CONTINUOUS IMPROVEMENT IN THE AMUSEMENT PARK INDUSTRY:

AN ILLUSTRATION

THESIS

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by

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ABSTRACT

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Continuous improvement is an ongoing effort to improve products, services, or processes and an important aspect of successful business operations remaining strategically competitive. The purpose of this paper is to provide a framework for continuous improvement initiatives in the Amusement Park industry through an illustration of the retail department at a specific water park. Efforts are directed at the evaluation of specific processes and generation of solutions to reduce waste resulting in overall process improvement.

The methodology to accomplish the desired results revolves around the DMAIC model, consisting of five stages: define, measure, analyze, improve, and control. At each stage, this study uses qualitative and quantitative tools specifically selected to define and measure the problem, analyze its root cause, and select solutions for improvement. The project team applied the proposed framework and successfully identified areas of potential improvement and possible solutions. Finally, this research shows the strength of having a structured approach to continuous process improvement.

CHAPTER I

INTRODUCTION

Industry Background

The origins of the amusement park industry date back to the "old world" in Europe where merchants, entertainers, and food vendors gathered at ancient and medieval religious festivals to reach large crowds (Milman, 2010). According to the International Association of Amusement Parks and Attractions (IAAPA) the world's oldest amusement park is Bakken located in Klampenborg, Denmark, dating back to 1583 (2011). The emergence of theme parks was the result of Walt Disney who opened Disneyland in 1955 with the idea of organizing amusement areas, rides, and shows under themes (Milman, 2010). Following Disney's lead, many businesses developed with similar design and as a result the industry has grown over the years into a global industry.

Today, this industry is considered to be part of the global leisure facilities sector, made up of amusement parks (18.6%), health and fitness clubs (45.0%), and golf courses (36.4%). Overall, this sector grew by 4% in 2010, reaching a value of $136.9 billion, and is estimated to reach a value of $170.4 billion by 2015. The Walt Disney Corporation is the leading player in the global leisure facilities sector, generating a 7.7% share of the sector's value (Datamonitor, 2011). The global amusement park industry is a global industry that includes over 400 amusement parks and traditional attractions in the United States, approximately 300 in Europe, and many more across the globe (IAAPA, 2011).

These firms offer rides and other entertainment attractions for the purpose of entertaining millions of customers. According to an International Association of Amusement Parks and Attractions (IAAPA) survey, 28% of Americans surveyed visited an amusement park last year and 50% of Americans indicated that they plan to visit an amusement park within the next 12 months (IAAPA, 2011).

Schlitterbahn Waterparks

Schlitterbahn Waterparks is a family-owned and operated company focused on providing customers a safe, clean, unique, and innovative family entertainment experience. The company opened its first park in New Braunfels, Texas in 1979 and since then this park has grown to be one of the largest in the nation, spanning over 65 acres. Now the company operates a total of three parks in Texas and one in Kansas City, Kansas. All of these parks offer guests a number of family friendly amenities, including free parking and free inner tubes, as well as allowing families to bring in their own food and beverages into the park, excluding alcohol and glass containers.

Schlitterbahn Waterparks are seasonal parks, typically operating from late-April to mid-September. One park location does offer an indoor section that has limited operations during the fall and winter seasons. This being the nature of the industry each day of operation is important to the profitability of the company. Schlitterbahn Waterparks rely on Admissions, Retail, and Food and Beverage departments to generate revenue, as well as, Operations (lifeguards), Maintenance, and Transportation to ensure the safety and well being of their customers. All departments play an important role in making Schlitterbahn Waterparks a leader in family water entertainment.

The Retail Department

The Retail Department in New Braunfels, Texas operates five key locations that stock a full selection of merchandise as well as two smaller stores and two resort locations that carry daily essentials and a small variety of other merchandise. This merchandise ranges from apparel, shoes, hats, jewelry, glassware, swimwear, towels, and much more to satisfy consumer souvenir wants and needs. With thousands of customers through the park each day, it is critical that Retail keeps each store stocked with hot selling items and eliminates waste from its operational processes in order to maximize revenue from the sale of merchandise. Figure 1 shows the hierarchy of the Retail Department to illustrate how the warehouse staff and the operational staff are organized. These staff members each have a specific job within the department but they all rely on one another to operate successfully.

Figure 1: Hierarchy of the Retail Department

In order to keep these stores well stocked the Retail Department has a team of warehouse personnel that arrive every morning at 6:30 am to print a *pick list* (a list of all

merchandise sold the previous day) they then pull that merchandise. After all of the merchandise is pulled and scanned to the stores it is loaded into a van and delivered for the in-store staff to replenish the shelves. Once this is done the store supervisor will look for any areas within the store that may not have been filled completely. This *lack of fullness* may be a result of many different things, such as they may have sold out of a particular item and they need to request something new to replace it, a display may have been redone to look more appealing, or there may have been theft or damages. Based on this lack of fullness the store supervisor will make an order of what they need. The list is then sent to the warehouse, the items are pulled, and the merchandise is delivered to the stores. All of this is done in order to maintain the appearance and to meet customer expectations.

Past Improvement Initiatives

Past improvement initiatives began by describing the original process in detail to better understand where bottlenecks, waste, or unnecessary steps were occurring. The manual order process begins in the store when the store supervisors recognize there is a need for additional merchandise, thus generating a handwritten list of items needed. Once the store supervisor has completed a custom order (a hand written list), they call the warehouse and let them know “the list is ready.” Since each store varies in size and staffing the orders are completed at different times. The warehouse personnel do not leave to fetch the orders until all stores have called in, which results in a delay. Another reason that there may be a delay between when the list is called in and when the warehouse driver leaves is if the driver is occupied by another project. In some cases a

retail operations manager may pick up the orders. This can lead to confusion and lost orders. The estimated time of these delays is between 20 minutes and an hour.

The driver (warehouse staff member) is dispatched and heads to each retail location to pick up the order lists. Along the way, they may encounter delays such as seasonal New Braunfels traffic and other stops (deliveries, appointments, unforeseen interactions with coworkers or customers). This can take 20-45 minutes depending on the number of stores they need to stop at and the number of delays they encounter. After all the orders have been picked up the driver returns to warehouse, again delayed by traffic, taking 10-20 minutes.

Once the driver returns he places the orders in a bucket and as warehouse personnel become available to pull the list they take the orders out of the bucket. In some instances there may be a delay if there is not enough personnel to pull all the lists at once or if they are working on another project. Generally these orders take priority and the warehouse staff will begin pulling immediately. The estimated time a list will sit in the bucket is 0-10 minutes.

Warehouse personnel walk through the aisles of inventory and pull the requested items from the shelves and then place these items in a designated holding area specific to each store. Some of the issues with these orders that may result in errors are that they are not always easy to read since they are hand written, the supervisor may not have filled in all of the specified columns like size or color, and they are not written in the same order that the warehouse aisles are laid out in. If the list is requesting an item that is out of stock or the warehouse staff pulling the list is missing information they then have to call the store to find out what they really needed or what they can send in replacement of the

out of stock items. Since there are only two phone lines, there can be delays in wait time to call multiple stores, which can vary from 5-15 minutes. In addition, some supervisors will request more items than other supervisors so it may take longer to pull those orders. To pull orders for all of the stores can take 20-45 minutes.

Once there are no more orders in the bucket to be pulled, available personnel begin the scanning process, although there may be other personnel still pulling orders. Since the inventory is specific to each location, every item must be scanned to that location. At each holding area, the personnel will scan these items with a barcode scanner and placing them in grey totes. Once the tote is full it is closed and labeled with the location destination on a hot pink piece of paper taped to the top of the tote. After all of the items on the order have been scanned and packaged in totes the totes are moved to the loading area at the front of the warehouse. It takes approximately 20-40 minutes to complete scanning all items for all locations, packaging them, labeling the totes, and then moving them to the loading area.

The full totes are then moved to the loading area where they wait to be loaded in the delivery van until all the totes are ready (5-10 minutes). One or two warehouse personnel then help the driver load the van and one will travel with the driver to unload. Estimated time to load the van is 5-10 minutes. The driver and one warehouse staff member leave to deliver the orders. While transporting the orders they face the same delays mentioned at the beginning of the process: traffic, additional stops/activities, customer interruptions, and unnecessary interactions with coworkers or friends. These delays make delivering the orders take 20-45 minutes. The orders are unloaded at each location in 5-10 minutes completing the order fulfillment cycle.

The process map in Figure 2 on the next page illustrates the original as-is process for manual order fulfillment of retail merchandise at Schlitterbahn in New Braunfels. In order to begin thinking of ways to improve the process we need to fully understand how the current process works and process mapping provides an illustrated picture of the process. As seen in Figure 2 we used the basic symbols to illustrate when certain types of steps are taken, like decisions, movements, delays, etc. By examining this diagram we could better determine which steps add value and which do not. This then provided more insight into simplifying the work and determining if the work needs to be done in the first place.

Through the use of continuous process improvement tools like the Fishbone diagram, interrelationship diagraph, check sheets, and Pareto chart the past improvement initiative was able to identify some of the root causes of delays in the manual order process. In order to construct the Fishbone diagram or Ishikawa diagram the project team defined the problem as “problems with the manual order process”, and then used input from Schlitterbahn’s management team to fill in the causes. The major causes on which to build the fish-like structure were defined as people, product, the list, and transportation. This brainstorming activity was aided by the written input of the retail team. From here the project team decided to apply some of the primary issues to an interrelationship diagraph to better understand the causal relationship between them with the hope of determining where we can apply process improvement initiatives for the greatest impact.

Figure 2: Original Process Map

Many of these issues that initially appeared in our cause-and-effect analysis and interrelationship diagraph where carried through to the construction of a check sheet to measure the frequency in which these issues occur. Based on the results of the check sheet observations, the two delays that had the highest number of observations were traffic delays and out of stock inventory. As shown by the process map traffic delays are incurred twice during the process because the lists have to be picked up and then the ordered merchandise have to be delivered to the stores. The benefit of completing a check sheet is this information can be used in generating a Pareto chart. Having a Pareto chart helped the project team identify and prioritize the problems to be solved. Traffic delays made up 25.85% of the delays in the process followed by out of stock items accounting for 24.49% of delays (and errors). Combined these two issues accounted for approximately 50% of the total delays for the manual order fulfillment process. This Pareto analysis indicated that these two issues should be prioritized in applying process improvement efforts.

The project team recommendations to the retail department included electronic order submission, order standardization, and employee training to improve the manual ordering process. Electronic order submission was directed at eliminating the delays related to initially picking up each stores orders. Order standardization was suggested to create consistency in the written orders each supervisor was making. Finally, employee training is a valuable tool for process improvement. The project team recommended that employees should be trained on a regular basis to identify out of stock items and how to more effectively handle filling the void those items may have left in the stores.

Based on the project teams recommendations the project as-is process can be seen in Figure 3. It is this point that is the starting point for applying continuous process improvement efforts for this thesis. Since the process map in Figure 3 is only an estimate of how the process may look the new project team will generate a new process map within the constructs of the DMAIC cycle.

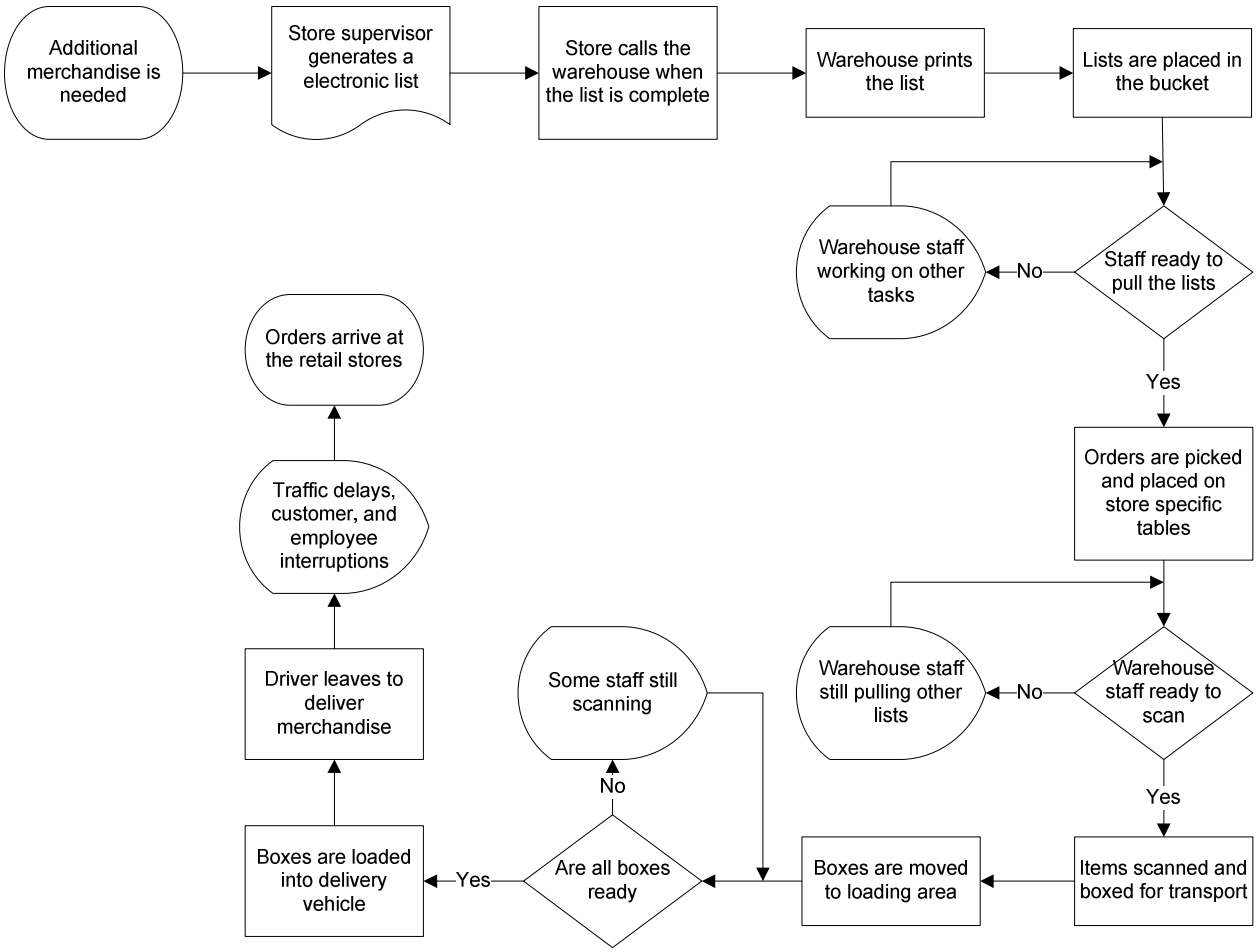

Figure 3: Projected Process Map

Problem Statement

This study will use the retail department at Schlitterbahn Waterparks in New Braunfels, Texas as the illustration of implementing continuous improvement efforts. Schlitterbahn in New Braunfels has been voted the World's Best Waterpark 13 years in a row and is an industry leader in providing water rides and attractions for guests (Baldwin, 2010). Currently, there is very little research on continuous improvement within this industry and so it is difficult to gauge how well Schlitterbahn is doing in terms of process improvements.

Even though the management team has seen considerable improvement in operations through process modifications and the application of new technology, there is the possibility for further improvement. Potential improvements would lead to a reduction in merchandise pulling errors, waste in the form of unnecessary transportation, and improved internal and external customer satisfaction. Currently, the company and the retail department lack a structured plan for continuous improvement efforts. In addition, they lack a method to measure current processes to determine where improvements need to be made.

One of the challenges the company faces in trying to move forward with continuous improvement efforts is resistance to change both by employees and management. Overall, the company culture plays an important role in the success or failure of process improvement projects. Currently, the culture is not driven to make continuous improvement a priority, which affects the motivation of employees and the management team.

The lack of focus on making improvements to services and processes will result increased costs. The management team lacks the understanding of process improvement tools and techniques, making it difficult for them to measure current standards and make recommendations for improvement projects.

Purpose

The purpose of this thesis is to effectively apply the concepts of continuous process improvement in order to provide a framework for retail operations in the water park industry and determine areas where improvements would yield higher overall value for the company. If mistakes and delays can be reduced, the company has a better chance of keeping store shelves stocked with the right merchandise to maximize revenues and increase overall profitability. In order to determine the areas for improvement the project team will use the DMAIC methodology, which is a popular quality tool for process improvement. To direct continuous improvement initiatives DMAIC consists of five stages: define, measure, analyze, improve, and control.

Research Objectives

1. Define the objectives and benefits of continuous improvement within organizations, including waste reduction, costs of quality, value added activities, training and organizational culture.
2. Identify each phase of the DMAIC project methodology as well as its potential strengths and weaknesses for process improvement projects.

3. Explore qualitative and quantitative analytics commonly used to measure current processes to determine bottlenecks, waste, and other issues that need management's attention.
4. Demonstrate the interconnectivity of these elements with change management, company culture and employee motivators.
5. Identify a framework built upon DMAIC project methodology for amusement park process improvement needs.
6. Determine areas of possible improvement relative to waste reduction, cost reduction, and improved quality of service to internal and external customers.

CHAPTER II

LITERATURE REVIEW

Continuous Improvement

Continuous improvement is a strategic approach for an organization's ongoing efforts to eliminate waste, simplify the design of both products and processes, and improve quality and customer service. This quality philosophy assumes further improvements are always possible and there is a never-ending effort to expose and eliminate root causes of problems. Efforts are customer focused and use continuous incremental improvements as opposed to giant changes in a product, service, or process to create customer value. Competition and increasing standards of customer satisfaction has proven to be the endless driver of performance improvement efforts for an organization (Bhuiyan & Baghel, 2005). This is more readily achieved as the quality of the firm's employees is improved, when managers give employees the tools, support, and encouragement to help them identify problems, evaluate alternatives, and make the appropriate decisions (Nakhai & Neves, 2009).

Brief History

During the late 1800s and early 1900s, much attention was given to scientific management; this involved developing methods to help managers analyze and solve production problems using scientific methods based on tightly controlled time-trials to

achieve proper piece rates and labor standards (Bhuiyan & Baghel, 2005). In the 1920s, Walter Shewhart, a physics PhD, developed the first statistical control chart by assigning controls and studying how these influenced the results of a manufacturing process. One of many common-sense processes he introduced is known as the *Shewhart Cycle*-plan, do, check, act (George, Thomas, & Weimerskirch, 2006). As an admirer of Shewhart, W. Edwards Deming took his teachings and applied them to new types of situations and is historically known for his contributions in Japan. He taught Japanese business leaders statistical quality control concepts by creating Deming's "14 points", which emphasized that it is management's job to optimize the system (Evans, 2005).

The Japanese continued to develop the concept of quality control, which was used initially in the manufacturing process, and has evolved into a management tool for ongoing improvement involving everyone in an organization (Bhuiyan & Baghel, 2005). Sometimes continuous improvement is referred to as kaizen, a Japanese term, which suggests the cumulative effect of hundreds or thousands of small improvements are what create dramatic change in performance (Unknown, 2008). Kaizen originated in Japan in 1950 when the management and government acknowledge that there was a problem in the current confrontational management system and a pending labor shortage (Singh & Singh, 2009). By the 1970s, many Japanese organizations had embraced Deming's advice and were very quickly enjoying the benefits of their actions. Most notable is the Toyota Production System, which spawned several business improvement practices utilized heavily in Japan, including just-in-time inventory (JIT) and Total Quality Management (TQM) (Evans, 2005).

Eliminating Waste

Since the primary goal of continuous improvement is to eliminate waste it is important to understand management's rational for waste removal and what constitutes as waste. The use of waste removal as a means to drive a company's competitive advantage was first pioneered by Toyota's chief engineer, Taiichi Ohno, and sensei, Shigeo Shingo (Hines & Rich, 1997). Originally orientated at improving productivity rather than quality, the idea of waste removal meant that improved productivity would lead to leaner operations, which help expose further waste and quality problems in the system. Thus, the systematic attack on waste is also a systematic assault on the factors underlying poor quality and fundamental management problems.

The types of activities that take place throughout a process can be categorized into three types of functions: value added, necessary but non-value added, and non-value added. In order to determine where waste is occurring in the process it is important to map out the process to determine what activities fall into each of the three categories. Value added operations are those that involve the use of resources to transform products or services form, fit, or function such that it adds value to make someone, i.e. the customer, else better off than before (Basu, 2009). Necessary but non-value added may be wasteful but they are required under the current operating procedures and support the business' ability to operate and produce products. Changes to these activities in the process may not be easily possible. Finally, non-value added activities are pure waste and involves unnecessary actions that should be eliminated completely. Often this is referred to as muda, the Japanese term for waste or anything that does not add value to the process.

As established by the Toyota production system (TPS), the seven commonly accepted wastes in a production process are: overproduction, waiting, transportation, over processing, excess inventory, unnecessary motion, and defects (Hines & Rich, 1997).

1. Overproduction – this occurs when companies continue to produce products and services at a rate greater than demand. It leads to excessive lead and storage times which may result in late detection of defects, artificial pressure on work rates, and excessive work-in progress inventories.
2. Waiting – when time is being used ineffectively or there is a delay in the process. These occur when goods are not moving or being worked on which affects both the products and employees.
3. Transportation – this involves goods being moved about. Excessive movements likely involve double handling and may result in damages or defective products.
4. Over Processing – this is the result of companies utilizing overly complex solutions to simple procedures. This can discourage employee ownership and encourage employees to overproduce to recover large investment costs.
5. Excess Inventory – the company caries too much inventory in the form of raw materials, parts, work-in-progress, and finished goods. Too much inventory hides problems and has an opportunity cost, where funds could have been invested elsewhere to yield a higher return.
6. Unnecessary Motion – the ergonomics of production where employees have to stretch, bend, and pick up which may result in employee injury and product defects. In addition, simply walking is another example of employee motion that leads to waste.

7. Defects – when products and services do not meet the design specifications and any mistakes must be corrected. The bottom-line is that defects are a direct cost to a company that possibly could be avoided.

In order to be successful at continuous improvement efforts, organizations should understand the rational for waste removal and what constitutes as waste. For all companies there is a cost associated with waste and so it stands to reason that by eliminating waste a company would become more productive and in turn more profitable, everything else being constant. To find and eliminate as much waste as possible tools for measurement and analysis should be utilized to determine where waste is occurring. These tools will be discussed in a subsequent section.

Costs of Quality

For all organizations quality plays an integral role in the design of, process to create, and ultimately the customer's satisfaction with products and services. Many, if not all, continuous improvement initiatives are the result of a variance between current quality and desired quality in a product, service, or process. To better understand the role of quality in continuous improvement initiatives this section will define quality, the costs of quality, and the effect of quality on an organization.

There are many different definitions and dimensions of quality in books and academic literature. One constant theme in the various definitions of quality is that the characteristics of the product, service, or process meet the requirements of internal or external customers and results in satisfaction. An organization's quality strategy is made up of three dimensions: product/service quality, process quality, and organization quality.

Product quality should be defined by the performance, features, reliability, conformance, durability, serviceability, aesthetics, and perceived quality requirements to meet customer requirements. Process quality should also be defined by the criteria of acceptable service level so that the conformity of the output can be validated against the criteria. Organization quality dimensions include top management commitment, sales and operations planning, single set of numbers, using tools and techniques, performance management, knowledge management, teamwork culture, and self-assessment (Basu, 2009). These three dimensions of quality support TQM, a philosophy that requires the cultural embrace of an organization and every member of an organization is responsible for its success. TQM focuses on careful, team-oriented planning, design, and control of processes during the creation of a product (Ramseook-Munhurrun, Munhurrun, & Panchoo, 2011).

Management will always be interested in the profitability of an organization, and since profitability is affected by costs it is important to understand the total costs of quality. The cost of quality is derived from the non-value added activities or wastes in the process including control costs and failure costs. Prevention costs are part of the control costs in an organization and include activities such as quality planning and administration, process analysis and improvement, employee training, and product design verification. Most firms that invest money to prevent poor quality see this investment as paying for itself since it reduces the cost of poor quality, hence the expression “quality is free”. The other element of control costs are appraisal costs which are the costs associated with discovering defects before the customer is affected. These activities take place every day in companies across the world, from inspection, product testing, and

quality audits, to labor checking. The second element of the total cost of quality is failure costs, which includes internal and external failure costs. Internal failure costs are incurred when the company spends money to repair, replace, or discard poor-quality work prior to the customer's purchase or use. External failure costs result when poor-quality work reaches the customer and a company must spend money related to warranty costs, service costs, product recall or returns, legal judgments, and regaining lost goodwill (Sharabi & Davidow, 2010). Overall poor-quality costs are those related to appraisal, internal and external failure, and should be the focus of continuous improvement initiatives.

Philip B. Crosby, author of *Quality Is Free*, developed a four-point quality management philosophy: (1) "Quality" means conforming to a set of specific requirements, (2) A company's objective should be to prevent nonconformance, not appraisal, (3) The only standard for performance is "zero defects", and (4) The cost of nonconformance is the only measurement of quality. He argued that as companies spend more on preventing poor quality from occurring in the first place, less money will be spent on appraisal, and internal and external quality problems will diminish or even disappear. When these poor-quality costs decrease, revenues should increase at least significantly enough to cover the costs of prevention, making the cost to maintain a high level of quality "free" (Kiani, Shirouyehzad, Bafti, & Fouladgar, 2009). Prevention costs are a result of continuous improvement projects that work to expose the areas in the process that result in poor-quality costs. It seems like common sense that improving quality would improve profitability but in many instances, companies have a difficult time linking these activities.

Critical Success Factors

Despite the demonstrated benefits of continuous improvement, many organizations struggle to make this philosophy a reality. There has been much research on what the critical success factors are for implementing continuous improvement in an organization and much of this research has a common elements: commitment of top management, education and training, culture change, customer focus, clear performance metrics, and attaching the success to financial benefits.

- *Commitment of Top Management*: This has been found to be the leading factor of whether a project will be successful or not. It needs to be "top-down" rather than initiated be a particular department or from the ground. Top management involvement helps to influence and restructure business organizations and the culture change in attitudes of individual employees toward quality in a short implementation period.
- *Education and Training*: This helps employees understand the fundamentals, tools, and techniques of continuous improvement. Training is part of the communication process to make sure that managers and employees apply and implement these techniques effectively.
- *Culture Change*: In order for continuous improvement to be sustainable it must become a part of the organizations culture. Employees facing culture change and challenges due to implementation need to understand this requirement. Management must have a clear communication plan and channels to motivate individuals and to help them overcome resistance to change.

- *Customer Focus*: All continuous improvement initiatives should be done based on what would add value for the customer. This is emphasized in terms of critical to quality characteristics.
- *Clear Performance Metrics*: Most organizations understand the need and the value of having performance measures but they have difficulty in determining what to measure. For any continuous improvement project the performance metrics should be determined early and remain consistently applied throughout the project. This will allow the organization to see where they started at and how the continuous improvement initiative has helped improve the business.
- *Attaching the Success to Financial Benefits*: All organizations are concerned with the bottom-line and so it is important to relate the success of continuous improvement projects in financial terms. In addition, financial benefits as a measure of success makes it easily understandable for employees and helps them relate more to the projects outcome.

These are not the only factors that relate to the success of a continuous improvement initiative nor do they guarantee that a project will be successful. They are, however, a good foundation on which to build an organization focused on continuous improvement for the good of the customer.

DMAIC: Define, Measure, Analyze, Improve, and Control

The DMAIC cycle is commonly used as a basic component of the Six Sigma methodology developed by Motorola, and it is used to identify and improve any existing process that are not meeting quality standards. The standard problem-solving approach known as DMAIC has five stages: define, measure, analyze, improve, and control. The

DMAIC project methodology provides the rigor of a proven project management life cycle, and since the DMAIC cycle is so extensively used in Six Sigma initiatives, it is generally recognizable.

Define

At this stage, organizations will identify their relevant customers and their product or service requirements. These can best be determined through a Critical-to-Quality tree (CTQ), which helps derive the more specific requirements of the customer rather than just general needs (Wei, Sheen, Tai, & Lee, 2010). In addition to defining the customer and their needs the define stage identifies a specific problem within the operational processes that requires attention. Potential improvement projects are then identified based on gaps between process outputs and customer requirements. It will also be important to consider how these projects relate to the organization's strategic goals. Once the project of importance has been identified the problem must be clearly defined in operational terms that facilitate further analysis. A good problem statement should identify customers and the CTQs that have the most impact on product or service performance, describe the current level of performance, identify relevant performance metrics, and quantify the potential outcome from successful process improvement. The process of drilling down to a more specific problem statement is sometimes referred to as project scoping (Evans, 2005).

Project Charter: Other valuable information to be included during the define phase is addressing project management issues such as what will be done, by whom, and when. This information is often recorded in project documents such as the project charter which includes the problem statement, project objective statement, project scope/limitations,

project goals and targets, expected benefits and other general information on the project (Kumar & Sosnoski, 2009). The project charter is a working document for defining the terms of each continuous improvement project. It can help make a project successful by specifying the necessary resources and boundaries that will lead to success. The document will evolve as the project moves forward. Therefore, it is important to monitor the current version and communicate expectations (Basu, 2009).

Measure

The measurement stage is the start of turning the ideas and objectives of the project charter into a structured appraisal process. During this stage a data collection plan is created to measure the current performance, also known as the as-is process. This is important in order to determine if improvement initiatives are successful and waste has been reduced. These measurements are then linked to the inputs of the process that affect performance and the outputs that affect customer satisfaction (Chakrabarty & Tan, 2007). This begins by generating the process flow map to visually illustrate the steps that take place within the process. Relevant data are collected using various tools, such as check sheets, histograms, control charts, etc. These data may come from gathering data on procedures, observation, and listening to feedback from supervisors, workers, and customers. In addition, a more detailed comparison of customer requirements and process capabilities can be performed to determine if the firm should continue to move forward. If the company determines that the project will add value to the processes it will then move on to the analyze phase, where a deeper analysis will be completed to identify the key assignable causes most likely to be causing waste in the process (Sharabi & Davidow, 2010).

Analyze

By this stage there should be a good understanding of the critical process inputs and activities that significantly impact the process outputs. It is necessary to identify and validate the root causes of problems in the process. Using the information gathered in the previous stage, analysis will determine what bottlenecks, errors, or other areas are causing waste in the process. In addition, the analyze stage will attempt to identify all possible sources of variation in the process and distinguish between special and common causes of variation (Kumar & Sosnoski, 2009). In order to conduct a thorough analysis tools such as the Fishbone diagram, the Five Whys, check sheets, and Pareto charts are utilized. Once the largest contributing cause or causes have been identified, the project will move on to the improve stage.

Improve

At this stage, ideas of possible solutions to the contributing causes discovered during the analysis stage are generated. These various options are then compared with each other to narrow down the list based on organizational goals, budget, and the most likely to be successful. Once the most promising solution is selected, it is necessary to develop an implementation plan. In many cases, the solution will be implemented using a pilot test, which is a preliminary small-scale test or study, in order to eliminate any bugs in the revised process and minimize costs should the pilot test not produce the desired results (Kumar & Sosnoski, 2009). After the solution has been implemented and satisfactory results are produced the project will move on to the control stage.

Control

The objective of the control stage is to fully implement the solution, ensure that the solution is sustained, and share the lessons learned from the continuous improvement project throughout the company. In order to maintain the improvements achieved, the organization may put tools in place to ensure that key variables remain within acceptable ranges under the modified process. These improvements might include new standards and procedures, training employees, and instituting controls to make sure improvements do not die over time (McCuiston & DeLucenay, 2010).

Tools for Continuous Improvement

CTQ Tree

CTQ is a term that is widely used within the field of continuous improvement activities to describe the key output characteristics of a process. This tool is utilized most during the define stage of a continuous improvement project. Once the project has established who their customers are, it will then move towards determining the customer needs and requirements. Essentially, the requirements of the customer should be the output of the process. A CTQ tree helps to derive the more specific behavioral requirements of the customer from his general needs. There are essentially three levels to the development of a CTQ tree, starting with level one, which identifies the customer and their general needs. At level two, the requirements to meet those needs are listed, followed by level three, the identification of specific behavioral requirements of the customer. Finally, validate the requirements with the customer through one-on-one interviews, surveys, or focus groups (Basu, 2009).

Process Mapping

This is a visual representation of all major steps in a process using process symbols that represent various types of activities in a process. It helps those involved understand the process better by identifying the actual flow or sequence of events in a process that products or services follow (Basu, 2009). This tool also helps identify the value added and non-value added activities in a process. Those non-value added activities, as discussed earlier, are waste or muda and should be the focus of process improvement efforts. This tool is developed in the measure stage of the DMAIC cycle but is often updated with greater detail throughout the project.

Cause-and-Effect Diagram

The cause-and-effect diagram is considered one of the most useful tools for identifying root causes of problems in a process, also known as a Fishbone or Ishikawa diagram, named after the Japanese quality expert who popularized the concept. The purpose of the diagram is to assist in brainstorming and enabling the identification and graphical representation, in increasing detail, the root causes of problems. As a brainstorming tool, small groups are usually formed, drawing from various contributors to the process. A facilitator guides the discussion to focus attention on the problem and causes, based on facts, not opinions. This tool requires significant interaction among group members and an effective facilitator who can listen carefully to capture important ideas (Basu, 2009). The effect is a specific problem and is considered to constitute the head of the diagram. The potential causes and sub-causes of the problem form the bone structure of a skeletal fish. This is typically used during the measure or analyze stage of a project and focuses participants on the causes, rather than symptoms of the problems.

The Five Whys

The Five Whys is a technique that is widely used to analyze problems in both manufacturing and service operations. The goal is to probe the causes of a problem to hopefully get at the heart of the problem. This tool is very straightforward and uncomplicated but very effective for identifying root causes of a problem. The basic steps of this tool include: select a problem for analysis, ask five close questions starting with 'why', and identify root causes (Evans, 2005). A facilitator will ask each question allowing time for respondents to answer directly. The respondents and facilitator applying this tool should avoid trying to defend their answers or point blame.

Check Sheets

These sheets or forms allow users to systematically record and compile data from observations so that trends can be shown clearly. The check sheet is very easy to apply and can be used to record non-conforming data and events, including the breakdown of equipment, non-value added activities in a process, and mistakes or defects related to a product (Basu, 2009). Quality related data are of two general types: attribute and variable. Attribute data are obtained by counting or from some type of visual inspection, and variable data are collected by numerical measurements on a continuous scale. To generate check sheets implementers must agree on the type of data to be recorded and decide what characteristics and items are to be checked. Next, determine the type of check sheet to use: tabular form, defect position, or tally chart. Finally, design the form and decide who will collect the data (Evans, 2005).

Pareto Charts

A Pareto chart is a special form of bar chart that rank orders the bars from highest to lowest in order to prioritize problems of any nature. It is known as 'Pareto' after a nineteenth century Italian economist Wilfredo Pareto who observed that 80% of the effects are caused by 20% of the causes: 'the 80/20 rule'(Basu, 2009). Pareto charts are applied to analyze the priorities of problems so that improvement efforts are directed to areas that will yield the greatest impact. There are usually two variants in the application of Pareto charts. The first type is the standard histogram chart where each bar represents the frequency of a particular defect or problem, in order of highest to lowest. The second type is a line representing the cumulative frequency of defects. This tool is very valuable in the define and analyze stages of the DMAIC cycle. During the define stage it can be used in determining which projects should be the focus of continuous improvement efforts (Kumar & Sosnoski, 2009). At the analyze stage a Pareto chart can illustrate which root causes lead to the highest frequency of defects or problems, thus moving the project into the improve stage.

CHAPTER III

METHODOLOGY

This section describes the set of procedures used to conduct this research as well as the underlying assumptions of the particular procedure. The foundation of this project rests upon the selection, analysis, and implementation of specific continuous improvement tools that would provide a framework that follows the DMAIC methodology for the retail department of Schlitterbahn Waterparks to create a constant driver for increased efficiency. These tools provide a means of identifying and eliminating waste in current operational processes to continuously improve the value added activities of these processes. Each individual tool provides valuable information and when they are combined, result in an overall working framework that is simple in design requiring limited training and can be utilized on a regular basis. These tools have been grouped into the recognizable steps of DMAIC: define, measure, analyze, improve, and control. An important element to remember during the improvement process is the critical success factors for implementing continuous process improvement initiatives.

- Commitment of top management
- Education and training
- Culture change
- Customer focus

- Clear performance goals
- Attaching success to financial benefits

These were incorporated into the various stages of the process to encourage overall acceptance and value of the process improvement project. In order to develop this thesis as a means to create a continuous improvement framework the area of interest will be the manual order fulfillment process which was the focus of a prior process improvement initiative the previous year.

Define

The purpose of the Define phase is to clearly define the problem, the customers impacted, and the project goals. In order to accomplish this data was collected through informal brainstorming sessions with the Retail Director and the management team. By speaking directly with the cross functional management team involved in the various steps of the process it provides multiple points of view in order to better understand how the current process works and where there is need for improvement. Specific information included a detailed description of current processes, organizational goals and objectives, internal customer requirements, and the feasibility of continuous improvement initiatives.

Project Charter

The project charter was drafted based on the results of these conversations in order to align the project with the company's and the department's strategic and operational goals. It defines the management issues such as what will be done, by whom, and when, including the following specific elements: a problem statement, overall project goal, project scope, project team members, customer requirements, tentative timeline, and

limitations. The problem statement provided a concise description of the issues that need to be addressed by continuous improvement initiatives, followed by the goal statement, and project scope. The project scope defined what the project is supposed to accomplish in clear terms and boundaries. The next two sections focused on describing the customers that are affected by the process that was selected for improvement and those attributes that are critical to the quality based on the customer's needs. The development of CTQ's is discussed further in the following section and is structured by the levels of the elements of what is considered critical to the process. In order to reach project goals the project charter included a detailed timeline at which certain steps should be accomplished. There is also a section that covers the project limitations that will affect the outcomes of continuous initiatives. Finally, the project charter lists the project management team members and their signatures, acknowledging and agreeing to the terms of the project as described. Overall, this document is vital in guiding the efforts of the continuous process improvement initiatives, providing the foundation, boundaries, and clear goals.

CTQ Tree

In order to better understand how the end customers were affected by the process a CTQ tree were developed which described the key output characteristics of the process. By clearly defining the customer it was then necessary to determine the customer's general needs and specific requirements. By using this tool it was possible to drill into the general needs of the customer to define the specific behavioral requirements of the output. Through informal brainstorming with the cross-functional management team the customer was defined as the retail supervisors that generates the manual order and receives the merchandise as an end result of the process. Subsequently the CTQ tree was

established using three levels. At the first level the team defined the customer's general needs, followed by the second level that identifies the first set of requirements for those needs, and at the last level, the specific behavior requirements of the customer.

Measure

It was during the measure stage of the DMAIC structure that the current process was carefully examined to provide the project team an appraisal of the current performance. To accomplish this, the team took part in a brainstorming session in which they applied personal observations of the process to create a detailed process map.

Process Mapping

Process mapping presented a snapshot overview of the selected process, end-to-end, clarifying what really occurs in the process. It provided a visual representation of all major steps in the manual order process using symbols that represent various types of activities in the process. The process map illustrated the flow of sequence of events that take place when processing a manual order. This tool helped build the foundation for the following phases of continuous improvement by helping identify the value added and non-value added activities in the process. This provided the baseline measurement of the process which will be used at the end of the project to determine the success of the improvement efforts.

Analyze

Once the project was understood and defined in the define stage, and then the baseline performance was documented at the measure stage, it was time to perform an in-depth analysis of the process. Through selected tools and techniques the project team was

able to identify and validate the root causes of waste within the process. The tools selected for this stage include: generating a Cause and Effect diagram, Five Why analysis, check sheets, and Pareto chart. After completing the qualitative and quantitative analysis of process information the project team was able to generate a prioritized list of sources of variation.

Cause and Effect Diagram

Cause and Effect diagrams are invaluable in brainstorming the root causes of a given problem. The first step in generating this analysis was determining the format that would group the related causes: People, Equipment, Products, Process, Management, and Environment. This combination of various inputs that affect the manual order fulfillment process was derived from the traditional 6M Diagram, which as the name implies, the bone structure is made up of: Machine, Manpower, Material, Method, Measurement, and Mother Nature (Environment). The modification to the grouping of causes was to facilitate the understanding of the project team, which has limited experience working with specific process improvement tools. Following the goals stated in the project charter the effect was then defined, putting it in a box to the left of the diagram, where a horizontal line is drawn the length of the page with six main branches off of which the root-causes can be grouped and mapped. Present in the brainstorming sessions, I acted as the facilitator providing guidance of topic discussions and probing questions for getting a detailed illustration of causes and sub-causes.

Five Whys

Based on the same effect used in the previous tool the Five Whys probed the causes of the problem, getting to the heart of the problem. As the name implies, this analysis tools involved systematically asking five questions successively. These questions were closely related, each starting with 'why'.

1. Why are there delays in the manual order process?
2. Why does this happen?
3. Why has it not been changed?
4. Why does it work this way?
5. But why?

To collect this information each member was individually asked each of the five questions and their responses were then recorded. The respondents were asked not to defend their answers or blame others, as well as, refraining from offering possible solutions until the analyze stage was complete.

Check Sheets

A check sheet is a simple and convenient recording method for collecting and identifying the occurrence of events. The data to be collected were how often certain activities occurred during the manual order process. The check sheet form was prepared in advance of recording the data deriving key elements for observation from previous tools including the Cause and Effect Diagram and the Five Whys. The activities to be recorded consisted of the following:

- Hot Sheet not submitted
- Boxes returned

- Out of stock items
- Lost network connection
- Hot Sheet not deleted
- Deliveries
- Transfer mistake
- Phone calls made

Data were then collected by the project team over the course of two weeks for four separate retail locations. The recording of data was done by making tally marks based on the activities occurrence. Table 1 illustrates a sample check sheet that was used to collect the necessary data. The totals from this analysis were then applied to the Pareto Chart.

Table 1: Sample Check Sheet

Store 1 (Main) 8/8 – 8/14	MON	TUES	WED	THUR	FRI	SAT	SUN
Hot Sheet not submitted							
Boxes returned							
Out of stock items							
Lost network connection							
Hot Sheet not deleted							
Deliveries							
Transfer mistake							
Phone calls made							

Pareto Chart

The Pareto chart is a special chart that contains both bars and a line graph, where the bars are rank ordered from highest to lowest in order to prioritize problems in the process. Named after Wilfredo Pareto, a nineteenth century economist who observed that 80% of the effects are caused by 20% of the causes, thus the 80/20 rule (Basu, 2009). With the data provided by the check sheets the project team then plotted the Pareto chart with causes along the x-axis and the frequency occurrence along the y-axis. The causes

were charted in descending order of values from left to right based on the percent of total frequency that activity occurred. For the second half of the Pareto chart analysis the team calculated the cumulative percent for activity occurrences which was then plotted as a line graph to complete the Pareto chart. The importance of this analysis was to provide the project team a clear illustration to guide improvement efforts, focusing on priority areas that would have the greatest impact.

Improve

Based on the results on the analyze stage the project moved into the improve stage which focused on generating solutions to eliminate or reduce the contributing causes of waste in the manual order process. First the project team conducted a brainstorming session designed to generate creative solutions, “thinking outside the box”. Even though many creative improvement solutions may not be feasible, this first step allowed the team to challenge assumptions, listing ideas without comments, discussions, or criticisms. After a short break, the team returned to evaluate and select the most promising ideas. This process required confirmation that the proposed solution would positively impact key process variables. Based on the organizational goals, budget, and the likelihood of success these solutions were ranked to see which one to pursue in a pilot test.

With the most promising solutions selected the team then worked on applying these solutions to a pilot test. This provided the team a means to ensure a workable and effective solution is reached. Using the same four retail locations observed during the check sheet analysis, solutions could be applied on a small scale limiting investment risk. Based on the results of the pilot test the team learned what worked, what did not, and what changes or modifications could improve the effectiveness of the solution. Once the

results met expectations the team moved the project into full implementation. Since the four largest stores were already using the improved process the remaining stores should smoothly transition.

Control

The Control stage focuses on maintaining the improvements, which means putting tools in place to ensure the key variables remain within acceptable range under the modified process. These tools include establishing new standards and procedures, training the workforce, and instituting controls to verify the changes are adopted. The first step was adding process changes to staff handbooks, providing documentation for reference and clear guidelines. A structured employee training was then developed for all staff members to take part in. The overall control and enforcement of process modifications is the responsibility of the management team.

Limitations

By designing this process to be straight forward to accommodate the application within a company with no previous process improvement experience or training it has certain limitations. These limitations are both the result of the chosen methodology and the process being studied.

The financial analysis of this project was limited both at the request of the company and as a result of the methodology. In the initial stages of the project there was no development of a budget for possible improvement recommendations. The goal of management was small modifications that had no real financial investment, to make improvements to the process. The most substantial savings would be recognized in labor

savings for the department, but minimum staffing levels may require that those employees still be present, therefore the savings is not as easily recognizable.

The second limitation has to do with the extent to which the findings can be generalized beyond this study. This study was limited to one process, in one department, in one company within the amusement park industry. However, the DMAIC method has the capability of application in numerous situations and should be further applied and studied across various processes, departments, and companies. The results of this study will provide a basis for further improvements.

Additionally, this study was significantly affected by uncontrollable variables within the process being studied. The warehouse staff and store supervisors were randomly assigned and therefore the results of data collection may be skewed based on the mistakes or actions these employees may be prone to making. Due to the nature of the industry, having such a short operating season, the company culture has a sense of constant urgency. When they observe a task that needs to be completed they immediately work to complete it. This means they do not take the time to study the process of the task and do not always employ the most efficient and effective means for accomplishing the task at hand.

CHAPTER IV

ANALYSIS AND DISCUSSION OF RESULTS

The amusement park industry is a unique industry and there is little published about how specific processes within each company are completed on a regular basis and how they handle process improvement to increase efficiency and effectiveness. However, as a result of the decision to implement the DMAIC methodology in continuous process improvement initiatives Schlitterbahn Waterparks has taken its desire to improve the systematic quality of internal services to a higher level.

In the define phase, the project team applied the following DMAIC tools: project charter and CTQ tree. The first stage of results included a complete project charter that defined the problem statement as "Each retail location submits manual orders as needed, the warehouse staff then work to satisfy those orders. This process lacks structured procedures and leads to various types of waste such as mistakes, unnecessary transportation, and additional employee labor." This document also covered the scope of the project, a goal statement, and other driving factors for the project. Also incorporated into the project charter were the customers and the critical to quality attributes which were taken from the development of a CTQ tree which is shown in Figure 4. The customers were defined as the retail supervisors that generate the manual order and receive the merchandise as an end result of the process. The general need of the

customer, established as the level one need, was recognized as the need to replenish each of the retail locations. The level two needs, which are the first set of requirements, include receiving the correct merchandise, timely delivery, and the ease of order placement. Level three works to identify the specific behavioral requirements of the customer which were discovered to be speed, technology, transportation, and number of items.

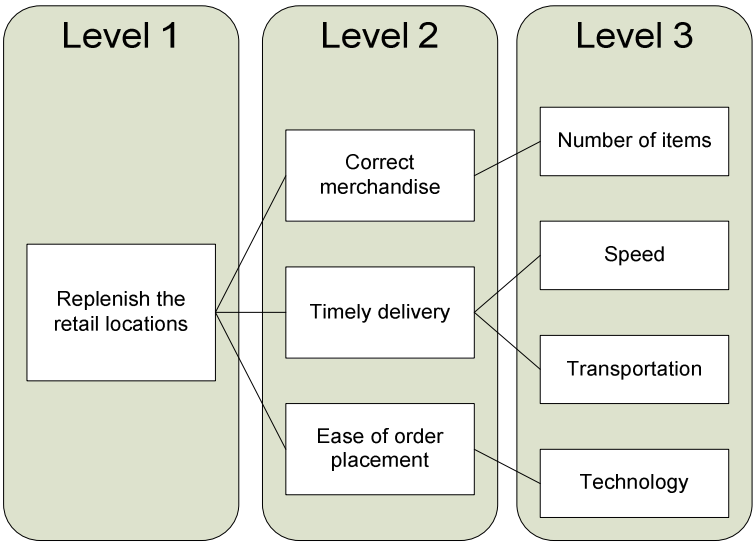

Figure 4: CTQ Tree

With the selection of the process to be studied and the customers defined the project then moved into the measure stage. The results of the brainstorming of current manual order processes resulted in the development of a process map (Figure 5) that illustrated the steps that occur, including activities, delays, and decisions that take place. This process starts with the manual order being electronically generated by the store supervisors, which is then sent and automatically prints on a printer in the warehouse. The warehouse manager on duty then takes the list and assigns them to any available warehouse staff member. The manual order, also known as a Hot Sheet, takes priority over any other tasks being completed in the warehouse. When this document is

electronically generated it is designed list needed items based on their bin locations within the warehouse so the staff can easily pull the items being requested. As the staff pull the items they place them on different tables designated for each retail location. Once the staff member has completed pulling their list they begin scanning and boxing the merchandise for delivery. The boxes are then labeled with the retail location destination and moved to the loading area. The warehouse manager on duty must then determine if all stores have been completed, if not they contact the stores that have not submitted an order and must determine if the ready deliveries should go out or wait. Once the manager has determined the deliveries should go out the boxes are loaded into the delivery vehicle and the driver leaves to drop off the boxes. During the delivery of merchandise the driver may encounter various delays such as traffic, customer interruptions, and distraction from retail store employees. As Figure 5 illustrates each of these steps and how a manual order moves through each of these steps. This mapping of current process steps provided the basis on which the improvements could be measured.

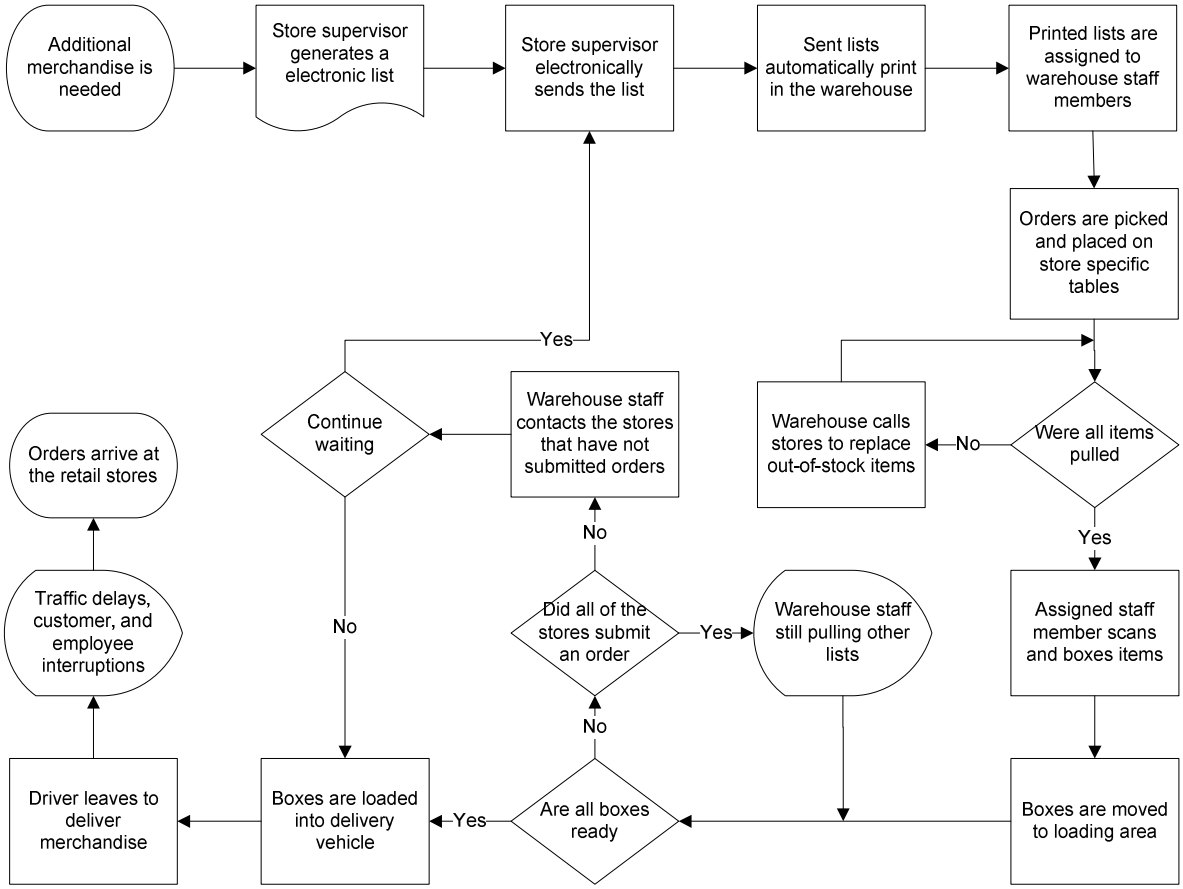

Figure 5: Current As-Is Process

During the analyze stage the project team applied multiple quality tools to gather both qualitative and quantitative data to support project related process improvement decisions. This was accomplished through cause-and-effect diagraming, five why questioning, check sheets, and Pareto charting. The first analysis conducted was the cause-and-effect analysis, by having the project team brainstorm the causes related to "inefficiencies in the manual order process," which was designated as the effect to be analyzed. Respondent responses were grouped into six categories: people, equipment, products, process, management, and environment. The completed diagram is shown in Figure 6 on the following page.

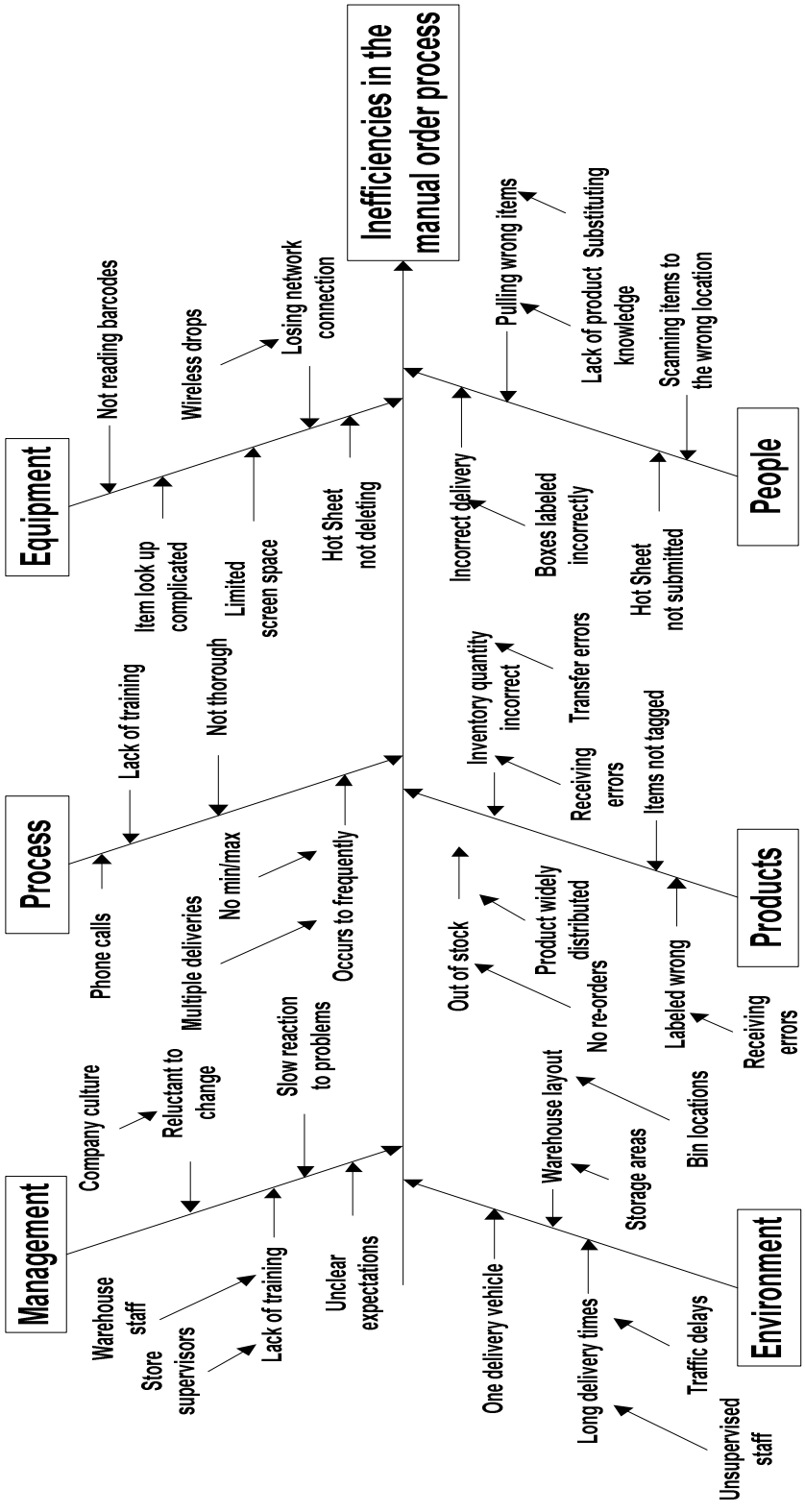

Figure 6: Cause and Effect Diagram

The results of the cause and effect analysis were then compared to the responses of the five why questioning to determine which issues would be the focus of quantitative data collection through check sheets. The eight primary causes selected for further observational research are listed below.

- **Hot Sheet not submitted:** When the Hot Sheet is not submitted it adds waste to the process in the form of waiting. The warehouse manager must seek out the store supervisor and then determine if the ready merchandise should be delivered or wait for all store orders.
- **Boxes returned:** This is a result of the manual order process and consists of the wrong merchandise being pulled for the retail location.
- **Out of stock items:** This issue is one of the initial reasons for needing a manual order. Often the store supervisor will put out-of-stock items on their list even though the electronic order generator shows the stock levels of items added. If left on the order warehouse staff may waste time looking for an item they are out of.
- **Lost network connection:** When the network connection is lost the system is essentially down. The scanner devices still appear to be working but they are not actually recording any information, leading to inventory inaccuracies.
- **Hot Sheet not deleted:** When the Hot Sheet is not deleted any subsequent orders will be added to the original order. This results in the wrong merchandise being pulled and merchandise returns to the warehouse at a later time.
- **Deliveries:** Traffic is an uncontrollable cause of the delays in manual order fulfillment cycle time. In addition, interruptions from customers while delivering

merchandise and staying in the stores longer than needed to visit with co-workers add delays.

- **Transfer mistake:** This occurs when boxes are delivered to the wrong location. Possibly the boxes were labeled incorrectly or the staff delivering was not paying attention.
- **Phone calls made:** Since Schlitterbahn is trying to keep their stores fully stocked they require the warehouse staffs call whenever they have any questions about the supervisor's list. There is only one main line and a secondary line available for the warehouse staff to use to call the stores and so the staff may have to wait to make the necessary calls.

The check sheets measured the frequency each primary cause occurred and provided the necessary data for a Pareto chart. The results of this data collection effort are shown in Table 2. This type of analysis is very valuable for management since it clearly highlights the most substantial set of problems within the process. As shown in Table 2, deliveries occurred most frequently and as the Pareto analysis will illustrate, this should be a focus for the process improvement team.

Table 2: Check Sheet Totals

Manual Order Delays	Store 1 Week 1	Store 2 Week 1	Store 3 Week 1	Store 1 Week 2	Store 2 Week 2	Store 3 Week 2	TOTAL
Hot Sheet not submitted	2	1	1	1	2	0	7
Boxes returned	13	10	9	8	7	9	56
Out of stock items	11	5	6	6	6	5	39
Lost network connection	2	1	0	1	0	0	4
Hot Sheet not deleted	2	1	1	1	2	2	9
Deliveries	16	14	13	14	15	15	87
Transfer mistake	2	1	0	1	0	1	5
Phone calls made	12	7	8	14	11	12	64

The Pareto analysis, illustrated in Table 3, ranked the process problems highest to lowest stating with deliveries (32%), phone calls made (24%), boxes returned (21%), out of stock items (14%), Hot Sheet not deleted (3%), Hot Sheet not submitted (3%), transfer mistake (2%), and lost network connection (1%). This indicated that the focus of continuous improvement should be placed on reducing the frequency of deliveries followed by phone calls and boxes returned.

Table 3: Pareto Analysis

	Frequency	Percent of Total	Cumulative Percent
Deliveries	87	32%	32%
Phone calls made	64	24%	56%
Boxes returned	56	21%	76%
Out of stock items	39	14%	91%
Hot Sheet not deleted	9	3%	94%
Hot Sheet not submitted	7	3%	97%
Transfer mistake	5	2%	99%
Lost network connection	4	1%	100%
Total	271	100%	

A Pareto chart was also provided to the management team to graphically show the important areas to focus on for continuous improvement efforts. Figure 7 presents the frequency of each of the eight primary cause for delays or waste in the manual order process.

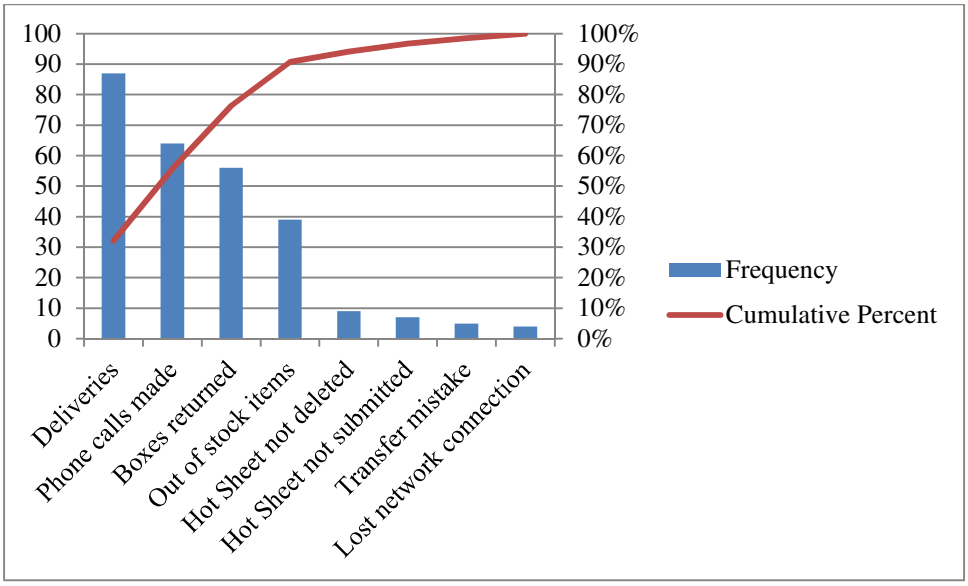

Figure 7: Pareto Chart

The improve stage generated a list of possible solutions for improving the process with specific emphasis on the primary causes identified during the previous stage. Brainstorming yielded a multitude of possible solutions, some seemingly obvious and some that were more extravagant. From this list the project team evaluated the solutions to determine which would be likely to succeed and have a substantial impact on improving the process. The most promising ideas included: having scheduled delivery times, training the supervisors to check inventory levels on requested items, and providing supervisors an inventory list each week of overstocked merchandise. By scheduling the deliveries there should be more orders ready to go at the same time versus taking out one order only to take out another as soon as the driver returns to the warehouse. The scanner system for generating the manual order does have the functionality to check the inventory level at every store, so training the supervisors to make better use of the available technology would reduce the reliance on phone calls between the stores and the warehouse. In addition, by providing the store supervisor a list of overstocked merchandise they can replace the merchandise they have run out of with something else, without calling the warehouse.

With the solutions selected the project team worked to create a pilot test using the four primary retail locations. The delivery times were set at 10am and 4pm to cover the merchandise needs that may occur during the day. This was discussed with the supervisors at the beginning of each shift, as well as, a short training on inventory look up. The training required each supervisor to go through the steps of using the scanner to do an inventory look up on specific items randomly chosen. They were then asked to explain what they should do if they come across items that were out of stock. From there

the project team illustrated the use of the list of over stocked merchandise and how to choose replacement merchandise. At the beginning of the pilot test the warehouse had to call the stores on a regular basis to remind them to have orders submitted before the designated delivery times and the stores continued to call the warehouse with inventory questions. By the end there was a reduction in the frequency of deliveries and phone calls made. The project team then determined it was appropriate to apply the solutions to all retail stores. There was a relatively smooth transition since most supervisors and warehouse staffs were already familiar with the process changes.

Due to the seasonality of Schlitterbahn Waterparks operations were reaching closing for the remainder of the year by this point in the DMAIC methodology. Thus, a control plan had to be developed to be implemented at the start of the following season. The first step was to make the necessary modifications to the supervisor and warehouse employee handbooks to reflect the changes in the manual order process. Next, a structured training of the process was designed to be incorporated to the manual annual training the each retail staff member must attend. Finally, management had to determine the controls they were going to use to verify that the process was being executed appropriately. They determined check points at which they would contact the warehouse to confirm the deliveries were going out on time. Management would also work closely with supervisor to make sure they understand the scanner technology and how to use the overstock document.

CHAPTER V

CONCLUSION AND RECOMMENDATIONS

Conclusion

Organizations around the world are driven to seek out ways to improve their business and continuous process improvement provides just that. The DMAIC methodology applied for this project successfully lead to substantial improvements in warehouse and store operations relating to the manual order process. This indicates a reduction of waste within the process, and as many business professional realize waste is a principal enemy of business operations. The problem with not establishing a means for continuous improvement is that waste will sink into the process leading to inefficiencies. The seven most common forms of waste are over production, waiting, transportation, over processing, excess inventory, unnecessary motion, and defects. In some way each of these can be identified in retail operations and should be the focus of future projects.

By providing a straight forward and trainable methodology for structuring process improvement initiatives Schlitterbahn will be able to apply what was learned to other areas of the company. Each tool in the DMAIC methodology structured for this project was specifically selected to provide the most usability and value for this company. The project charter in the define stage sets the overall direction of the project providing problem definition, goals, and a timeline. This document is critical for management to maintain a top-down approach, holding project team members responsible for the

process. In the measure stage the process map is the baseline of which to gauge improvements against. It puts the process into a visual aid that often sheds light onto bottlenecks, delays, and errors that may have gone unnoticed.

At the analyze stage the project team begin to research the cause-and-effect relationship of the process. The most obvious and very powerful tool selected for this is the cause-and-effect diagram which relies on the collaborative effort of the project team to brainstorm primary and sub-primary causes to a specific effect. Management should realize that process improvement is not a one-man job it is the result of the efforts of a team and this exercise builds on that. Another qualitative tool selected for this stage is five why which also digs for the root cause of the problem. From these results the management team would generate a check sheet for which to gather pertinent data that will then be used to generate the Pareto analysis. This analysis can be easily understood by management, providing them the necessary data to drive process improvement in the most appropriate direction.

The improve stage again relies on the collaborative effort of the project team to generate, select, and test possible solutions. A pilot test was included as part of the methodology to provide a way for management to test possible solutions without taking on too much risk or investment. Once the best solution has been applied the project moves into the control stage. This important step should be closely monitored by management to make sure improvement efforts are not undermined or that the process does not fall back into old habits.

There is tremendous application of traditional Six Sigma DMAIC methodology in the manufacturing industries, but as this project illustrates there is a clear benefit to similar application in service industries including the amusement park industry.

Recommendations

There are a number of recommendations that can be offered to Schlitterbahn Waterparks to maintain continuous process improvement within their organization. To begin the company should begin initiating continuous process improvement across all departments. At the start of each season each department should select a process in which there is observable room for improvement. In order to become adept at applying the DMAIC methodology and using the various tools the company should hire a process improvement specialist to work with each department director. This person would oversee the progress of each initiative, keeping them on track, linking financial benefits, and making recommendations for successfully applying the DMAIC cycle. By bringing all departments on board with continuous process improvement they can determine areas in which processes overlap and there can be a joint effort to reduce inefficiencies. For example, both the retail and the food department make deliveries throughout the day to various sections of the park. If the company developed a unified delivery method for both departments there would likely be a reduction in labor and transportation expenses.

Another recommendation would be to make better use of the available technology. This can be applied to both the retail department and as an expansion of the previous recommendation of implementing the DMAIC process in other departments. The management team for this project was working under financial constraints to find improvement solutions that required little to no financial investment. In the future it

would be possible to work with the scanner software developers to add in more specific functionality. For example, when the network drops there could be an error noise that goes off. While implementing scanning capabilities in other departments the company would benefit from general knowledge sharing of past experiences: what works, what does not, and how ideally it should work.

In order to make these recommendations and any future process improvement efforts more successful the company should focus on the critical success factors outlined in the literature review. For continuous process improvement to have employee support it must fully be supported by top management. This begins with direction of the general manager and the commitment of the department directors. They should tie process improvement initiative to manager incentives. The direction of company leaders will also impact company culture. And in order for process improvement to become a continuous element of the company the culture must support always striving to be more efficient and effective. Subsequently, employee training should be updated to reflect process changes and the importance of continuous process improvement. Employee training is likely to have the greatest impact on process improvement in this service industry. By communicating to employees the fundamentals, tools, and techniques of continuous improvement the company should be able to smoothly apply improvement initiatives.

The final recommendation for Schlitterbahn Waterparks is to clearly define performance goals and link those goals to financial benefits. One of the limitations of this project was not connecting the project outcomes to cost savings. In addition, the project goal was to reduce waste, a seemingly vague goal which could have been expanded to include expected labor reduction, error reduction, or even reducing the time it takes to

complete the process. By defining the performance goals more clearly the company will be able to assign financial value to them. It will be the dollars that will drive top management and so a cycle is formed. For continuous process improvement it needs the commitment of top management and for management to continue to push process improvement they need to validate it against something measureable, dollars.

APPENDIX A

Project Charter – Documentation of Project

Project Charter
Project Title
Continuous Improvement to the Manual Order Process
Date
August 1, 2011
Problem Statement
Each retail location submits manual orders as needed, the warehouse staff then work to satisfy those orders. This process lacks structured procedures and leads to various types of waste such as mistakes, unnecessary transportation, and additional employee labor.
Project Description
The Schlitterbahn Retail Department would like to continually work on increasing the efficiency of their manual order process. This will in turn keep each retail shop fully stocked to better serve the customer.
Goal Statement
Increase efficiency by eliminating waste.
Project Scope
This project will include the study of the current "as-is" process to determine what factors influence the manual order process. There will be brainstorming sessions with a cross-functional management team to determine root causes of inefficiencies in the process. The information from these two actions will provided a basis on which to make recommendations for improvement.
Team Members
Project Coach – Carol Keyes Retail Director – Tracey Baker Warehouse Manager – Tricia Springs Operations Manager – Casey Ortega
Customers
Retail Shop Supervisors
Critical to Quality – CTQs
Level 1: Replenish each retail shop Level 2: Correct merchandise, timely delivery, and ease of order placement Level 3: Speed, technology, transportation, and number of items

Timeline
August 1-August 20: Data collection of current “as-is” process August 22-August 26: Make and discuss recommendations with management team August 29-September 2: Implement changes on a small scale September 5-September 9: Make modifications and move to full implementation September 10-September 17: Monitor process September 18: Schlitterbahn closes for the Fall/Project Deadline
Limitations
• Short operating season • Resistance to change • High employee turnover • Lack of consistent job tasks
Signatures
Carol Keyes: _____Date: _____ Tracey Baker: _____ Date: _____ Tricia Springs: _____Date: _____ Casey Ortega: _____ Date: _____

APPENDIX B

Five Whys – Standard Form for Recording Respondent Responses

Problem for analysis: Delays in the manual order process

1. **Why are there delays in the manual order process?**

Respondent 1:
Respondent 2:
Respondent 3:

2. **Why does this happen?**

Respondent 1:
Respondent 2:
Respondent 3:

3. **Why has it not been changed?**

Respondent 1:
Respondent 2:
Respondent 3:

4. **Why does it work this way?**

Respondent 1:
Respondent 2:
Respondent 3:

5. **But why?**

Respondent 1:
Respondent 2:
Respondent 3:

Five Whys – Summary of Responses

Problem for analysis: Delays in the manual order process

1. **Why are there delays in the manual order process?**

Respondent 1: Employees are not pulling the correct merchandise from the warehouse.
Respondent 2: Store supervisors are slow to submit Hot Sheet requests.
Respondent 3: Scanner not working.

2. **Why does this happen?**

Respondent 1: Lack of training.
Respondent 2: They don't know how to work the scanners efficiently.
Respondent 3: Network problems, pushing the wrong buttons will take the system down, and login issues.

3. **Why has it not been changed?**

Respondent 1: Formal training was never done before in the warehouse. One session was conducted but not all staff was present and bad habits already existed.
Respondent 2: There is a lack of structured training.
Respondent 3: The retail department lacks sufficient IT support.

4. **Why does it work this way?**

Respondent 1: Change is hard to implement. We are a seasonal employer, so it is difficult to make changes once we have started our operating season.
Respondent 2: The new process was implemented after the season began, leaving limited time for training.
Respondent 3: The IT department doesn't have a good understanding of our systems.

5. **But why?**

Respondent 1: We are only operational a few months out of the year so it's hard to break bad habits once they are formed and we are in the swing of things.
Respondent 2: Once the season begins issues must be "on fire" to get attention.
Respondent 3: They lack the man power and the initiative to learn.

APPENDIX C

Check Sheets – Standard Form for Recording Data

Week One

Store 1 (Main) 8/8 – 8/14	MON	TUES	WED	THUR	FRI	SAT	SUN
Hot Sheet not submitted							
Boxes returned							
Out of stock items							
Lost network connection							
Hot Sheet not deleted							
Deliveries							
Transfer mistake							
Phone calls made							

Store 2 (Blast) 8/8 – 8/14	MON	TUES	WED	THUR	FRI	SAT	SUN
Hot Sheet not submitted							
Boxes returned							
Out of stock items							
Lost network connection							
Hot Sheet not deleted							
Deliveries							
Transfer mistake							
Phone calls made							

Store 3 (Wave) 8/8 – 8/14	MON	TUES	WED	THUR	FRI	SAT	SUN
Hot Sheet not submitted							
Boxes returned							
Out of stock items							
Lost network connection							
Hot Sheet not deleted							
Deliveries							
Transfer mistake							
Phone calls made							

Week Two

Store 1 (Main) 8/15 – 8/21	MON	TUES	WED	THUR	FRI	SAT	SUN
Hot Sheet not submitted							
Boxes returned							
Out of stock items							
Lost network connection							
Hot Sheet not deleted							
Deliveries							
Transfer mistake							
Phone calls made							

Store 2 (Blast) 8/15 – 8/21	MON	TUES	WED	THUR	FRI	SAT	SUN
Hot Sheet not submitted							
Boxes returned							
Out of stock items							
Lost network connection							
Hot Sheet not deleted							
Deliveries							
Transfer mistake							
Phone calls made							

Store 3 (Wave) 8/15 – 8/21	MON	TUES	WED	THUR	FRI	SAT	SUN
Hot Sheet not submitted							
Boxes returned							
Out of stock items							
Lost network connection							
Hot Sheet not deleted							
Deliveries							
Transfer mistake							
Phone calls made							

Check Sheets – Data Collection Results

Week One

Store 1 (Main) 8/8 – 8/14	MON	TUES	WED	THUR	FRI	SAT	SUN	Total
Hot Sheet not submitted	1		1					2
Boxes returned	2	1	1	2	2	3	2	13
Out of stock items	1	1	2	1	3	2	1	11
Lost network connection		1					1	2
Hot Sheet not deleted	1		1					2
Deliveries	2	1	2	2	3	4	2	16
Transfer mistake				1			1	2
Phone calls made	3	1	2	2	1	2	1	12

Store 1 (Blast) 8/8 – 8/14	MON	TUES	WED	THUR	FRI	SAT	SUN	Total
Hot Sheet not submitted		1						1
Boxes returned	2	1	1	1	1	2	2	10
Out of stock items		1	1		1	2		5
Lost network connection		1						1
Hot Sheet not deleted		1						1
Deliveries	1	1	2	2	3	3	2	14
Transfer mistake			1					1
Phone calls made	1	2	1			2	1	7

Store 1 (Wave) 8/8 – 8/14	MON	TUES	WED	THUR	FRI	SAT	SUN	Total
Hot Sheet not submitted					1			1
Boxes returned		2	1	1	2	2	1	9
Out of stock items		1	1		2	1	1	6
Lost network connection								0
Hot Sheet not deleted					1			1
Deliveries	1	1	2	2	2	3	2	13
Transfer mistake								0
Phone calls made		1	1		2	3	1	8

Week Two

Store 1 (Main) 8/15 – 8/21	MON	TUES	WED	THUR	FRI	SAT	SUN	Total
Hot Sheet not submitted					1			1
Boxes returned	1	1	1	1	1	2	1	8
Out of stock items		1	1	1	1	2		6
Lost network connection			1					1
Hot Sheet not deleted		1						1
Deliveries	1	2	2	1	3	3	2	14
Transfer mistake	1							1
Phone calls made	1	1	2	3	2	3	2	14

Store 2 (Blast) 8/15 – 8/21	MON	TUES	WED	THUR	FRI	SAT	SUN	Total
Hot Sheet not submitted			1				1	2
Boxes returned	1	1	1		1	2	1	7
Out of stock items	1			1	2	1	1	6
Lost network connection								0
Hot Sheet not deleted	1						1	2
Deliveries	2	2	1	2	2	3	3	15
Transfer mistake								0
Phone calls made	1	2		2	1	3	2	11

Store 3 (Wave) 8/15 – 8/21	MON	TUES	WED	THUR	FRI	SAT	SUN	Total
Hot Sheet not submitted								0
Boxes returned	2	1		2	1	2	1	9
Out of stock items		1	1		1	2		5
Lost network connection								0
Hot Sheet not deleted						1	1	2
Deliveries	1	2	2	3	2	3	2	15
Transfer mistake	1							1
Phone calls made	2	1	1	2	2	3	1	12

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