accurate, so a physical inventory count assured of this. Making the necessary corrections allowed the countertop demand to match the physical inventory. SWS maintained a very small safety stock of different sized countertops. Those countertops were only used in the rare event of their supplier having machine troubles, supplier unable to locate laminate, and lastly if a Party City store requested a countertop when they were not on the forecast. While it was very rare for a Party City store to need a countertop when they were not on the forecast, it did happen occasionally with franchised stores.

**Summary**

This chapter discussed the background of AB International, SWS, and Party City. SWS had an overabundance of countertops in sizes that rarely got used. SWS warehouse was at full capacity, so freeing up racking and floor space was just as valuable as finding a new home for these unused countertops. With their previous format of receiving order forms one week prior to shipping, it had made it impossible to forecast each of Party City’s needs due to the wide variation of store designs and sizes. By receiving the floor plans three months ahead of time, SWS can now design the custom countertops well before they need to be shipped out. This allowed SWS to order only the countertops they needed for the upcoming month from XYZ Woodworking. The previous methodology, no forecasting of countertop sizes, SWS was forced to make large bulk orders of the countertops to make sure they had every scenario covered. With just-in-time inventory strategy in place, SWS now has the racking space to store all the merchandising displays that Party City stores are requesting. This change in inventory management has not only led to reduced inventory on hand and more racking space available,
but it has also reduced the amount of damaged displays that SWS was enduring. Will all displays currently off the warehouse floor and place in the racking shelve it has eliminated much of the accidental damage that SWS was previously seeing. The next chapter will delve into the literature associated with just-in-time inventory strategies, inventory management, and store design.
Chapter II: Literature Review

AB International had inventory issues with regards to their countertop department. They received their purchase orders from stores one week prior to being shipped out. The one-week lead time did not allow them make to order so AB International were forced to carry an excess of inventory in all the different sized countertops. The excess of inventory also led to poor utilization of cube space within their warehouse. A just-in-time inventory strategy was put into place focusing on lean manufacturing and continuous improvement. Toyota’s just-in-time strategy was the model AB International aimed to achieve.

The literature reviewed in this chapter identified the different strategies that have been used to move to just-in-time inventory. These strategies included lean manufacturing, continuous improvement, made-to-order, solid supplier relationships, and strong collaboration between sales and production teams.

**Lean Manufacturing**

Lean manufacturing comes down to one main objective, that being the elimination of waste. Byrne (2012) stated that lean will eliminate any activity or function that is not adding value. The benefits of lean manufacturing were quite obvious. If you eliminated all the processes and products that are not added value to an organization, the organization will see immediate cost savings (Feld, 2000).

According to Liker (2003), two factors must be met to make lean manufacturing possible. These factors were: the processes were under control and also predictable, and basic disciplines involving quality control, material handling, setups, and so forth were put into place.

Many organizations tried to implement lean and were not successful at it. The failure rate of implementing lean process was well over 50% (Abernathy, 1999). Extremely high start-up
costs, the previously mentioned high failure rate, and lack of patience have all been reasons as for why organizations have shied away from lean manufacturing (Abernathy, 1999).

Liker (2003), stated that the benefits of lean manufacturing were an improved quality of the product, increased efficiency, elimination of problems, a safer work environment, and also total involvement of all workers in the organization.

According to Connor (2008), there were ten steps that an organization should take to transform from their current state to a lean manufacturing state. These steps were: organizational lean assessment, forming a lean team, 5S organization, visual communications, poka yoke, value map streaming, set-up time reduction, cellular design, creating a pull system, and standardization of the organizations lean program.

In the first step of organizational lean assessment, the organization was simply analyzing where their lean practices compare to some of the other organizations who were widely known for having exemplary lean manufacturing systems in place (Connor, 2008). This allowed them to get a benchmark and strategized how they got to that platform.

When forming a lean team, the organization needed to make sure they were including all aspects of the organization from the executives down (Connor, 2008). The entire organization needed to be on board and involved when the lean training begins (Feld, 2000).

Sort, set in order, shine, standardize and sustain, these five things helped organize the workplace. When everything was in the place it should have been and there is no searching or cleaning of tools, it cuts down on time that was previously used for those activities (Feld, 2000). Time is a valuable commodity when transitioning to lean manufacturing. Anywhere you can save time, you are eliminating waste (Abernathy, 1999).
The work place can become very chaotic depending on the amount of work flow going through. Connor (2008), suggested that visual controls, or signals, can help reduce the confusion and also speed up many of the processes when properly used. Everyone needed to be on the same page when using visual controls. If one person misinterprets a signal it will have an adverse lean affect (Connor, 2008).

Poka yoke, or better known as mistake proofing, was the next step in lean transformation. It was very easy to say do it right the first time and we won’t have any waste, but there needed to be processes put into place where one has only one option and that is to do it correctly (Abernathy, 1999). If an operator was provided with the means and processes to produce a high quality part every time, than there was little need to go back and inspect each part (Feld, 2000).

Once an organization has eliminated wastes from their processes, they needed to analyze their work flow. Value stream mapping does exactly that. Value stream mapping tracked the flow of a product from customer order until delivery (Feld, 2000). Value stream mapping analyzed each step along the way and identified any wastes that may be present. Value stream mapping was extremely useful in identifying wastes in inventory, lead times and material handling (Feld, 2000).

One of the most common areas that organizations eliminated waste was in their set-up times between each batch. Any period of time that is not adding value to the organization was considered waste (Abernathy, 1999). For many organizations, there was too much down time between the last product of one batch to the first product of the next batch (Abernathy, 1999). Organizing like batches, eliminating some of the tasks, and reevaluating priorities were all methods of reducing set-up time (Byrne, 2012). Set-up time had a direct correlation on manufacturing lead time, thus when set-up time can be minimized, lead time reduced.
Cellular manufacturing should be designed so a product can efficiently go from one machine to another with no wasted time (Feld, 2000). According to Feld (2000), the most efficient manufacturing cell design was a U shape. This allowed the operator to stay stationary while keeping track of the batch that was moving from machine to machine. The product was typically moved through the production process one part at a time (Abernathy, 1999). By sending the products one at a time through the cell designed work stations, it allowed any changes that needed to be made to meet customer requirements quite easy. One main advantage for organizations that used cellular manufacturing was the flexibility it allowed (Feld, 2000). Designed properly, changes to a product to meet customer’s requirements should not take much time at all.

The last physical step that an organization did when implementing a lean manufacturing system was to create a pull system (Connor, 2008). A pull system worked on actual demand rather than forecasts. Once a product was shipped to a customer it was signaled to the operation in front of it what particular thing needed to be replenished. This continued with each operation down the line (Connor, 2008). By having a pull system, it greatly reduced the waste throughout the operation due to the fact that there was never any overproduction (Connor, 2008).

Lean certification was a beneficial last step for an organization to take. It showed your customers how committed the organization was to making a quality product (Abernathy, 1999). Certification allowed all employees to know the guidelines on how every operation within the organization was to be run. It also allowed the executives knowledge of the exact capabilities and outputs of the organization (Abernathy, 1999). Individuals who had their lean certification can bring that with them from business to business and it was an enhancement on a job seekers resume (Abernathy, 1999).
Just-in-Time Inventory Systems

A just-in-time inventory system was a system that was set up to reduce carrying costs to a minimum (Cammarano, 1997). To achieve lower levels of carrying costs, organizations relied heavily on its forecasting abilities. Like all inventory strategies just-in-time came with advantages and disadvantages.

According to Byrne (2012) the three biggest advantages of implementing a just-in-time inventory system were less space needed, waste reduction, and smaller investments. When an organization achieved those three goals, they would have been saving the organization large amounts of money (Byrne, 2012).

Byrne (2012), also stated that there were three drawbacks from just-in-time systems. Those included risk of running out of stock, lack of control over time frame, and more planning was required with this type of inventory strategy. If a just-in-time inventory strategy was setup and ran properly it can be seen as one of the best, if not the best, ways to control an organization’s inventory (Cammarano, 1997). This was a particular strategy where the benefits of a well run just-in-time inventory system greatly outweighed any disadvantages that may came up along the way. Cammarano (1997) stated that to run an efficient just-in-time system, data and customers played a large role. An organization needed to be clear with their clients about lead times that met the customer’s needs and demand. The organization was not only relying on customer orders, but also predicting trends through detailed forecasting (Liker, 2003). The gold standard around the world for lean manufacturing and just-in-time inventory was Toyota.

Toyota’s Leadership in Just-in-Time

The credit for developing a just-in-time strategy went to Toyota (Liker, 2003). Although some of the just-in-time methods could be traced back to Henry Ford, it was Toyota and Taiichi
Onho who transformed it into a manufacturing strategy. According to Liker (2003), post-World War II the Japanese were at a crossroads when it came to car manufacturing. They wanted to benchmark their processes against the American car builders, but the car market was much smaller than the one in America at the time. Toyota knew that making large batches of different models would not be a good strategy with their market. Liker (2003), also stated that another issue facing Toyota at the time was pricing. American car manufacturers were doing a mark-up on the cost price, but Toyota and Onho knew there wasn’t the same demand in Japan so this would lead to a price resistance.

**Waste reduction.** To get over these hurdles, Ohno knew that he would have to get rid of all the waste that was involved in manufacturing their cars. Those wastes included overproduction, keeping dead stock inventory, wasted time spent by workers on the assembly line, time spent on transportation, and waste associated with defective items (Liker, 2003).

Factory arrangement was the first area that Toyota changed. Instead of transporting parts back and forth across the factory, they rearranged the machines and created a much more efficient flow to the factory. Once the factory had a good work flow, Toyota implemented autonomination. Automating the production system not only eliminated waste on time, but also defects.

**Challenges faced implementing a just-in-time strategy.** According to Liker (2003), Toyota faced many challenges while implementing a just-in-time strategy and it took many years to fully implement. Those challenges included multi-skilling the workforce, redesigning every part of the vehicle, and testing and training all of their suppliers (Liker, 2003).
Continuous Improvement

Continuous improvement was a method to always being observant for areas where streamlining and elimination of waste could be present (Byrne, 2012). Many organizations elected to go with continuous improvement strategies over lean strategies due to the fact that continuous improvement was much more flexible and the organization can deviate away from it whenever they want. Byrne (2012), pointed out that continuous improvement could be categorized as a formal practice or an informal set of guidelines.

Benefits. Like all methodologies continuous improvement had its pros and cons. The benefits of implementing continuous improvement included increased productivity, improved quality, lowered costs, reduced employee turnover rate, decreased delivery times, and improved employee satisfaction (Cammarano, 1997).

Drawbacks. Cammarano (1997) also stated that continuous improvement had some drawbacks too. Those disadvantages included the expense that an organization must pay to train the employees in continuous improvement. The training could also take an adsorbent amount of time. Another drawback to continuous improvement was with all the changes going on in the organization, there was opportunity that something running smoothly might get changed. Lastly not all negative feedback that the organization received from its employees and customers is accurate. There could be times when changing processes due to what a customer said may have had a negative affect instead of improving the issue.

Supplier Relationship

In order to have a successful organization, you must have high quality and reliable suppliers. According to Booth (2010), when an organization does find a supplier who fulfills all their expectations, they must treat them like gold. To maintain a good manufacturer-supplier
relationship both parties must respect each other and looks out for each other’s needs (Booth, 2010). There were four main ways that a supplier can impact an organization. Those four criteria were: timeliness, technical ability, price, and quality (O’Brien, 2014).

Supplier timeliness had two primary benefits to an organization. The first primary benefit was being able to provide the material or product in the allocated time so the organization would be able to provide their customers with the desired product when requested (Booth, 2010). On time delivery rates to the customers would result in those customers coming back to purchase more products from the organization (O’Brien, 2014). O’Brien (2014) stated, “If a supplier lets you down, then you let the customer down.” The second benefit of supplier timeliness was inventory turnover rate. Having a supplier who was constantly on time would lead to an organization having the ability to reduce its inventory levels and thus lowering the carrying costs of their products (O’Brien, 2014).

When choosing a supplier an organization must make sure the supplier had the technical ability to provide the needed parts and materials (Booth, 2010). The supplier possessed the technical knowledge of any parts, products, processes that an organization had coming in the future (Booth, 2010). The supplier would spend more time with these parts and products than the organization, so the supplier should have much more knowledge on these items. A good supplier would take this knowledge and be innovative with how they processed and developed the part or product (O’Brien, 2014). An exemplary supplier would know exactly what changes needed to be made to keep the organization satisfied (Booth, 2010).

According to O’Brien (2014), the lowest price for a product would not always bring the best value for an organization. Price did play a vital role when selecting a supplier. Pricing point could become the deciding factor if multiple suppliers came in ranked equally (Booth,
The goal of every organization was to find a supplier that produced a high quality product at a fair price and on time (Booth, 2010).

Quality should never be overlooked when choosing a supplier (O’Brien, 2014). Quality was meeting and exceeding all the necessary requirements of the customer (O’Brien, 2014). The supplier should meet specifications set out by the organization, anything less than that was unacceptable (Booth, 2010). Quality of a product had a direct correlation with customer loyalty. Poor quality would result in customers looking elsewhere for a similar product (Booth, 2010). Along with the product meeting all the necessary specifications, packaging needed to be factored into quality too (O’Brien, 2014). Often times, suppliers would solely concentrate on making sure the part or product was produced to the highest quality and they would forget about shipping needs. It would not make a difference how the quality of the product was if it showed up to the organization not in one piece. A quality product would be processed to meet the organizations requirements and also be packaged properly so it arrived to the attended person in the exact condition it was made (Booth, 2010).

**Make-to-Order**

Suri (1998) described make-to-order as a manufacturing process that was setup to satisfy the customer’s requirements once they had placed the order. Make-to-order utilized both customized and standard parts to fulfill the customer’s order (Lane, 2007). Organizations needed to carefully analyze their products and processes to make sure a make-to-order production system was right for them. Some of the factors that an organization needed to analyze include: inventory carrying costs, how long customers were willing to wait for the product, manufacturing lead time, if the customization was right for that product, and setup costs to produce the product (Lane, 2007).
With all production systems there were advantages and disadvantages with a make-to-order production system. One of the top advantages of make-to-order was the ability of customization to meet the needs and requirements of the customer (Suri, 1998). Another benefit of a make-to-order production system was that it allowed inventory levels to be minimal (Lane, 2007). An organization no longer needed to hang onto any unnecessary inventory (Lane, 2007).

The lack of inventory can also be viewed as a disadvantage too. With very little inventory an organization cannot stock store shelves or readily have a product on hand that a customer could take home that day (Lane, 2007). This could possibly cut into profits that would have been there had the organization deployed a make-to-stock system (Lane, 2007). Another disadvantage of make-to-order was the waiting period for the customer (Suri, 1998). Since each product was made after the customer puts in their order, it took longer for that customer to receive the product (Suri, 1998). If the customer was made aware of this prior to the order it would eliminate any frustration on the customer’s part.

**Sales and Operations Planning**

There was a major area in every organization that existed between the strategic business planning and the day-to-day operations of the organization; this vital area was sales and operations planning (Wallace, 2004). Sales and operations planning was a vital tool in supply chain management. The sales and operations planning meetings with an organization would bring managers from all different departments (Palmatier & Crum, 2003). Sales and operations planning was setup to determine the best avenues to use the organizations resources (Wallace, 2004). The direction of the organization was often set within sales and operations planning meeting. This was where the organization would go over customer service, inventory supply and demands, and distribution (Wallace, 2004). For sales and operations planning to be successful
they needed to be given accurate data. This data included inventory totals, production capabilities, demand forecasts, and any limitations that may have been present within the organization.

According to Wallace (2004), there were five steps that need to be taken to properly implement in within an organization. These steps include: strategy review, demand review, supply review, financial review, and executive business review.

In the strategy step the organization was taking one of their products and using data and analytics trying to forecast the best strategy to use to profit the most out of this product. Many times with new innovations and products this step could become difficult because there was no previous data to go off of (Wallace, 2004).

The second step was demand review. Once the organization had their business strategy in place on how they were going to produce and sell the product, they needed to dive in deeper to predict the demand of this product (Wallace, 2004). This step could be very challenging to forecast, but done accurately it would make the organization thrive.

Supply review centered around two key aspects. The first being; how could we best optimize our inventory? And the second being; what was our production capabilities? At this point the organization had determined what they believe the demand for the product would be, so it was up to the production managers to make sure they had a plan in place to meet that demand (Palmatier & Crum, 2003).

The fourth step in sales and operations planning was financial review. This was the step where all upper management had agreed on the demand and the supply forecasts (Wallace, 2004). This step was a reevaluation of the plan in both volumetric and financial measures
(Wallace, 2004). This step was put into place to eliminate any bias that may have been present in the demand and supply stages of implementation.

The last step was the executive business review. This was where the strategic plan has joined with the operational plan and everyone was on board with the organizations processes moving forward (Wallace, 2004). The executives during that time will break down all the risks associated with their supply chain and make sure everyone was on the same page. Once the review was over, the plans go into motion and actions to accomplish the agreed upon plan go into place (Wallace, 2004).

**Summary**

SWS had problems with overstock of inventory, lack of warehouse racking space, and displays becoming damaged due to warehouse placement. To achieved their goal of transitioning their warehouse inventory strategy to a just-in-time strategy SWS relied heavily on lean manufacturing methods. SWS goal of a three month transition window reinforced the need for the literature review.

The literature review provided the needed guidance with lean methods that SWS was seeking to perform the transition. It also provided SWS a view of what organizations were the pioneers and leaders in those areas of lean manufacturing. Chapter III presents the detailed methods that SWS used to reach their goal of a just-in-time inventory strategy.
Chapter III: Methodology

SWS had over $250,000 worth of countertop inventory that was to be allocated to Party City stores. All Party City stores were different in shape and size, thus many different sizes of countertop were needed to be on hand for upcoming stores. SWS did not receive the floor plans and purchase order of the Party City store until the week of shipment, which meant that they needed to have a large inventory of all sizes on hand to satisfy the incoming orders. This chapter described the methods of collecting and analyzing data, which was heavily focused on reducing the current inventory and implementing a just-in-time inventory strategy.

Instrumentation

Demand planning and quantitative analysis were used extensively to construct an A3 document to collect the needed countertop data for SWS. Receiving floor plans and forecasting three months ahead of time allowed SWS to design the countertops and place their orders with their supplier for only the countertops they knew were going to be used.

Data Collection Procedures

SWS had to reach out to the project managers who were in charge of building the new Party City stores or remodeling the old ones and collect the floor plan for each particular store. Once the floor plan was sent to SWS, the countertop design could be put into place. SWS ordered their countertops from XYZ Woodworking and all countertops had a four week lead time from order date. Data was then entered into an Excel spreadsheet to keep track of their inventory which covered the demand of the upcoming three months. If the Project Managers did not have the approved floor plan of the Party City store, SWS contacted Party City’s computer aided design operator who provided SWS with the information. The following methods were used for the planning of this implementation, the collection of data, and also analyzing the data.
Planning

A plan was set forth to reduce SWS countertop inventory. The plan centered on lead times, demand, carrying cost, and ordering cost. The time frame for SWS to transition their inventory strategy to a just-in-time method was three months. During this three month period, SWS identified the problem, determined the current state of their inventory issues, developed goals, performed root cause analysis, brainstormed countermeasures, checked and analyzed their results, and put the plan into action. SWS did these steps by using an A3 document. An example of an A3 document is shown in Figure 1.

Figure 1. A3 document example.

A3

An A3 document refers to the size of the paper used. A3 is a European measurement with regards to size; the American measurement is 11 inches by 17 inches. This document is used by many organizations for lean manufacturing and continuous improvement, most widely
known for Toyota’s use of it. The A3 produced proposals, current situations, and also provided problem solving solutions. The document varied from one organization to another regarding the steps taken to complete it. The document that SWS used contained eight areas of examination. Each area helped SWS on their goal of having a just-in-time inventory strategy.

The first step when constructing an A3 document was to identify the problem. This involved input from upper management, middle management, and employees on the shop floor. Having all three levels allowed different perspectives to be achieved. This contained only the current problem or problems that faced SWS, not solutions to those problems. Also in identify the problem, was how the problem arrived and why it was important that it needed to get solved.

SWS needed to analyze the current state of the inventory issues and they also broke down the problems of that area in greater detail. The current state was also the area to prioritize the issues that faced SWS. Problems could be prioritized by severity or occurrence. To get a better idea of the current state of SWS countertop inventory, they deployed process mapping.

Project leaders were tasked to develop goals. The goals needed to be specific and attainable. Numbers were set as parameters that should be met by the time of implementation. This needed to be very detailed of all the outcomes that SWS wanted to achieved

Root cause analysis utilized a couple different lean manufacturing methodologies. Fishbone diagrams and 5 whys were constructed. Executing those lean methods provided SWS with a detailed plan of where the problems were occurring and how they could be corrected.

Taking the information collected in root cause analysis, SWS were able to brainstorm solutions against those problems. Brainstorming countermeasures detailed the work that needed to be done by SWS to complete a successful transition to a just-in-time inventory. Process mapping was used to ensure that SWS was eliminating their issues step by step.
Creating an implementation plan provided SWS with a layout of what improvements needed to be done, by whom is doing those improvements, and lastly the target date that those improvements needed to be accomplished by. Once all the needed improvements had been in place, it was time to check the results. SWS deployed a trend graph to analyze the inventory data and ensure that they were meeting their set goals.

The last area to be examined by the project leaders was to update the process and work box. This detailed any of the work that still needed to be completed and also illustrated some of the findings that came to fruition while completing the A3 document.

**Process Mapping**

Changing the inventory strategy was not a one step process. It involved many different steps to achieve the outcome that SWS was looking for. The process of collecting the floor plans, deciphering the layout of the store, designing the countertop, ordering the countertops, pulling correct countertop sizes per store, crating the store’s countertops up, and shipping the countertops out each required analysis and revision to transition to a just-in-time-inventory. Figure 2 is an example of a process map. SWS utilized this method in analyzing the current state and brainstorming countermeasures of the A3 document. When performed in these two steps of the A3 document, SWS was able to compare their current state to their goal state. SWS used processing mapping from the very start of receiving the initial store floor plan until the countertop was shipped out. The reason SWS wanted the entire process capsulated in the process mapping was to ensure every step was being performed at maximum efficiency and there would be no bottlenecks from one process to the next.
Figure 2. Example of a process map.

Fishbone Diagram

The fishbone diagram, also called a cause and effect diagram was used by SWS to identify the causes of the problems they were having with their current inventory strategy. The fishbone diagram was used in root cause analysis of the A3 document. The name of this diagram was due to that fact that is resembled a fish skeleton when drawn. At the head of the fish was where SWS recording their problem they were having. From there the diagram has a straight line drawn from the problem, to resemble a fish spine. Connected to the fish spine were a minimum of four causes that contributed to said problem. These causes are drawn with lines and arrows resembling the fishes back bones. Connected to the causes were brainstormed ideas using the 5 whys of what contributed to the causes. Figure 3 shows an example of a fishbone diagram. By using this diagram, it allowed SWS to retrace it steps to pinpoint some of the causes that were major factors to their inventory issues.
Figure 3. Example of a fishbone diagram.

**Trend Graph**

SWS needed to reaffirm that the processes that they had put into place were achieving the desired results. To analyze the progress made during this three month implementation period, SWS created a trend graphs. To achieve this SWS did a physical inventory count once a week and calculated the costs associated with this inventory. Table 1 is an example of the data collected for the trend graph.

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Sample of Trend Graph Data for Inventory Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date of Inventory</td>
<td>Inventory Costs</td>
</tr>
<tr>
<td>6/5/2017</td>
<td>$0</td>
</tr>
<tr>
<td>6/12/2017</td>
<td>$0</td>
</tr>
<tr>
<td>6/17/2017</td>
<td>$0</td>
</tr>
</tbody>
</table>

SWS also wanted to ensure that racking space was becoming available at the rate they intended. Table 2 is an example of racking space utilized by the countertop department.
Table 2

Sample of Trend Graph Data for Racking Space

<table>
<thead>
<tr>
<th>Date of Inventory</th>
<th>Racking Space Utilized in Cubic Feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>6/5/2017</td>
<td>0 Cubic ft.</td>
</tr>
<tr>
<td>6/12/2017</td>
<td>0 Cubic ft.</td>
</tr>
<tr>
<td>6/17/2017</td>
<td>0 Cubic ft.</td>
</tr>
</tbody>
</table>

Those graphs not only showed SWS if they were moving in the right direction, but it also illustrated just how close or far they were to reaching their preset goals. Figure 4 is an example of a trend graph that SWS created. The graphs were confirmation of effect area of the A3 document. SWS documented a three month period when they were using their old inventory methods and compared it with the past three months of the newly created methods. The trend graph allowed easier analyzation of these different methods to ensure satisfactuary outcomes going forward.

Figure 4. Example of a trend graph.
Limitations

The limitations with that methodology included floor plans that were not finalized within the three month lead time, stores that had damaged parts in shipping that needed to be immediately replaced, and custom designs to countertops that were not part of the original SWS countertop design system for Party City. Those limitations, while rare, would cause inventory and ordering issues that needed to be resolved. Getting the final floor plan approved by the three month buffer time frame proved to be somewhat of a challenge, but it was always resolved by the four week lead time of XYZ Woodworking. As much as SWS tried to eliminate damage in shipping, part damage would always pose an issue on inventory count and thus SWS had implemented a small safety stock of each size. With all innovated organizations there was production and design change, and as long as SWS had an open dialog with XYZ Woodworking about those changes they would not pose an issue.

Summary

SWS needed to reduce their countertop inventory drastically and to do this they implemented a just-in-time inventory strategy. Instead of floor plans and purchase orders received the week of and fulfilling accordingly, SWS planned three months ahead. They achieved this by creating an A3 document. The eight areas within the document allowed SWS to dictate their problem, brainstorm goals, conduct root cause analysis, implement said plan, check their progress, and develop new plans for continuous improvement in the countertop department. To accomplish the needed strategies on the A3 document, SWS utilized process mapping, fishbone diagrams and trend graphs. These methods allowed SWS to identify the problem, figure out what was causing the problem, brainstorm ideas to change the problem, and compare
the progress of the new process ideas versus what they had previously done. The next chapter will review and analyze the data collected from these methods.
Chapter IV: Results

The previous chapter listed the methods SWS used to transition their countertop inventory strategy to a just-in-time strategy. Applying these methods allowed SWS to gain an understanding of where they were having issues and how to eliminate those issues to reach their goal of having less than $50,000 of countertop inventory on their racking.

The purpose of this study was to eliminate costs that were tied up in unused inventory. Executing those methods also allowed SWS to gain warehouse racking space. SWS has 92,160 cubic feet of warehouse racking. Their prior countertop inventory strategy had 25,600 cubic feet occupied by different countertop parts and countertop packaging pieces. Although the countertops were just one out of ten different products they produced, they were taking up 27.7% of the available warehouse racking. This chapter will review the results from the A3 document, fishbone diagram, process flow map and the trend graphs.

Data Analysis and Collection

SWS had $254,000 in countertop inventory, most of it being unused sizes. That total was the result of not receiving order forms on time and project managers making last minute changes. Those issues forced SWS to order all of their countertop sizes in large bulk orders. Not knowing what was coming from week to week led to overstock and warehouse utilization problems.

A three month goal of fully transitioning their inventory strategy was put in place. On June 5, 2017 SWS began producing an A3 document. The problem for SWS was over ordering counters to ensure they would have all sizes for store orders. Over ordering led to a large amount of uncommon countertop sizes that would never get used. The problem consisted of poor communication between project managers, computer-aided designers, and production employees. The current state area of the A3 document focused on the state of the inventory
strategy before the transition. Figure 5 shows a process flow map before the transition to just-in-time of the countertop process from supplier to shipping to the store.

![Process Flow Map](image)

**Figure 5.** Previous SWS process flow map.

SWS analyzed their process flow and could identify flaws with how the countertop department functioned. Ordering needed to come after the floor plan was received. By doing this it would eliminate ordering uncommon sizes. Another item that the project leaders identified was that each countertop design needed to be approved by the project manager. This would ensure that both SWS and the project manager were on the same page. SWS took this information and used it for goal development of the A3 document. The goals SWS stated were to be achieved in a three month time frame. SWS wanted to reduce the warehouse inventory from over $250,000 to below $50,000. Another goal stated was for the countertop department to utilize under 10% of racking space within SWS warehouse. Last goal stated was for no wrong sized countertops to be sent to Party City stores. To achieve this they adjusted their process flow map. Figure 6 shows the improved countertop process.
Figure 6. Current SWS process flow map.

The new process flow allowed SWS to first receive the floor plan, then design the layout and order from the design. It also added safeguards with project manager approval. That eliminated SWS sending out wrong designed countertop sizes. The new process relied on accurate inventory totals. To achieve this SWS conducted physical inventory counts once a week.

To better identify why the errors were occurring, SWS performed a fishbone diagram in the cause and effect area of the A3. The fishbone diagram recognized overstock of inventory in the countertop department as the major problem. To figure out what was causing that problem, they analyzed six different areas. Those six areas included measurement, management, process,
environment, people and materials. Figure 7 identifies those areas and also the effects they had on the overstock of inventory.

Figure 7. Fishbone diagram of inventory issues within SWS.

SWS brainstormed ideas to counter the causes of overstock inventory. In this area of the A3 they stated the need for earlier arrival of the stores order form and floor plan. To achieve this SWS put in a benchmark of receiving floor plans and order forms a minimum of three months before that store was scheduled to ship. That allowed SWS to place their order with the supplier for the exact countertops they needed, which had a lead time of one to two months depending on the size of the order. That time frame also gave SWS ample time to go over the countertop design and get approval. SWS decided that rarely used countertop sizes would be sent back to XYZ Woodworking and those countertops would be reworked into more popular sizes. That was done at a 30% discount for SWS due to their strong relationship with the supplier and because they had already paid for the previous size countertop.
Analyzing the Results

A goal of three months to complete the transition of their inventory strategy to a just-in-time strategy. Weekly inventory counts were documented to ensure SWS was heading in the right direction. Table 3 shows the progress SWS made during this three month period.

Table 3

Countertop Inventory Costs

<table>
<thead>
<tr>
<th>Date of Inventory Count</th>
<th>Countertop Inventory Dollars</th>
</tr>
</thead>
<tbody>
<tr>
<td>6/5/2017</td>
<td>$254,000.00</td>
</tr>
<tr>
<td>6/12/2017</td>
<td>$220,000.00</td>
</tr>
<tr>
<td>6/19/2017</td>
<td>$204,000.00</td>
</tr>
<tr>
<td>6/26/2017</td>
<td>$177,000.00</td>
</tr>
<tr>
<td>7/3/2017</td>
<td>$163,000.00</td>
</tr>
<tr>
<td>7/10/2017</td>
<td>$149,000.00</td>
</tr>
<tr>
<td>7/17/2017</td>
<td>$149,000.00</td>
</tr>
<tr>
<td>7/24/2017</td>
<td>$122,000.00</td>
</tr>
<tr>
<td>7/31/2017</td>
<td>$117,000.00</td>
</tr>
<tr>
<td>8/7/2017</td>
<td>$93,000.00</td>
</tr>
<tr>
<td>8/14/2017</td>
<td>$75,000.00</td>
</tr>
<tr>
<td>8/21/2017</td>
<td>$62,000.00</td>
</tr>
</tbody>
</table>

In the three month period of inventory transition SWS reduced their inventory costs in the countertop department by $192,000. The goal of keeping the inventory under $50,000 was not met in this three month period, but they were heading in the right direction to meet that goal.
Figure 8 displays the weekly inventory activity in the countertop department and their proximity to reaching their goal.

![Graph of weekly inventory activity](image)

**Figure 8.** Trend graph of SWS inventory value.

Prior to June 5, 2017, SWS countertop department was utilizing 27.7% of the available racking space. Table 4 shows the weekly racking space utilized by the countertop department.
Table 4

*Utilization of Racking Space for Countertops*

<table>
<thead>
<tr>
<th>Date of Inventory Count</th>
<th>% of Racking Space Utilized</th>
</tr>
</thead>
<tbody>
<tr>
<td>6/5/2017</td>
<td>27.7%</td>
</tr>
<tr>
<td>6/12/2017</td>
<td>24.2%</td>
</tr>
<tr>
<td>6/19/2017</td>
<td>21%</td>
</tr>
<tr>
<td>6/26/2017</td>
<td>19.6%</td>
</tr>
<tr>
<td>7/3/2017</td>
<td>17.2%</td>
</tr>
<tr>
<td>7/10/2017</td>
<td>15.8%</td>
</tr>
<tr>
<td>7/17/2017</td>
<td>15.8%</td>
</tr>
<tr>
<td>7/24/2017</td>
<td>14%</td>
</tr>
<tr>
<td>7/31/2017</td>
<td>13.2%</td>
</tr>
<tr>
<td>8/7/2017</td>
<td>12.1%</td>
</tr>
<tr>
<td>8/14/2017</td>
<td>10%</td>
</tr>
<tr>
<td>8/21/2017</td>
<td>7.6%</td>
</tr>
</tbody>
</table>

The large amount of racking space used by that department led to other merchandising displays that SWS produced to be stored on the floor. Displays stored on the floor were subjected to getting damaged by fork lifts, pallet jacks, and other environmental hazards. The goal set by SWS was 10% racking utilization or under for the countertop department. That figure would put the space available for countertops to 9,216 cubic feet. Figure 9 shows the utilization of racking space with regards to the countertop department.
As of August 21, 2017 the countertop department had reduced their racking utilization to 7004 cubic feet. The 7.6% that the countertop department had allocated surpassed the goal that had set.

In updating the standard work, project leaders needed to establish who was going to do which tasks moving forward. It was decided that the countertop manager was to be in charge of receiving the floor plan and order form. Also they were in charge of doing all of the countertop ordering through their supplier and designing the layouts for each Party City store. The countertop associates were tasked with completing the physical inventory weekly, packaging up the necessary counter components for each store for shipment, and also responsible for any custom parts that may need to be manufactured in the shop.

**Summary**

An A3 document was developed to make SWS countertop department operate leaner and to transition it to a just-in-time inventory. During the A3 process, problems were identified that

![Figure 9. Trend graph of the utilization of racking space by the countertop department.](image)
SWS was having, recognized their current state, deployed process flow maps, and analyzed fishbone diagrams and trend graphs.

The results found in three months of this transition were their countertop inventory cost went down $192,000 and their available racking space increased by 20.1%. SWS did not reach their goal of carry less than $50,000 worth of inventory, but that would be accomplish within the next three weeks. SWS did meet their goal for racking utilization, surpassing the set out goal by 2,212 cubic feet. Achieving this goal allowed all SWS displays to be store in racking and not on the warehouse floor. Chapter V will discuss the conclusions and recommendations for this study.
Chapter V: Discussion, Conclusion and Recommendation

SWS, a division of AB International is a company that designs, builds, and installs over the top merchandising displays. This company has experienced inventory issues within their countertop department. Due to receiving last minute orders SWS was forced to order their countertop sizes in large bulk orders to assure each incoming store was being fulfilled. This led to large quantities of overstock for the less common sizes used in Party City Stores. The inventory issues also led to available racking space shortages with regards to the other merchandising displays that SWS builds for Party City. The analysis on these issues determined that transitioning to a just-in-time inventory strategy would not only reduce the carrying costs of inventory with the countertop department, but also free up racking space for other merchandising displays to be stored safely.

Chapter I introduced AB Internationally and more specifically SWS, the department where the analysis took place. Additionally, this chapter identified more efficient inventory control was needed in their countertop department. Terms regarding countertops, inventory, and lean manufacturing methods were discussed. This chapter concluded by stating which limitation might cause issues with this study and also which methodology would be best to use to improve the inventory control efficiency.

Chapter II reviewed the literature related the lean manufacturing and the leading organizations within lean manufacturing. The review highlighted Toyota’s revolutionary methods with regards to lean manufacturing. Continuous improvement and just-in-time were also reviewed. The literature review in those areas stated not only the benefits with which are associated, but also some of the drawbacks that could present themselves.
Data collecting procedures and overall methodology were discussed in Chapter III. To employ lean manufacturing methods in their inventory department, SWS first completed an A3 document. This document allowed SWS to state their problems in detail, identified what the current situation of the countertop inventory was, the goals SWS was attempting to achieve, tools and methods used, and lastly the results the found from completing the A3. Process flow maps and fishbone diagrams were used in filling out the A3 document. The process flow map allowed SWS to identify areas that were not adding value. The fishbone diagram examined the root causes of the countertop issues. The last method SWS used was to construct a trend graph. SWS collected inventory data weekly and used this data to ensure they were going to hit their preset goals.

Chapter IV discussed the results garnered when the previously mentioned methods were executed. The completed A3 document revealed transitioning to a just-in-time inventory system reduced the costs of countertop inventory and also freed up racking space. Switching the countertop strategy saved SWS $192,000 in countertop inventory and reduced the occupied countertop racking space from 27.7% to 7.6%.

Limitations

The findings of this study were limited to receiving the floor plan within three months of the ship date, accounting for lost or damaged countertop parts, receiving an exact lead time from the supplier, and lastly factoring in franchise stores that would need countertops that were not listed on the corporate store forecast. As the study progressed, the success rate increased of receiving floor plans from Party City project managers three months from ship date. Damaged countertops and unaccounted for franchise stores limited SWS from reducing their inventory further due to the need of safety stock.
Conclusion

SWS, a division of AB International, had inventory control and warehouse racking utilization issues. On June 5, 2017 SWS had $254,000 of countertop inventory in their warehouse racks. These countertops occupied 27.7% of all warehouse racking. Prior to June 5, 2017 SWS would receive a floor plan and order form from a Party City store the same week that it needed to be shipped out. That lack of lead time led to SWS carrying bulk quantities of all sizes of countertops. Many of these countertops were uncommon sizes or styles; therefore they occupied needed racking space. On June 5, 2017 SWS deployed a transition to a just-in-time inventory strategy. To achieve this, SWS contacted Party City architects, computer-aided designers, and Party City store project managers to receive the floor plan three months prior to the ship date. Receiving the floor plans three months prior to ship date allowed SWS to design the stores countertop and put in a countertop order to its supplier for only the exact sizes and styles that it needed. SWS also had its countertop supplier rework the uncommon sizes that were in the racking to sizes that could be used for future orders. XYZ Woodworking, the countertop supplier for SWS, had a lead time of one month from when SWS placed their order. This allowed time for any changes that SWS needed to make with the design and also allowed time for an unseen occurrence such as their supplier unable to secure the proper laminate. Each week a physical inventory was conducted to ensure that SWS was going to meet their goal of under $50,000 in countertop inventory and under 10% of all racking used by the countertop department.

At the end of the three month transition period, SWS hit one of their goals and just missed out on the other. On August 21, 2017 SWS had $64,000 worth of countertop inventory on their racks and 7.6% of racking used by the countertop department. At the end of the three
month period SWS had reduced their countertop inventory by $192,000 and freed up 7,004 cubic feet of racking. The freed up racking space allowed SWS to place their other merchandising displays that were stored on the floor up into the racks.

**Recommendations**

SWS needs to continue to contact Party City project managers, architects, and computer-aided designers until they have a 100% success rate of receiving those three months in advance. Over the course of this study, the success rate of receiving the floor plans improved and that will continue as long as SWS follows through. SWS needed to look into crating their countertops more securely. Currently countertops are placed in a wood crate with styrofoam sides for cushioning, but SWS needs to bubble wrap the smaller countertop pieces that shift around the crate freely. This will reduce damaged parts showing up on location and the need for SWS to ship new parts out to the store. SWS also needs to implement a system where the employee who is packaging the countertop checks off each countertop component that gets placed in the crate and once finished another employee rechecks. Both employees will then sign the packing slip. This will ensure that no counter pieces are missing and also safeguarding SWS from Party City stores saying they did not receive a part.

Last recommendation is that SWS should invest in doing the countertops in house. SWS currently have two CNC machines and available work time on those machines. The two factors that have previous steered SWS away from this were lack of space and an edge banding machine. The equipment needed would pay for themselves within six months, leaving only space as an issue. SWS could reconfigure their current warehouse layout by removing the rotational molders, which are no longer in use, and set up the countertop equipment in that location. By having the ability to manufacture countertop in house it would allow SWS to not
only save money on supplier prices, but it would also allow SWS to have to rely on having a safety stock. If a franchise store popped up or a part was damaged, SWS could easily manufacture a new one.
References


