Author: Diaz, Ivanov

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STUDENT:

NAME: Ivanov Diaz **DATE: 12/07/2020**

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

NAME: Xuedong Ding **DATE: 12/07/2020**

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1. **CMTE MEMBER'S NAME:** **DATE:**
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Diaz, Ivanov. ***Standardization of Operating Procedures as a Training Principal***

Abstract

The production department of Company XYZ (this is not the real name of the company) observed a growing trend of human errors that caused significant downtime for the production lines. The intent of this study was to understand the causes of human errors and to identify possible solutions to could prevent them from happening again. Two main set of data were collected to investigate the issues and to come up with the best possible solutions for the company. First, real time information about the human errors that took place during a time period of twelve months was analyzed. Second, a questionnaire aimed to understand the possible barriers that could prevent the operators from performing their job successfully was answered by 8 employees. The data analysis concluded that there was an absence of standard operating procedures (SOPs) for multiple activities, and many of the existing standard procedures lacked important details; Therefore, the training of new employees and the way that regular operators performed their job was inconsistent and unreliable. Recommendations were made to review, update, and create standard operating procedures for every position at the production lines. As well as to re-train operators, improve their document control system, and implement a two-way radio communication system for the plant.

Acknowledgments

I would like to thank my wife Billie Diaz for her patience and support during this project, as well as my mother Alba Gonzalez for her constant encouragement throughout my studies. I would also like to thank Dr. David Ding for his time and assistance as my advisor, guiding me though the process of completing this research project.

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Chapter I: Introduction

Company XYZ acquired a mid-size beverage processing plant that had been in business for over 20 years. After the acquisition, the production department of Company XYZ evaluated data about the key performance indicators (KPIs) of the department. The evaluation was intended to define the main areas of concern and to establish the department's priorities. One of the performance indicators that revealed an increasing negative trend was the number of human errors. The errors were responsible for major downtime to the production lines, various quality holds, and safety incidents. This study concentrated in understanding the barriers that prevented the employees from performing the job successfully, as well as finding actions that could prevent those errors from happening again.

All human errors that took place during the past twelve months were analyzed individually in order to find common circumstances that could be responsible for the occurrences. In many cases, it was concluded that errors occurred due to the lack of clear expectations and the lack of proper work instructions. The operators did not have a clear understanding of the responsibilities of the job or how to perform the activity in the first place. Some Standard Operating Procedures (SOPs) were vague, they lacked important details, and in some instances, there was no documentation to describe the task. The employees performing the activities did not have well-defined procedures or safety guidelines to follow; consequently, improvisation and unsafe behavior were frequently practiced. In addition, it was found that for certain activities that did not need to be completed daily, Company XYZ only had one operator familiar with the tasks required. On days when that operator was not working, the rest of the team struggled to perform the activities adequately because few reference documents were available to show them how to perform these tasks, which resulted in increased downtime and

opened doors for quality and safety issues. In general, the lack of detail in some of the reference documents contributed to operators performing the same activity in different ways. This resulted in inconsistencies in time spent to complete the same activity across operators, even when the activity was performed on regular basis.

Before Company XYZ acquired the plant, the operators received some training, but there were insufficient training records to document the specific training that each employee had received. For this reason, when errors occurred, it was difficult to hold people accountable because employees could argue that they had not been trained to follow any specific steps. During their training period, trainees had different instructors due to the lack of designated trainers in the production department. The trainees learned from the person who was running the equipment on that particular day, which changed often due to sick days, vacation days, and employee rotation based on production needs. Since no written procedures were followed and no specific trainer was designated, the trainee might have received different versions on how to perform the same task. It was also observed that first and second shift employees performed the same activity in different ways, which created misunderstandings and errors during shift exchange. Company XYZ is ISO9000 certified, but it is clear that there are gaps that need appropriate attention. Using ISO9000 guidelines, the research conducted in this study aims to update, create, and enforce the use of SOPs during the training period, as well as during daily operations.

This paper describes the process of standardizing operating procedures at Company XYZ's production department as recommended by ISO9000 guidelines in order to improve performance consistency, close knowledge gaps, and consequently decrease safety incidents, quality holds, and unplanned downtime. The implementation of standard work techniques

described in this study intends to go from having process knowledge that is only held by a select one or two employees, to being able to provide clear, written directions so that any authorized individual can perform the work successfully when required.

Statement of the Problem

The production department of Company XYZ has experienced an increasing number of human errors due to the lack appropriate SOPs to train its employees, which led to various problems. Some of the problems included safety issues, quality holds, and unplanned downtime. This translated into financial and human resource losses for the company.

Purpose of the Study

The purpose of this study was to develop SOPs that provide clear expectations and detailed instructions on how to perform specific activities in order to reduce the number of safety incidents, quality holds, and unplanned downtime caused by human errors. It was also the intent of this study to recommend on how to organize and collect training records to have information about current competencies and development opportunities for the production employees.

Assumptions of the Study

The following were the assumptions of this study:

1. Management supports the creation and enforcement of SOPs to train production employees.
2. New policies regarding document control are implemented.
3. New policies regarding adherence to SOPs are implemented in the production department.
4. There are no process changes for the current operation.

Definition of Terms

Throughout this paper, terminology that is specific to the manufacturing industry is used. The terms are listed and described below:

Digital manufacturing operations (DMO). DMO is a software used in manufacturing that allows automatic or manual data entry in order to analyze the performance of production lines.

Downtime. "Downtime is any period of time when a machine is not in production" (Immerman, 2018, Para. 1).

ISO9000. "A set of international standards on quality management and quality assurance developed to help companies effectively document the quality system elements needed to maintain an efficient quality system" (American Society for Quality, 2020, Para 1).

Key performance indicators (KPI). "KPIs provide a way to measure how well companies, business units, projects, or individuals are performing in relation to their strategic goals and objectives" (Marr, 2019, para. 3).

Quality hold. Quality hold is a procedure designed to remove questionable product for use until the quality department evaluates its condition and determines its disposition (Dosland, 2007).

Root cause analysis. Root cause analysis (RCA) is defined as a collective term that describes a wide range of approaches, tools, and techniques used to uncover causes of problems. It is a method of problem solving used to identify the origin of the issues in order to prevent it from happening again (American Society for Quality, 2020).

Shift handover. Shift handover is the process of transferring responsibilities and tasks from one individual to another or a work team to another. It is one of the best-known types of safety and production critical communication events (Vatanparast, 2010).

Standard operating procedures (SOPs). "A set of written instructions that document a routine or repetitive activity followed by an organization" (United States Environmental Protection Agency [U.S. EPA], 2007, p. 1).

Total quality management (TQM). "TQM is a management approach to long-term success through customer satisfaction. In a TQM effort, all members of an organization participate in improving processes, products, services, and the culture in which they work" (American Society for Quality, 2020, para. 1).

Limitations of the Study

This study is limited to the creation of standard procedures for Company XYZ only, which is specific to a Chicago beverage processing plant. Downtime evaluation is limited to incidents caused by human errors.

Methodology

The following methodology was used in order to achieve the purpose of this study. First, data from three different departments was reviewed in order to identify issues that had been caused by employees from the production department; specifically, incidents categorized as human errors. From the quality department, the log book of quality holds was reviewed; from the safety department, the incident report log was reviewed; and from the production department, the downtime report from the digital manufacturing operations software (DMO) was reviewed. Next, a list of human errors was generated and analyzed by a cross-functional team of eight employees from the safety, quality, and production departments. Additionally, a questionnaire consisting of

eight questions was provided to each of the eight members of the team, from which the answers helped to define a common denominator associated with the human errors and to provide the most adequate solution to reduce these incidents in the production department. Afterward, a literature review related to training in manufacturing was completed in order to outline the most effective ways to avoid errors and to improve training methods.

Chapter II: Literature Review

The lack of clear expectations and detailed instructions about job activities can create multiple issues across departments in different organizations. Proper training is essential to make sure those expectations and instructions are clear and followed. Company XYZ experienced multiple human errors due to the lack of appropriate SOPs to train its employees. Production operators created inadequate methods to perform their job, which resulted in safety incidents, quality holds, and unplanned downtime. This chapter explores the literature about the evolution of training in manufacturing plants, the importance of adequate training in a continuous improvement environment, as well as the benefits of standardized work, SOP creation guidelines, and the importance of document control.

Evolution of Training in Manufacturing Companies

During the second World War, there was a rapid increase in demand on different manufacturing sectors, this made companies wanting to train their new employees faster but at the same time improve the quality of their products; consequently, training departments became established in many companies during this period (Sleight, 1993). Businesses started to look for ways to train their workers fast, efficiently, and cost effective. Burrhus Frederic Skinner, an American Psychologist, had previously performed some studies in training and individual behavior. Skinner introduced the reinforcement behavior theory in 1938, he argued that positive reinforcement is more effective than punishment in modeling assimilation (McLeod, 2018). This theory supported the idea that actions that are positively reinforced tend to be repeated by the learner faster and more consistently than when the learner receives negative consequences for not performing the action as desired. Upon the concept of Skinner, the idea of individualized automated instruction with positive reinforcement was created when businesses were booming as

the world tried to rebuilt itself (Sleight, 1993). Industrial work was becoming automated and mass production was the future of manufacturing. Training departments had to come up with methods that could keep up with constant changes and upgrades to equipment and processes while still meeting production demand, safety guidelines, and quality requirements. Sleight (1993) introduces this concept as follows: “Just as in industrial work, training itself was about to become automated. Individualized instruction with programmed materials replaced the teacher. Programmed materials are instructions that are divided into small steps which are easily understood by the learner” (Sleight, 2013, para.35). This was the beginning of standard operational instructions as a training principal in automated production environments.

Education and training after the war were also strongly supported in great part by the Servicemen’s Readjustment Act of 1944, also known as the G.I. Bill. This Bill was created to provide support to those members of the military who were returning from the WWII. The bill included several benefits such as tuition and benefits to attend college, finish high school or participate in vocational education (Torraco, 2016). The positive effects of these federal actions were reflected in the exponential growth of job training programs created to fulfill the demand of participants in vocational education. With increased demand of products and strong support of government, the environment couldn’t be better for the manufacturing companies along with their training programs to flourish developing new ideas that offered a more efficient way for employees to learn along with the continuous improvements that industries experienced. Work procedures changed rapidly and frequently; in such a work environment, learning multiple new procedures and all the information required to do the job was very difficult (Sleight, 1993). A new form of training was needed to manage such a rapid change at work. Job support ideas were introduced to help employees find the changing information they needed. Job support tools

contained step-by-step instructions on how to do a task. These tools became very helpful when certain tasks were not performed on regular basis or jobs that must be done absolutely correctly or in a particular order every time. This concept was transformed with the years into what we know today as Standard Operating Procedures (Sleight, 1993).

Benefits of Standardization of Work

Standardized work is not just a format to document work instructions. It is a work philosophy that creates a continuous improvement environment by encouraging permanent evaluation to make things better in very small increments (Martin & Bell, 2017). With this being said, it is clear that standardized work is consistent but continuously evolving even if the current process looks ideal. With standardization of work, it is absolutely necessary to have a mentality and process of constant improvement (Martin, & Bell, 2017). Martin and Bell, 2017 also recommend that improvements should be in very small increments in order to minimize the risk. If the changes are not too radical or too big, they can be evaluated quickly. After the evaluation, the elements that represent gains can be established as a norm, and those changes with negative outcomes can be abandoned rapidly causing the least possible disruption (Martin, & Bell, 2017).

A common misconception about standardized work is that it is created specifically for the individual performing the job. Actually, the person who performs the work on daily basis usually knows the details of the job better than others in the organization. Standardized work is for all, including management; it allows the management team of a company to regularly review and confirm that all the necessary steps in the process are being followed according to legal regulations and the company's own standards (Martin, & Bell, 2017). Standardization of work facilitates the implementation of internal and external audits and provides a clear scenario for improving processes. When updates are necessary in a company, it is easier to come up with the

specific changes that are needed to guarantee compliance with the new requirements. Standardized work is vital to the continuous improvement efforts in a lean enterprise system. “Where there is no standardized work, there is no process discipline, team member accountability, reliable data, continuous improvement or lean sustainability” (Doman, 2013, para. 2).

Working standards facilitate consistency, and consistency translates into reliable quality for costumers. When the work is standard, unnecessary activities can be eliminated and effective supervision can be implemented. If a company wants to ensure the quality of their products, the best wat to achieve this is by implementing standard procedures that are created and followed by the parties involved (Rivas, 2019). “At the same time, standardization allows the maximum use of human resources and technology, while maintaining a production rhythm adapted to the customer needs” (Rivas, 2019, para. 4). Research agrees that standardization of work brings multiple benefits to companies, in particular to the manufacturing industry. An explanation of the most important concepts among the list are described here.

Economic Benefits

Economist have developed different models that establish standard sources of economic growth among nations, the three main sources of growth are an increase in capital, increase in labor, and technical progress (Blind et al., 2011). When studying how to achieve and sustain technical progress, the main idea is that businesses invest in research and development; therefore, economic growth is stimulated by creating new products and methods. But why is standardization important then? Because new knowledge and new products can only ensure economic growth if that knowledge is broadly spread, so that as many businesses as possible can take advantage of its benefits and consequently create a stable momentum of economic growth.

Standards that are developed in agreement with companies associated to specific industries are particularly appropriate for spreading technical knowledge fast and accurately. Experts create standard documents with accurate information that facilitate knowledge and technological growth among companies (Blind et al., 2011). Companies also create their own internal standards by appointing subject matter experts in agreement with parties involved so that specific processes to the company can be shared quickly and correctly.

Standardization not only helps with technological progress and creation of new products, it also helps to reduce expenses in processes that are already established. Saving money is always a primary objective for any business; therefore, standardizing work becomes essential in terms of savings. All phases of business operations can be standardized, from the procurement process to the delivery of finish goods, all activities can be made standard to allow companies to use the same language and the same data models internally and between business partners (Rivas, 2019). This common language speeds up activities, prevents miscommunications, and gives a clear picture of the condition of associated businesses. The synchronization between business partners and internal departments helps with the reduction of waste across the seven waste categories in lean manufacturing.

Reduction of Errors

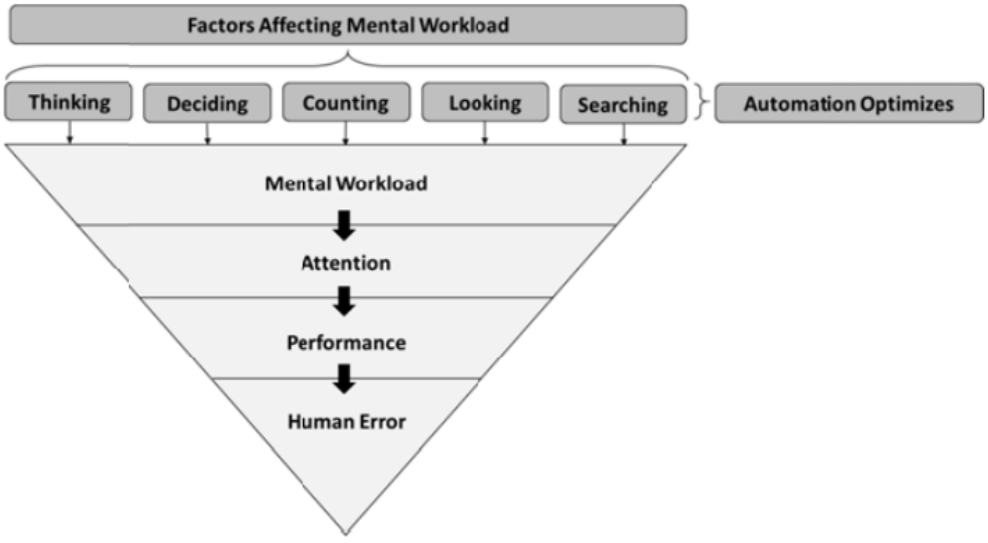
Interviews and deviation reports from various companies have shown that the main cause of human error is the amount of time spent thinking and searching for the right information when deciding the next step in the process as figure 1 shows. This affects the cognitive load of the operator in that particular moment, therefore it disrupts their performance (Qeshmy et al., 2019). This argument is more evident when new technology is introduced to the job. In this scenario, the operator is faced with a new situation and a new environment where previous know-how or

rules no longer apply. Consequently, the approach to the situation requires a higher conceptual level and a knowledge-based approach (Qeshmy et al., 2019). An effective way to keep the required knowledge available and up to dated is by implementing an internal program of standardization of procedures. It is essential to review the standards periodically and every time changes are introduced to the process or equipment.

Standards must be a central part of the operator's training, they need to be well organized in a verified system that allows easy access when necessary. By standardizing processes and information, the dependence on individuals, services or suppliers is reduced. As a result, companies are less sensitive to individual errors along the manufacturing chain (Rivas, 2019). Standardization of work reduces the chances for errors because it leaves no room for improvisation or short cuts. When instructions and expectations are clear and there is a written procedure on how to get from point A to point B, there is far less opportunities for deviations during the process.

Figure 1.

Mental Workload Framework



Note. From “Managing Human Errors: Augmented Reality systems as a tool in the quality journey” by D. E. Qeshmy, J. Makdisi, E. H. D. R. da Silva, and J. Angelis, 2019, *Procedia Manufacturing, 28*, p. 27 (https://doi.org/10.1016/j.promfg.2018.12.005). Copyright 2019 by The Authors.

Creation of Knowledge Bases

Intellectual property is one of the most important assets companies can have; therefore, it is important to develop a reliable method to document, preserve, and improve it. All information captured in operating procedures establishes the baseline for accurate training and future positive performance results. The creation of a library system for internal use allows easy access to standards and facilitates the distribution of knowledge. Virtual libraries have multiple advantages over traditional libraries in the manufacturing environment. It makes easy to update documents, it allows access to information from multiple locations, it guarantees that the information retrieved is the most updated version available, and it have less risks of damage or losing information (Neches, 1991). Either virtually of physically, standards should be kept in an organized system that allows access to the appropriate personnel when necessary. A system of document control can be established to make sure that updates are approved and shared as needed. Access to relevant information promotes company members to be self-sufficient in problem solving and achieve greater efficiency, better quality and safer practices when executing a task (Rivas, 2019).

More Satisfied Customers

When companies deliver great quality products in a reduced period time, it is very likely that costumers feel highly satisfied and tend to remain loyal to the company (Rivas, 2019). Standardizing processes increases the speed to complete activities because it evaluates the

process and gets rid of unnecessary actions, this allows companies to expedite the delivery of finish goods which is highly appreciated and almost essential in today's business environment. This concept can be applied to all steps of the business, from the acquisition of raw ingredients to the delivery of finish goods to their customers. Besides, following standard procedures makes processes and results more transparent. Costumers are increasingly adding value to the transparency of the process in which their products are manufactured. Standardization promotes the application of specific regulations and sets clear expectations for each procedure that is carried out within the company (Rivas, 2019). By creating standard procedures, companies ensure that their formal instructions comply with internal and external regulations necessary to fulfill industry regulations and maintain the confidence of their customers.

Training in a Continuous Improvement Environment

In manufacturing, continuous improvement is necessary to stay current with market demand and to remain profitable among competitors. Continuous improvement methodologies such as Kaizen, Six Sigma, or lean manufacturing have proven effective ways to train employees and sustain process updates (Otsuka et al., 2018). The fundamental principle of this training approach is the standardization of procedures. "When there is only one correct way to train a new employee, all employees learn the same amount of information. This reduces or eliminates knowledge gaps, creating a stronger work force" (Bailey, 2020, p.3).

In today's changing world, companies implement technological upgrades and process modifications as a response to competitors, new regulations, or the increase in production demand; unfortunately, changes that planned to improve processes can bring issues if the employees are not trained properly. Serious errors can be made when operating new equipment or performing new procedures without proper training. In order to sustain these changes, various

management tools are usually applied in leading corporations (Otsuka et al., 2018). Most of these job support tools and ideas originated in the west in line with the desire to improve production management (Otsuka et al., 2018). Later these ideas were imported to Japan, the concepts were improved and modified to fit the needs of the industrial climate and corporate culture of that country at the time. Together with the aspects independently built in Japan, they were further developed as kaizen. In the United States, Kaizen was also studied and modified to match the country's industrial climate and corporate culture (Otsuka et al., 2018). Typical examples of such improved and modified methods are six sigma, lean production system, and total quality management (TQM) (Otsuka et al., 2018). Kaizen develop useful tools for manufacturing companies that have resulted in positive outcomes not only in Japan and the United States but in European countries, in Asia, and the rest of the world (Otsuka et al., 2018, p. 112).

Based on kaizen principles, "the use of standard procedures minimizes variation and promotes quality through consistent implementation of a process or procedure within the organization, even if there are temporary or permanent personnel changes" (U.S. EPA, 2007, p. 1). It is important to note that there are many ways to implement continuous improvement methodologies; however, there are some fundamental principles that organizations need to have in mind to successfully apply these kinds of methodologies (Shetty, 1992). Some of these principles can be described as follows.

Management Commitment: Top management must be committed and have a permanent communication during the process implementation. It is essential to provide a clear vision of the organizational philosophy to all teams involved. It is also important that management makes it clear that everyone must be personally committed (Shetty, 1992). Management leads by example by allocating resources, being a good role model in communication and action; and monitor the

process (Shetty, 1992). Clear roles and responsibilities are also important to define, it is management's responsibility to encourage communication among departments, units and costumers, and naturally between management and employees (Shetty, 1992).

Well defined goals: Clear goals allow companies to monitor their own progress all year around. If employees know what they need to accomplish, they can monitor results as they progress and identify barriers that are preventing to reach the goals (Feliciano, 2008). Goals should be specific, measurable, attainable, result based, and timebound (SMART) (Conzemius & O'Neill, 2009). Clear goals provide specific direction, set priorities for decision making and give more control of the future. Also, regular evaluation of goals provides motivation to employees. Short term goals that are achieved provide a feeling of accomplishment and makes the long-term goals become more realistic (Conzemius & O'Neill, 2009).

Employees are the key to consistent quality: It is important to keep employees motivated and engaged with the process. Human resources also play an important role in supporting the implementation of continuous improvement during employee recruitment, selection and socialization (Dobbs, 1994). "The socialization process can be reinforced with education and training" (Dobbs, 1994. p. 91). Performance appraisal and reward systems are also encouraged to maintain positive trends with the human factor (Dobbs, 1994). Well trained employees with effective access to reference documents and standard procedures are most likely to deliver high quality products for costumers.

Teamwork: It is vital to work as a team between managers, employees and among departments. Continuous improvement only happens when all areas are synchronized and they embrace change as a team (Marino, 2013). Participation at all levels of the organization is necessary for continuous improvement tools to be effective. Effective teams create norms and

collective commitments they make for each other (Marino, 2013). It is easier to create a culture of constantly looking for ways to improve in an environment where everybody works towards a clear and common goal. When this happens, everyone helps making decisions that support the overall company direction (Martin, & Bell, 2017).

Never ending process: Efforts to improve businesses are continuous. Continuous improvement is not just a program; it is an ongoing way of doing business. “Quality goals, standards, measurements, training, and reward systems should be integrated into an organization's total management system, including planning budgets, information system, and human resource management practices” (Dobbs, 1994, p. 91)

Standard Operating Procedures (SOP)

SOPs are sets of instructions that cover specific processes and serve a directive within a company. The development and use of SOPs are fundamental for a successful quality system as it provides individuals with the information to perform a job properly, it also facilitates consistency in the quality and integrity of products (U.S. EPA, 2007). SOPs may be written for any repetitive technical activity, as well as for any authoritative or functional programmatic procedure that is being followed inside an organization. Other terms might also be used to refer to SOPs such as protocols, instructions, worksheets, and laboratory operating procedures; they all provide clear instructions on how to perform activities (U.S. EPA, 2007).

SOP Purpose

The purpose of an SOP is to guarantee that all workers are performing activities in the same way to obtain consistent results. When consistency is achieved, it is possible to run controlled experiments to test the impact and decide with confidence if the changes can be established as a norm (Akyar, 2012). SOPs describe the recurring work processes that are to be

conducted or followed within an organization in an organized and detailed manner (U.S. EPA, 2007). SOPs tell the what, how, when, why, and who (Akyar, 2012). They document the way activities are to be performed to facilitate consistent conformance to technical and quality system requirements and to support data quality (U.S. EPA, 2007). SOPs used as a central part of a personnel training program help in minimizing opportunities for miscommunication and can address safety concerns (Akyar, 2012). SOPs should be specific to the organization or company whose procedures are described and assist that company to maintain their quality control and ensure compliance with governmental regulations (U.S. EPA, 2007).

If SOPs are not written correctly or they are not easy to follow by employees, they are of restricted value. In addition, even the best written SOP will fail if they are not followed; consequently, management needs to review and enforce compliance to SOPs (U.S. EPA, 2007). SOPs should be easily accessible to employees in the work areas, otherwise they won't have much value to the company. SOPs can indicate compliance with organizational and governmental requirements such as ISO9000. They are a great tool to use as a part of an employee training program, since they provide detailed work instructions and step by step procedures. It reduces chances for miscommunication and can guide employees about safety requirements for the job (Akyar, 2012). Additionally, SOPs can be used as checklists by supervisors when inspecting procedures. Ultimately, the benefits of SOPs are reduced work effort, consistent quality, reliability, and legal defensibility (U.S. EPA, 2007).

SOP Preparation and Format

The organization can determine what procedures or processes need to be documented. This could be divided by departments since each department knows what procedures affect safety, quality or productivity. SOPs should be written by subject matter experts in alignment

with experienced employees who perform the work or use the process (U.S. EPA, 2007). A team approach is encouraged specially for processes that involve cross functional activities where a different number of individuals are necessary to complete the process. It is always positive to involve the workers in the development of SOPs in all the phases of the procedure that is being documented (Akyar, 2012). One of the goals of SOPs is that someone with limited experience about the procedure, but with basic understanding and the required authorization, can follow the document and successfully reproduce the procedure when unsupervised (U.S. EPA, 2007). There are some aspects of the job that will be performed that determine what format should be used to write an SOP. The number of big decisions that the employee needs to make during the process, the number of steps and sub steps in the procedure, and how important it is to insert pictures in the document for clear details. Routine procedures that are not long and do not involve multiple decisions to make can be written using simple steps format (Akyar, 2012). Long procedures that involve more than 10 steps, with few decisions should be written along with graphical format or hierarchical steps. Procedures that need many decisions should be written along with flow chart (Akyar, 2012). Requirement for document identification and control, accountability and traceability must be added to every SOP; this can be achieved by using standard formats.

SOPs should be brief, easy to read and describing a step by step procedure. The information presented should not be overly complicated. “The document should not be wordy, redundant, or overly lengthy” (U.S. EPA, 2007, p. 2). Well written SOPs should first define the purpose of the task or activity documented and the scope of the instructions (Akyar, 2012). Images can be used for illustration purposes and flow charts to illustrate the process being described. The United States Environmental Protection Agency recommends that the format

should be in accordance with the company's guidelines and should include but not limited to the following (U.S. EPA, 2007):

- Policy: The mission or standard that the procedure must meet.
- Purpose: The rationale of the procedure.
- Scope: Identify the areas of the company that are affected by the procedure.
- Responsibilities: Who is listed in the procedure and what they are required to do.
- Definitions: Describe the words used in the procedure that readers may not understand.
- Procedure: The activities and tasks or steps to the procedure
- Effectiveness Criteria: What is important to measure
- References: What other documents support this procedure
- Revisions: The changes that have occurred since publishing this procedure for the first time. (p. 6).

SOP Review and Approval

SOPs should be validated by individuals with enough training and experience with the process. A good way to validate SOPs is to have somebody different than the original writer follows the steps in a performance test to find gaps or steps that need a more detailed explanation (U.S. EPA, 2007). The final version should be reviewed and approved by the supervisor or quality representative, a document number should be assigned and saved to the SOP master list of the company. Isin Akyar. In his book Standard operating procedures. What are they good For? recommends to consider the following aspects when evaluating an SOP before approval:

- There should be an appropriate QA system in place to guarantee that the procedures can be kept up to date and that any errors are rapidly detected and corrected.
- The procedures should not be needlessly regulatory. The best way of guaranteeing that procedures do not become overly prescriptive is through involving the operator during the design stage.
- Procedures should contain information on the necessities for the wearing of personal protective equipment during the task.
- Any risks to the operator should be documented at the start of the procedure, based on a risk assessment of the task.
- An appropriate method of coding each procedure should be used.
- Each time a procedure is produced it should be dated.
- There should be no uncertainty between which procedures apply to which situations.
- Procedures do not always have to be paper based.
- At the start of the procedure an overview of the task should be provided.
- Prerequisites should be presented clearly at the start of the procedure to guarantee that the operator can check that it is safe to proceed.
- The most important information on the page should be defined and this should be designed to be the most prominent information.
- Separate headings should be used to discriminate apparently between sub tasks.
- Any warnings, cautions or notes should be placed immediately prior to the instruction step to which they refer.

- Language should be kept as simple as possible, i.e. use nomenclature familiar to the operator.
- The nomenclature should be consistent with that on controls or panels.
- Symbols, colors, and shapes used for graphics should conform to industry standards (para. 23)

Document Control

Each organization should create a document numbering system to identify and access their SOPs. The title of the SOP should be related to the task or process described (U.S. EPA, 2007). SOPs should be of easy access to the individuals performing the tasks, SOPs can be stored electronically or printed copies in a controlled log. Every time an SOP is updated, it is necessary to inform the affected parties about the change and replace the physical and electronic documents with the new revision (Akyar, 2012). Revision numbers need to be included in the SOP in order to keep track of the changes. Each SOP should have an owner, preferably the subject matter expert, supervisor or department manager. Any changes to the SOP need to be reviewed and approved by the document owner (Akyar, 2012). A periodic revision of SOPs should be implemented in order to detect any gaps or necessary updates. Revisions are usually performed once a year by a team with the proper knowledge of the activity described in the document (Akyar, 2012).

Chapter III: Methodology

The intent of this study was to find solutions that could possibly reduce the number of human errors in the production department of Company XYZ. The methodology used to accomplish this goal was the analysis of production data and the evaluation of responses from a cross-functional team to questions related to the problem of the study. Recommendations were given based on the results of the study to help reduce process errors, improve performance consistency, close knowledge gaps, and consequently, decrease quality issues, unplanned downtime, and safety issues. It is important to understand that multiple factors might contribute to human error occurrences at the production lines and not a single action will prevent future mistakes. However, the evaluation of data and the study of literature related to the problem allows the recommendation of actions in alignment with the final goal of the study. This chapter examines the subjects that were chosen for the study, the tools used to collect the data, and how the data was entered and analyzed.

Subject Selection and Description

The participants of the study were volunteers from three different departments. It was intended to have a cross functional team that was able to study data and bring the perspective of the main departments that have a connection to the human errors that occurred in the production lines. Specifically, five operators from the production department were selected, three females and two males. Three operators had over five years of experience and two operators were new hires who had recently finished their training period. In addition, two quality technicians with over four years of experience, and one safety leader with three years of experience for a total of eight people in the study team. It was explained to the team that participation on the study was completely voluntary and any member could withdraw or stop the process at any time. The

explanation of the research study was provided along with a consent form (Appendix A). The implied consent form was explained to each participant and they were asked to sign that they understood the purpose of the study and the participation process. The volunteers of the study answered the questioner individually, the questions were created to help understand the common causes of errors and the actions that could prevent those errors from happening again. A sample of the questionnaire is found in Appendix B.

Instrumentation

One of the tools used to measure the problem was a digital manufacturing operations software (DMO). DMO is used to enter data related to production stoppages for manufacturing lines. Operators had been trained on how to enter accurate information regarding changeovers, unplanned downtime, and planned downtime. Every time an unplanned downtime event was coded as a human error, the information was validated by a supervisor. The supervisor made sure the description of the error was accurate and that in deed a human factor was the root cause of the time lost. DMO allows to access data months or years later if necessary. After the list of human errors that occurred during the previous 12 months was analyzed, literature related to areas of concern was also reviewed in order to prepare the questionnaire that would be delivered to the participants of the study. The questions were formulated based on the evaluation of the errors that had occurred in the previous year. Common denominators were grouped together and the questions were created targeting the possible problem observed.

Data Collection Procedures

The data collection involved a mixed method of quantitative and qualitative systems. Two sets of data were collected for the study. First, a report of human errors that occurred during the previous 12 months was retrieved from DMO. The report contained the date, the time lost

due to the error, the production line where the error occurred, and a brief explanation of the error. DMO allows the operator to record the start time and stop time of every process order (PO) in real time. At the end of every PO, it can be determined the total period of good production and the total time that the line was not running. Operators can categorize every stoppage of the production line in different reason. They can be coded as Jams, adjustments, replace of mechanical components, human errors, raw material shortage, changeover, etc. For this study, the stoppages coded as human errors were the only ones reviewed. Every time a human error was entered in DMO, a comment was required with a brief explanation about the error. The comments were also part of the data that was analyzed to determine the gaps in the operator's performance.

The second set of data collected consisted of the answers to the written questions provided to the participants. Each individual was given unlimited time to answer the questions, the participants answered the questions individually and anonymously. The answers were collected and analyzed to determine the best possible solution for decreasing the number of human errors in the production department.

Data Analysis

The data collected was analyzed using a mix system of quantitative and qualitative methods. The quantitative portion of the data consisted of a list of human errors which took place in the previous year; however, 19 weeks of the 52 weeks of the year, the company did not run production. This was due to planned shut downs and forced shut downs related to Covid-19 precautionary measures. Consequently, the data analyzed is from 33 weeks of production. 138 human errors were recorded during the 33 weeks, averaging 4.2 errors per week. The total time

lost due to the human errors was 2757 minutes for an average of 20 minutes of downtime per error.

The answers to the written questionnaire were analyzed using a qualitative approach. They were reviewed for a frequency of common arguments. Four main areas were observed, (1) lack of communication, (2) performing non-routine tasks, (3) lack of clarity of procedures, (4) inconsistency of trainers. These common denominators were key points to address with the recommendations that this study intended to provide. The participants of the study had similar areas of concern which felicitated the approach to the root cause of the problems.

Chapter IV: Results

As Company XYZ identified a rising trend of human errors taking place in the production department, the purpose of this study was to determine the main causes of those errors and to identify possible solutions to reduce them, and consequently, their negative effects on quality, safety, and efficiency. In order to achieve these goals, two sets of data were reviewed. First, a list of all human errors that took place in the production department during the previous 12 months was studied. This helped to identify the common causes that prevented the operators from performing their job successfully. Secondly, the responses to a questionnaire completed by eight operators were examined and divided into groups of mutual characteristics that contributed to the occurrence of human errors in the production department.

Results of DMO Data Analysis

The digital manufacturing operations software is a helpful application that captures events related to the production line's performance in real time. Every time a new production order (PO) starts the manufacturing process, the PO is also started in DMO. Every event that causes the production line to stop is recorded in DMO to measure the efficiency of the production line. DMO determines the line's performance by comparing the time that it took to produce a certain number of finished goods with the expected amount of time for the line to produce that number of finished goods when running at the highest speed without experiencing downtime. DMO has the capability of dividing the downtime entries into categories such as planned downtime and unplanned downtime, as well as subcategories like changeovers, mechanical adjustments, jams, and human errors. This separation of reasons simplifies the analysis of the problems impacting the line's performance.

The data analyzed for this study was part of the human errors sub-category, which is included in the unplanned downtime category. Every time a production line stopped due to an incident that was considered a human error, a downtime event was entered in DMO along with the details about the incident. The details included date and time, how much time the production line was down, what specific piece of equipment was affected, and comments describing the circumstances that led to the incident. The analysis of data concluded that there were four main causes which led to the human errors that took place during the previous twelve months in the production department. The first cause found was that there was a gap in the standard operating procedure, which affected either the safety, quality, or efficiency of the activity. The second cause for human errors stemmed from a lack of attention from the machine operator. Thirdly, the procedure in place was correct, but the operator neglected to follow it. Lastly, an established SOP about how to perform the activity did not exist. Table 1 summarizes the errors according to the root-cause and its downtime impact. A detailed analysis of each cause follows below:

Table 1

Human Errors by Root Cause

Root Cause	Count of Events	Sum of Duration (minutes)	Total %
Procedure Gap	72	1601	58%
Lack of Attention	36	404	15%
Did Not Follow Procedure	22	400	15%
No Procedure Available	8	352	13%
Total	**138**	**2757**	**100%**

Procedure Gap

The downtime events assigned to this cause were reviewed to make sure that there was an available SOP associated with the activity being performed at the time that the error occurred. In every case, the analysis determined that although there was a general written procedure, it lacked important details that were necessary to complete the job successfully. The missing information had the potential to affect the safety, quality, or efficiency of the job. For example, as table 2 shows, the longest single downtime event recorded for this study is the result of an error during a changeover due to the SOP missing important information.

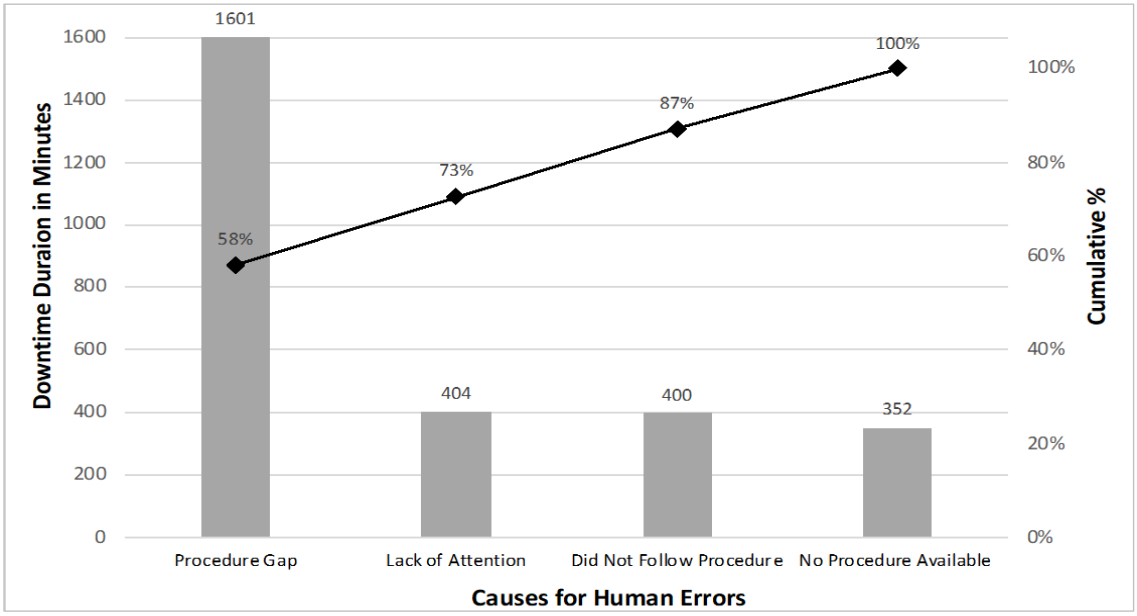
The operator accidentally sent water to the wrong tank, affecting the product that was being packed in a different production line. It was confirmed that there was an SOP listing the required tasks during a changeover; however, one of the activities was to send a water rinse to the empty tank that had been used, but the SOP did not describe how to send the water rinse to the tank. In order to send a water rinse, the operator needed to manually open various valves following a specific order. Next, from a computer, the operator would select an automated cleaning cycle following a specific order as well. If one of these steps is done in the wrong order or the wrong valve is opened, the water can go to the wrong place. Since the SOP did not clearly state the step-by-step details, the operators took it upon themselves to memorize the process. The error occurred on the first day of production after returning from a three-week shutdown due to the Covid-19 pandemic. The operator had not performed this task for an extended period of time, which may have affected his memory. Had a document been in place to clearly outline the specific steps of the process, the operator would not have had to rely on memorization alone. Of the total errors analyzed (n=138), 58% (n=72) of them were found to have the same common

denominator: There was a moment in the process when the operator had to follow their intuition due to a lack of standard directions.

The largest number of human errors and the most time lost were due to procedure gaps. Figure 2 illustrates the impact that procedure gaps had on the overall time lost; therefore, this should be the number one priority to address. A thorough revision of the production SOPs is necessary in order to close multiple gaps found during the data review. It is essential to create a list of the procedures that every operator is required to perform for each of the work positions in the production line. Once the list is completed, a cross functional team involving subject matter experts, supervisors, and operators need to make sure that every procedure performed on each work position is covered in an SOP and that it is written in sufficient detail so that an authorized employee is able to follow it and complete the job successfully without assistance. As shown in the literature review of this paper, the use of images is a successful approach for demonstrating specific details. Whenever a procedure is updated, all operators need to be retrained. Similarly, every time there is a new update to an SOP, it must be documented and communicated to the affected parties. New hires must be trained exclusively using the SOPs during the training period to ensure consistency in the way that each operator performs the job activities. In order to build proficiency, documenting training is essential. Internal trainings records should be kept for each operator, leaving no question as to which trainings have been completed by whom. This study has shown that in manufacturing improvisation can be very costly. It is important to encourage and enforce the use of standardized procedures for new and current employees alike.

Figure 2

Causes for Human Errors



Another major finding during the review of downtime caused by procedure gaps was the repetition of the same problem in multiple occasions. For example, the packaging lines waiting for the blending division to deliver the juice was observed multiple times. When adding the time lost on each occasion that the packaging line waited for the juice to be ready, it is clear that this situation caused the largest amount of downtime in the past twelve months. Figure 2 breaks down the issue into three main reasons.

Figure 3

Waiting for Blending

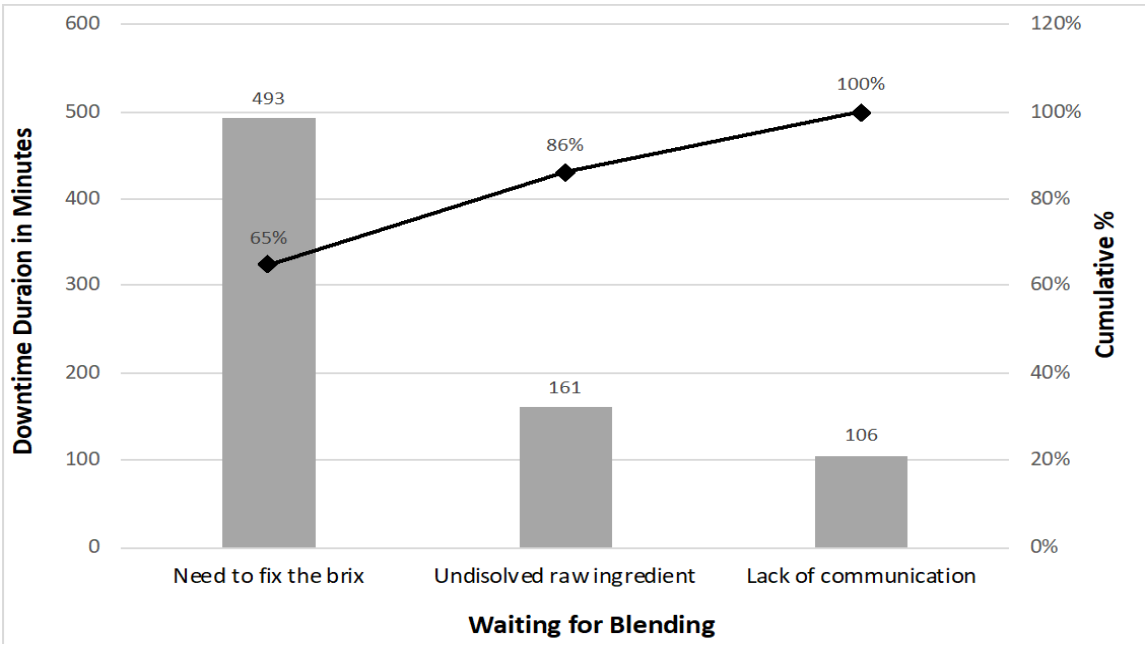


Figure 2 shows that 65% of the time (n=493 minutes) the juice was not ready because the brix did not meet the required specifications. The brix is a unit of measurement of the amount of dissolved sugar in a solution for its specific gravity. One-degree brix is 1 gram of sucrose in 100 grams of solution. The brix can be adjusted to the required specification by adding sugar or water as needed. This adjustment process is mentioned in the SOP, but important details are missing. The SOP only provides the formula needed to calculate the amount of sugar or water that needs to be added in order to adjust the brix to an acceptable range, but the SOP does not describe the following details: The amount of time required to mix the ingredients before checking the brix again; the speed at which the tank agitator should be set; how to take an accurate sample from the tank; or the procedure to follow before even making any adjustments. If the juice sample is not collected in the correct manner, a brix adjustment can be done unnecessarily. Water can remain in the sample port after cleaning; therefore, it is necessary to let juice run out of the

sample port for at least five seconds before taking the sample. If the sample is taken right after opening the sample valve, the water sitting in the sample port can throw off the reading, thus giving a false need for adjustment. If an adjustment is done unnecessarily, a second adjustment will be needed to bring the brix back to the original range, wasting valuable time. This data demonstrates that updating the SOP that covers the process of adjusting the brix needs to be a priority. More details should be added and different potential scenarios for troubleshooting before making any adjustments should be included. As with any updated procedure, the affected parties need to be retrained. As figure 2 shows, by fixing the brix adjustment issue, 65% of the time lost waiting for juice can be avoided in the future.

Another important cause for lost time was due to the raw ingredients not dissolving within the expected amount of time. One possible solution is that the receiving process for raw ingredients could be updated to include a quality assurance check to confirm that the density of the granules is within the necessary range to be able to dissolve as expected. It is also possible that starting the blending process one hour earlier may allow more time for completing the proper mixing process, which would require the schedule for the blending division to be moved one hour back. The blending process would need to start four hours earlier than the packaging line, instead three hours earlier as it is currently.

The analysis of errors also raised the question of why operators chose not to ask for help from a supervisor when in doubt about any step in the process. It is expected that SOPs sufficiently cover the details of all activities that have an impact on safety, quality, and efficiency. When there is a need for clarification in any step of the process, it is the responsibility of the person performing the job to ask for clarification before moving forward. The questionnaire completed by eight operators revealed that they did not have access to a reliable

communication system with their supervisors. Radios were not available for anybody at the plant; conversely, a speaker was used when assistance was needed, which could only be heard within a limited area of the production floor. Depending on where the supervisor was located within the plant at any given time, it may be impossible for them to hear any communication from the operators on the speaker. The analysis also revealed that the noise of the production lines made it difficult to hear the message on the speaker, and mechanics on the maintenance team reported difficulty understanding whose name was being called and where the assistance was needed. Clear and timely communication is crucial in a fast-paced production environment; therefore, the implementation of a reliable communication system is necessary. A two-way radio system for the plant is a potential solution that can be implement to solve the problem. Radios are widely used in many manufacturing plants, which provides clear communication between appropriate parties in real time.

Lack of Attention

When studying the errors grouped in this category, it was determined that all necessary information to complete the task was available to the operator. It was also confirmed that the operator had performed the task successfully in the past and the standard procedure was being followed when the error occurred; however, there was a distraction or lack of attention on the operator's part that resulted in the error. One frequent mistake noticed during the data review was the placement of pallets in the infeed compartment of the palletizer in the upside-down position. Upside-down pallets get jammed in the automated palletizer, creating major problems with the sensors and throwing off the palletizing sequence that the robotic arm follows. A major cause for the challenges encountered during the palletizing sequence comes from the way that the pallets arrive from the third-party pallets' supplier, which is often unorganized and creates an

added step for the production team prior to loading the pallets on the palletizer. Ideally, the third-party supplier will improve the way the pallets are organized when delivered. Meanwhile, Company XYZ directed the operators to check that all empty pallets are in the correct position before placing them in the palletizer. The pallets are stacked and moved in stacks of 15 high, the operator visually inspects them to make sure that every pallet is in the correct position; however, if the inspection is performed too quickly, one upside-down pallet in the stack of 15 can be missed. Lack of attention is probably the most challenging area to improve among the four causes of errors described in this study; however, constant coaching during pre-shift meetings, periodic review of SOPs with the operators, and visual aids on the production floor to remind the proper inspection process can help to improve the operators' attention. Lack of attention caused 15% (n=36) of the total number of human errors recorded (n=138), and these events caused a total of 404 minutes of downtime to the production department.

Did not Follow Procedure

400 minutes of production were lost due to operators choosing not to follow the standard procedure. It is possible that the operators chose not to follow the standard procedure because they assumed the results would be the same even when skipping steps of the usual process. Unfortunately, as a result of not completing the required steps, later in the process more time was lost than the time that was saved by deviating from the SOP. Assuming that everything was fine without the required verification of certain details was noticed in various examples. If an SOP states the necessity to verify a specific detail before moving forward, it must be completed even if the task is performed on daily basis. It is important to notice that the operators should have the ability to improve a procedure if they find a faster, or safer way to do it; however, any such changes to procedures need to be approved by the all parties involved, the SOP needs to be

updated, and the change has to be officially communicated to the affected personnel prior to implementation. Using the SOPs during training and involving the operators in the creation of the standard procedures is a great way to provide a sense of ownership and respect for the established procedures, however, management also needs to enforce the use of standard procedures and apply sanctions as needed. Not following procedures accounted for 15% (n=22) of the total number of errors documented for this study.

No Procedure Available

Although the number of errors that resulted from not having an SOP in place was considerably smaller than the other three reasons, the amount of time lost was comparable to the rest. 352 minutes of downtime were caused by not having a documented procedure on how to perform a required activity in the production department. These events represent 13% (n=8) of the total number of human errors. The majority of activities that do not have a documented procedure are related to new equipment or non-routine tasks. It is easier to forget how to perform tasks that are not done regularly; therefore, they need to be documented so when it is necessary to perform such activities reference documents are available to describe the process.

Research Questions

The second set of data was obtained from eight different questions that eight employees responded. The questions were developed after reviewing the errors from the first set of data which provided a good understanding of the possible reasons that lead operators to make mistakes. The following analysis provides answers to the questions:

How long did you train before holding your position?

Participants had different training periods before they started in their current positions. Four operators trained for a period of two months. Two operators trained for one month, and two

operators trained for three months. There was an evident difference in the length of time that each operator spent during training. In some cases, the training period was cut due to shortage of operators and the need to run the production lines. Some operators were asked if they felt comfortable running the equipment on which they were training in order to transition from training to holding the position as the main operator; however, no specific skills requirements were documented or verified before approving the transition. No standards for minimum or maximum training time existed for each position.

It is necessary to set a standard number of hours for the training period required of a new operator to be successful in each particular position. Trainees should be informed about the number of hours that are allowed for training on each position. During this time, a checklist including all required procedures for the job and the review of their SOPs should be completed by both the trainer and the trainee. The supervisor should have periodic evaluations with the trainer and the trainee throughout the progress of the training.

How many trainers did you have during this period?

Inconsistency was also observed in the number of trainers that each participant had during the training period. Four people had two different trainers. Two participants had only one trainer, and two participants had 3 trainers during their training period. There are two main reasons for this. The scheduling of operators follows a rotation system that allows backup operators to stay current on skills that they do not apply regularly. While this can be beneficial for the backup operators, it also creates confusion for the trainees because they may receive different versions on how to perform the same task according to the person that is serving as a trainer at that time. The second reason that operators had different trainers during their training period was because there were no certified trainers. It is recommended to assign designated

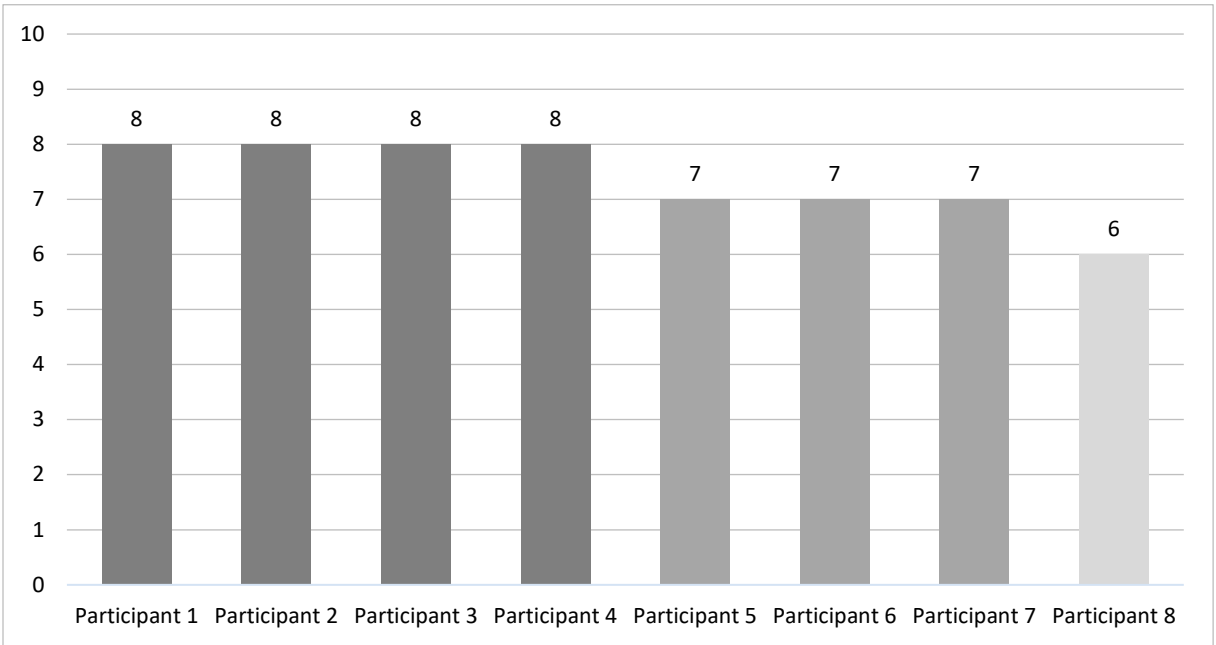
operators to train others for specific positions. These trainers can be selected once they meet certain criteria such as time of experience, attendance record, safety record, and development of leadership skills. It is also recommended to dedicate time training the trainers on how to demonstrate the knowledge and skills to their peers in an effective way that may not come naturally to operators who have not ever served in a leadership role.

From 1 to 10, how confident did you feel about completing all your responsibilities when you completed the training? With 1 being not confident at all and 10 extremely confident.

The score shown in figure 4 seems quite high due to the fact that the operators did not have clarity about their responsibilities because there was not standard document listing the expectations and responsibilities of each position; therefore, operators felt somewhat confident according to what they believed their responsibilities to be.

Figure 4

Confidence Level After Training



Are you aware of the required expectations of the tasks that you perform to consider them successful?

Three people responded they were aware of the expectations. Two people said no, and three people were not sure if they knew what the required expectations were in order to consider their work successful. Since there is not a document that shows the required expectations for each position, it is difficult to say if they were really aware or not about all required expectations. However, more than half of the participants felt they did not know what all the expectations were, which clearly shows the lack of clear documentation about expectations and responsibilities. By adding clear expectations and responsibilities to the SOPs operators will have a clear understanding of what success looks like and it would make it possible for them to know how confident they feel about accomplishing the expectations.

What particular tasks do you think are the most challenging to perform in your position? Why?

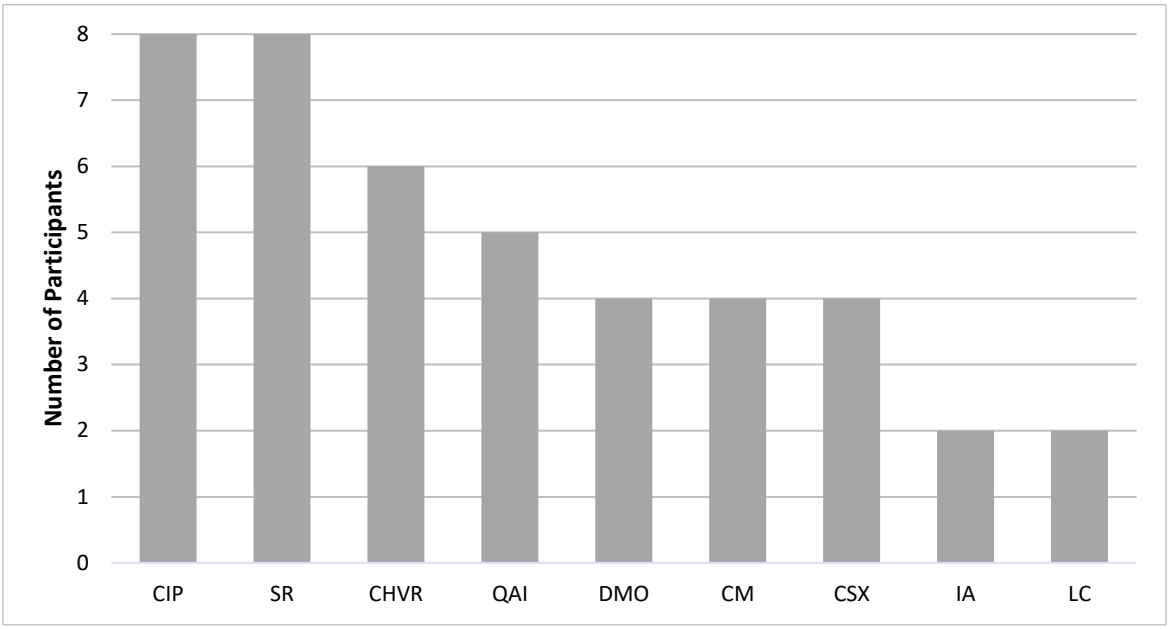
Nine different tasks were listed as the most challenging. Figure 5 shows how many participants of the questionnaire listed each task.

1. Cleaning in Place (CIP)
2. Sanitized Rinses (SR)
3. Changeovers (CHVR)
4. Entering QA inspections on time (QAI)
5. Entering data in DMO (DMO)
6. Accurate communication with maintenance (CM)
7. Accurate communication at shift exchange with other operators (CSX)
8. Maintain inventory accuracy of packaging materials (IA)

9. Find the root cause of leaky containers (LC)

Figure 5

Challenging Tasks



Everybody that completed the questionnaire agreed on two main tasks that they found to be challenging to perform. These are CIPs and sanitized rinses. The reason that these tasks are a challenge is that the production operators do not perform these activities on regular basis. Company XYZ has a sanitation crew that works during the night shift and usually performs the CIPs at the end of the production schedule. The daily production schedule is created in a way that avoids running products that need a CIP in between, which helps to save time and allows the sanitation crew to take care of the process during the night shift. However, there are some occasions when the schedule of production forces products to be added in the middle of the schedule, after which a CIP is needed. In these occasions, the production operators must perform the activity rather than the sanitation crew. Since these circumstances are not observed on a daily basis and there are not detailed documents outlining a step-by-step process, mistakes happen

frequently and it may take longer to perform the activity. The other tasks listed lack detailed documentation about the process and expectations.

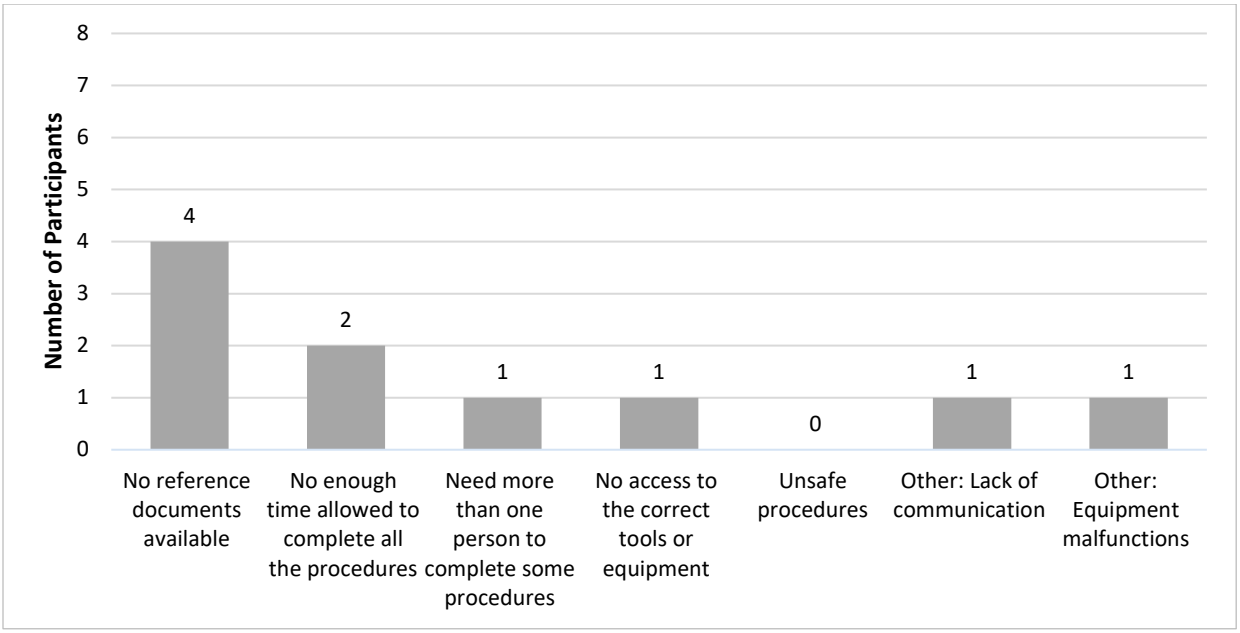
From the list below, what barriers do you think could prevent you from completing your job successfully?

- ***No reference documents available***
- ***No enough time allowed to complete all the procedures***
- ***Need more than one person to complete some procedures***
- ***No access to the correct tools or equipment***
- ***Unsafe procedures***
- ***Others:***

Figure 6 shows that half of the participants see the lack of reference documents as a main barrier to complete their job successfully.

Figure 6

Barriers



Are there any activities that your job requires you to perform that you feel you don't have enough knowledge to complete them?

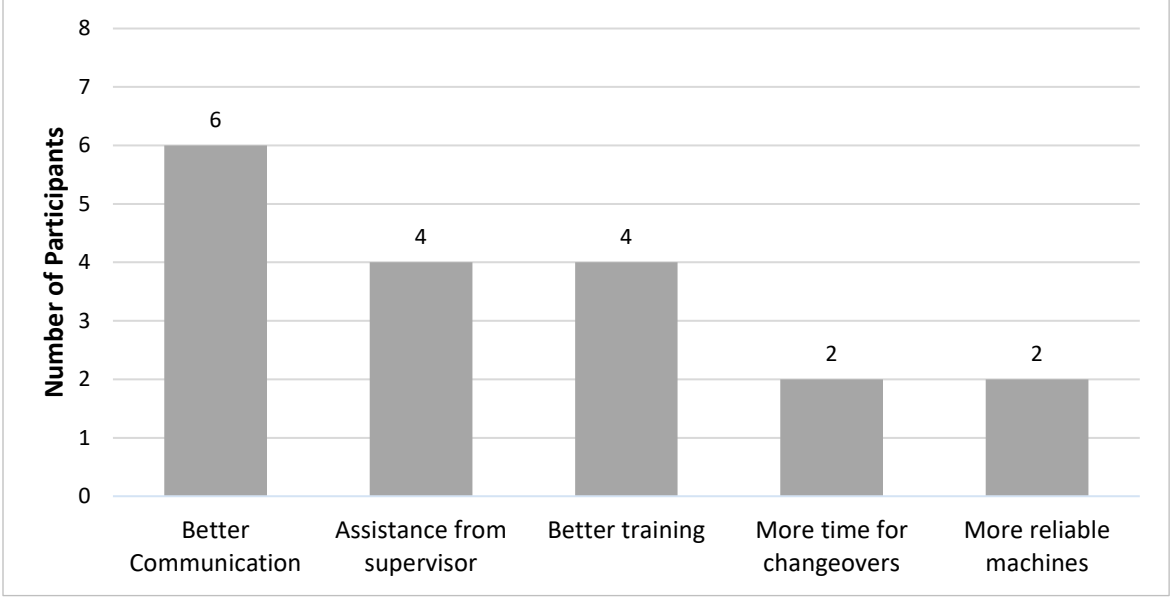
CIPs and sanitized rinses were listed again as the top two activities that the operators feel they do not have enough knowledge to complete them successfully. The activities that are performed infrequently and that lack reference documents with detailed step-by-step procedures are the most challenging tasks for the operators; therefore, the most vulnerable activities for human errors to happen. These activities have to be covered in SOPs and described with enough detail to allow any operator to complete the job successfully.

What do you think would help you to perform your job with the least potential for errors?

The operators that completed the questionnaire reported that poor communication, lack of assistance from supervisors when operators don't know how to proceed, and the need for better training are the main areas that need improvement in order to decrease the chances for human errors. Other suggested areas for improvement are also shown in figure 7. To improve communication in real time, the addition of radios can mitigate the issues that operators and supervisors experience, and the implementation of appropriate SOPs can address provide clear directions for every step of the process and improve the training methods for the new operators.

Figure 7

Suggestion for Improvement



Chapter V: Discussion, Conclusion and Recommendations

The purpose of this study was to understand the causes of human errors in the production department of Company XYZ, and to provide possible solutions to help reduce the number of errors. This chapter contains conclusions and recommendations established after reviewing related literature and analyzing detailed data collected for this purpose. The recommendations provided in this chapter do not guarantee the total elimination of human errors in a manufacturing facility; however, they do decrease the chances of operators making mistakes. The data used to support these recommendations is ample and contains enough details to understand the root cause of multiple errors. Furthermore, the participation of volunteers from different departments provided a cross functional analysis that involves different points of view and the study of real situations that took place in the production department

Limitations

This study was limited to events considered as human errors only which caused downtime to production lines. The data collected was limited to the packaging division of the production department. The mere act of creating documents with instructions on how to perform a job will not improve performance or reduce errors. It is necessary to enforce the use of standards procedures and to promote the implementation of continuous improvement behaviors in order to accomplish results. It is essential that management facilitates, promotes, and enforce any recommendation here provided if positive results are expected.

Conclusions

The majority of human errors that took place during the last twelve months at the production department of Company XYZ were linked to a lack of clear information about expectations and how to perform procedures. The standard operating procedures of Company

XYZ and the training process needs to be improved. It is essential to provide clear information and sufficient knowledge to the operators to perform their job successfully, an emphasis on standardization of work is needed in the production department.

Recommendations

Based on the review of literature and the analysis of data collected for this study, there are different recommendations that Company XYZ can implement in order to help with the reduction of human errors in the production department.

First, creating of a list of procedures that the operators are required to perform on each specific position. Once the list is completed, a cross functional team involving different departments, should review, update, and create standard operating documents according to the guidelines listed in the literature review of this study that include all procedures on the list.

Second, retrain the operators on the updated documents according the positions that each operator performs. The training should be documented and saved for future reference.

Third, implement periodical documented reviews between the trainer, trainee, and supervisor. It is necessary to evaluate the progress of the training and identify areas for improvement as the training advance to make sure it would be successful in the established time.

Fourth, implement periodic reviews of non-routine tasks such as CIPs and sanitized rinses. Review the step by step documentation and recreate the process if possible.

Fifth, create clear expectations about shift exchange communication and create a standard agenda that needs to be followed. Make sure that everybody involved is trained on it and the implementation is evaluated.

Sixth. The implementation of a radio communication system that allows reliable interaction between operators, mechanics, and supervisors.

Seventh, change the shift start time of the blending section to create a four-hour difference with the packaging area.

References

Akyar, I. (2012). Standard operating procedures (What are they good for?). In *Latest research into quality control* (pp. 366-391). IntechOpen. https://doi.org/10.5772/50439

American Society for Quality. (n.d.). *What is the ISO 9000 standards series?* https://asq.org/quality-resources/iso-9000

American Society for Quality (n.d.). *What is root cause analysis (RCA)?* https://asq.org/quality-resources/root-cause-analysis

American Society for Quality. (n.d.). *What is total quality management (TQM)?* https://asq.org/quality-resources/total-quality-management

Bailey, V. (n.d.). The effects of standardization in the workplace. *Chron*. http://smallbusiness.chron.com/effects-standardization-workplace-36773.html

Blind, K., Jungmittag, A., & Mangelsdorf, A. (2011). The economic benefits of standardization. *DIN German Institute for Standardization.* https://www.din.de/blob/89552/68849fab0eeeaafb56c5a3ffee9959c5/economic-benefits-of-standardization-en-data.pdf

Conzemius, A., & O'Neill, J. (2009). *The power of SMART goals: Using goals to improve student learning*. Solution Tree Press.

Dobbs, M. F. (1994). Continuous improvement as continuous implementation: Implementing TQM in the city of Santa Ana. *Public Productivity & Management Review*, *18*(1), 89-100.

Doman, M. (2013, March 8). *A beginner's guide to lean: Standardized work — The linchpin of lean*. Association for Manufacturing Excellence.

https://www.ame.org/target/articles/2013/beginners-guide-lean-standardized-work-%E2%80%94-linchpin-lean

Dosland, O. (2007, April 19). *Pitfalls of hold procedures for faulty product*. Quality Assurance & Food Safety. https://www.qualityassurancemag.com/article/pitfalls-of-hold-procedures-for-faulty-product/

Feliciano, D. (2008, April 9). *Why are goals and objectives important?* Fast Company. https://www.fastcompany.com/795028/why-are-goals-and-objectives-important

Immerman, G. (2018, May 8). *The real cost of downtime in manufacturing*. MachineMetrics. https://www.machinemetrics.com/blog/the-real-cost-of-downtime-in-manufacturing

Marino, J. J. (2013). *Continuous improvement through teamwork, collaboration & shared leadership!* Klasse. https://www.rehoboth.nu/upload/files/tuesday_all_day.pdf

Marr, B. (n.d.). *What is a KPI?* Bernard Marr & Co. https://www.bernardmarr.com/default.asp?contentID=762

Martin, T. D., & Bell, J. T. (2017). *New horizons in standardized work: Techniques for manufacturing and business process improvement*. CRC Press.

McLeod, S. A. (2018, January 21). *B.F. Skinner - Operant conditioning.* Simply Psychology. https://www.simplypsychology.org/operant-conditioning.html

Neches, R., Fikes, R. E., Finin, T., Gruber, T., Patil, R., Senator, T., Swartout, W., R. (1991, September 15). Enabling technology for knowledge sharing. *AI Magazine*, *12*(3), 36-56. https://doi.org/10.1609/aimag.v12i3.902

Otsuka, K., Jin, K., & Sonobe, T. (Eds.). (2018). *Applying the Kaizen in Africa: A new avenue for industrial development*. Springer Nature.

Qeshmy, D. E., Makdisi, J., da Silva, E. H. D. R., & Angelis, J. (2019). Managing human

errors: Augmented reality systems as a tool in the quality journey. *Procedia Manufacturing, 28,* 24-30. https://doi.org/10.1016/j.promfg.2018.12.005

Rivas, G. (2019, February 8). *How to gain productivity through process standardization?* GB Advisors. https://www.gb-advisors.com/process-standardization/

Shetty, Y. K. (1991). A point of view: Seven principles of quality leaders. *National Productivity Review, 11*(1), 1-7. https://doi.org/10.1002/npr.4040110102

Sleight, D. A. (1993). *A developmental history of training in the United States and Europe.* Michigan State University. https://msu.edu/~sleightd/trainhst.html

Torraco, R. J. (2016). Early history of the fields of practice of training and development and organization development. *Advances in Developing Human Resources, 18*(4), 439-453. https://doi.org/10.1177/1523422316659898

United States Environmental Protection Agency. (2017, April). *Guidance for preparing standard operating procedure (SOPs)*. https://www.epa.gov/sites/production/files/2015-06/documents/g6-final.pdf

Vatanparast, S. (2019, August 13). Why poor shift handover can lead to serious oil & gas incidents. *EHS Today.* https://www.ehstoday.com/safety/article/21920292/why-poor-shift-handover-can-lead-to-serious-oil-gas-incidents

Appendix A

Consent to Participate In UW-Stout Approved Research

Project Title: Standardization of Operating Procedures as a Training Principal

Description:

We are trying to understand what barriers or difficulties employees from Company XYZ have during their training period that can be responsible for errors that employees make once they are performing the job on their own. You will answer a brief written questionnaire about your training Experience and you will be able to provide some recommendations to improve the current training method. Please feel free to ask the researcher any questions that you might have regarding this study.

Risks:

There is a chance your data could be seen by someone that should not have access to it. We are minimizing this risk by keeping the answers anonymous and removing personal identifiers (except gender).

Benefits:

You may benefit by helping us improve the training experience for all employees and also by helping create the necessary tools to support employees on their regular jobs.

Confidentiality:

No identifying information will be publicized during this study. All data will be stored in a locked desk and will be permanently deleted once the Fall Semester 2020 ends.

Future Use:

Any information collected for this research project will be stripped of identifiers and will not be used in other research in the future.

Time Commitment:

Answering the questionnaire will likely take between 15 to 30 minutes

Right to Withdraw:

Your participation in this study is entirely voluntary. You may choose not to participate without any adverse consequences to you. You have the right to stop the survey at any time. However, should you choose to participate and later wish to withdraw from the study, there is no way to identify your anonymous document after it has been turned into the investigator. If you are participating in an anonymous online survey, once you submit your response, the data cannot be linked to you and cannot be withdrawn.

IRB Approval: This study has been reviewed and approved by The University of Wisconsin-Stout's Institutional Review Board (IRB). The IRB has determined that this study meets the ethical obligations required by federal law and University policies. If you have questions or concerns regarding this study, please contact the Investigator or Advisor. If you have any questions, concerns, or reports regarding your rights as a research subject, please contact the IRB Administrator.

Investigator: Ivanov Diaz-Gonzalez

678-399-0542 |

diazi7504@my.uwstout.edu

Advisor: Xuedong (David) Ding

715-232-1195 | dingx@uwstout.edu

IRB Administrator

Seth Langreck

Office of Research and Sponsored Programs

101 Vocational Rehabilitation Bldg.

UW-Stout. Menomonie, WI 54751

715.232.2691

Langrecks@uwstout.edu

Statement of Consent:

By signing this form, you agree to participate in the project entitled, Standardization of Operating Procedures as a Training Principal.

_____

Name Date

_____

Name of parent or guardian Date

(if minors are involved)

Appendix B

Interview Questions

1. How long did you train before holding your position?
2. How many trainers did you have during this period?
3. From 1 to 10, how confident did you feel about completing all your responsibilities when you completed the training? With 1 being not confident at all and 10 extremely confident?
4. Are you aware of the required expectations of the tasks that you perform to consider them successful?
    - Yes
    - No
    - Not sure
5. What particular tasks do you think are the most challenging to perform in your position? Why?
6. From the list below, what barriers do you think could prevent you from completing your job successfully?
    - No reference documents available
    - No enough time allowed to complete all the procedures
    - Need more than one person to complete some procedures
    - No access to the correct tools or equipment
    - Unsafe procedures
    - Others: _____

      _____

7. Are there any activities that your job requires you to perform that you feel you don't have enough knowledge to complete them?
8. What do you think would help you to perform your job with the least potential for errors?

Appendix C

Human Errors Raw Data Collection

Human errors classified as a result of a procedure gap

Production Line	Duration (minutes)	Comments
Bag and Box	165.0	Returned from lunch with water in the balance tank. Another line accidently put water to my tank when they were doing their change over. Error during the procedure.
3 Liter	85.0	Waiting on juice. Pasteurization was performed in the wrong order without communicating.
32oz Carton	72.0	Waiting on juice. Brix was low, blending needs to fix the batch.
Coffee Pouch	70.0	Waiting for coffee, blenders waiting on QA to perform brix check. QA is missing testing paper since 5am, found eventually on 1st shift, new tech didn't know where to look for test paper.
Coffee Pouch	61.0	Created message for batch 10000645 - barcode was incorrect waiting for mechanic to get out of training. Don't know how to set it.
3 Liter	60.0	New raw material came on wood pallets blender needs to put on plastic pallets before being able to blend. Communicated at 7am to receiving department to make the change. It was not communicated beforehand.
32oz Carton	60.0	Electric outlet was exposed to water during cleaning causing printer head to shut off. Outlet was no covered during cleaning. It has never been covered.
Coffee Pouch	50.0	Water rinse was sent with coffee transfer, blenders had to drum off what was transferred. Something went wrong during the transfer from blending.
Bag and Box	49.0	Adjusting brix. Blenders need to fix the brix. Of the batch
32oz Carton	38.0	Waiting on juice to be pasteurized due to high brix for pici012 waiting blenders to fix
Bag and Box	37.0	Waiting for blender to blend juice. Blender behind due to previous batch had to adjust brix
32oz Carton	34.0	Waiting on juice 2nd batch. Undissolved materials.
3 Liter	33.0	Blending fixing batch due to high brix
3 Liter	33.0	Aplio25 brix was too high, blender have to adjusted
3 Liter	30.0	Operator closed the drain valve before sending the air, which caused the filler bowl to get full of water preventing the transfer pump from sending juice. Maintenance was troubleshooting the pump and valve until they noticed the filler bowl was full of water.
3 Liter	29.0	Mechanics were fixing electrical trouble shooting. No electrical issues. Too many bottles in turn table
3 Liter	27.0	Metal detector found a piece of metal 10 minutes into the batch, Top cover on filler bowl was too low, it was hitting on filler bowl. Not noticed during start up. No verification processes.
3 Liter	27.0	QA found batch has low acid. Blending needs to adjust. Waiting for juice.

64oz Carton	25.0	Juice org 65 top seal leaking juice too much foam changes over and apple 615. Unable to get weights. Too foamy/air
3 Liter	21.0	Batch is not ready yet. Schedule was not blended in order. We'll move to next batch and then come back to orda655. Need to remove bottles with labels from the line
32oz Carton	21.0	Trying to adjust weights as 15 cases were low weights
Bag and Box	21.0	Waiting for blender to blend juice. Blender behind due to previous batch adjusting brix
64oz Carton	20.0	Mechanics late setting up/ adjusting j- bottoms
64oz Carton	20.0	Blending behind on 32oz due to pina colada undissolved gums. Whole process was pushed behind.
3 Liter	20.0	Blend tank 3 agitator was set at regular speed (55) but blending informed it now needs to run higher. This caused pulp to be low on first two pallets.
64oz Carton	20.0	Quality stop adjusting weights
3 Liter	20.0	Brix too high needed adjustment
64oz Carton	19.0	Mechanic on first shift replaced screw in the heater with wrong size that was installed.
32oz Carton	19.0	Cartons supposed to be non-j bottom / mechanics change heaters to non-j bottom
32oz Carton	18.0	Waiting for juice issues with coconut not dissolving
3 Liter	16.0	Juice not dissolving in pump changed to next batch unplanned. Blending will fix batch
3 Liter	16.0	Run out of labels system shows labels exist, physically labels do not exist for the bottles. Labels found later
Bag and Box	15.0	Low brix. Blending needs to adjust.
Coffee Pouch	15.0	Low solids for cofee. Checked another sample with QA
3 Liter	15.0	QA stopped the line said we cannot use this bottle labels. They are the old format
Bag and Box	15.0	QA had to stop the line due to low brix.
32oz Carton	15.0	Lema 025 brix is too high. Blending will fix. They recommended to move to next batch and come back to lema later.
64oz Carton	15.0	Filler change the j bottom mechanic changed j bottom / has to change to j bottom
3 Liter	15.0	Waiting on mx to fix descrambler/ no mechanical issue, the door was not properly closed.
3 Liter	15.0	Low brix, had to run a few bottles until brix was fixed. Water still in the line
32oz Carton	15.0	Mechanic went to lunch, hold tank pump stop (the bypass valve on the pump was not set properly for the product running not a maintenance issue)
3 Liter	14.0	Ingredients on orgio60 not dissolving. Causing mesh to clog operator changed mesh
32oz Carton	12.0	Operator didn't see the palletizer did not have a pallet to place case layers on too
3 Liter	11.0	QA stop, descrambler & filler operators miscommunication error caused operator to put wrong date code and labels
3 Liter	10.0	A full bottle of juice was rejected 3 times operators have to investigate. During investigation they found a piece of metal in a bottle raise top cover on filler bowl it was too low it was hitting on filler bowl

32oz Carton	10.0	Waiting on juice 2nd batch
3 Liter	10.0	Gums undissolved clogging up mesh filter. had to change mesh
32oz Carton	10.0	Gasket needed to be adjusted on filler nozzles side #1. It wasn't installed correctly.
64oz Carton	10.0	QA stopped the line to check if undissolved sugar was ok to run.
3 Liter	10.0	Had changed to the new format but had to change back to the old one because QA finally approved.
3 Liter	10.0	One ingredient on orgio060 not dissolve causing mesh clog.
3 Liter	10.0	One ingredient on orgi060 not dissolve causing mesh clog
3 Liter	10.0	Glue system fault \ glue bin ran out of glue \ operator from previous shift did not let me know glue was low \ filled up & had to wait for glue to heat up
3 Liter	9.0	Orga 59 one ingredients not dissolve causing clog mesh, operator have to change
Bag and Box	8.0	Glue machine turn off and need to heat up, no glue on boxes, we found that power switch was off with no alarms just turn switch on
Bag and Box	8.0	Waiting for juice. Adjusting brix
3 Liter	7.0	Ingredients in orgio60 not dissolving. Causing mesh to clog operator changed mesh
32oz Carton	7.0	Machine stopped with cartons inside on its own -maintenance was not called.
32oz Carton	6.0	Pump shut off (pump running too fast causing it to overload.)
32oz Carton	6.0	Machine stopped by itself with cartons inside -maintenance was not called. Found lube for the filler was not turn on causing filler to stop randomly with servo overload on pocket chains. No check list.
Manual Fill 3L	6.0	Printer shop down waiting to star up, cleared alarm, was not properly shut down the night prior
3 Liter	5.0	Ingredients not dissolving causing mesh to clog operator change mesh every stop.
32oz Carton	5.0	Air pressure was off so codes that went on to cartons were bad- operator error
32oz Carton	5.0	Empty line with all leakers from side 2
3 Liter	5.0	Raw material undissolved clogging up mesh filter. had to change mesh
32oz Carton	5.0	Machine stopped on its own with carton inside found lube for the filler was not turn on causing filler to stop randomly with servo overload on pocket chains.
32oz Carton	5.0	Operator had to adjust the weights. They were wrong.
64oz Carton	5.0	Mech change heaters wrong heaters on.
3 Liter	3.0	Ingredients not dissolving in product orgio60 causing mesh clog, blending changing mesh
3 Liter	3.0	Ingredients not dissolving in product causing mesh clog blending changed mesh
3 Liter	3.0	Orgio60 one ingredient not dissolved in product causing mesh to clog. Blending changed mesh
32oz Carton	2.0	Had to clean glue build up.

Human errors classified as a result of lack of attention

Production Line	Duration (minutes)	Comments
Coffee Pouch	30.0	Turn table fault. Power supply switch was turned off during the filling cycle by mistake when operator tried to stop the filler.
3 Liter	22.0	Forklift driver put an empty pallet upside down causing boxes fall.
3 Liter	22.0	Low brix on product put water by mistake
Coffee Pouch	20.0	Boxes with no tape were giving problem to palletizer. Tape run out and it wasn't replaced.
32oz Carton	19.0	Wrong country of origin entered on blend sheet.
3 Liter	18.0	Emergency stop button on the palletizer was pressed and the palletizer won't start up. Had to start hand palletizing.
3 Liter	17.0	Pallet upside-down, boxes fell and juice spilled.
Manual Fill 3L	16.0	Waiting for printing staring-operator shut off coder before going to lunch
Manual Fill 3L	15.0	1st shift had switched tank pump to tote pump by mistake.
64oz Carton	15.0	Cartons were coming out open due to container folder being bent out of place (after changing fill valve the clamps were put on improperly causing the top breaker to get bent causing top forming issues.)
3 Liter	15.0	Forklift driver placed pallet in the 3lt palletizer the wrong way causing it to break a sensor.
Coffee Pouch	15.0	When resetting case count, after set up, date code was changed. It wasn't noticed.
3 Liter	15.0	Upside down pallet was placed on palletizer
32oz Carton	13.0	Turned on drain to purge juice and forgot to turn off.
32oz Carton	12.0	Pump was leaking. Had to re adjust clamp, operator error
64oz Carton	12.0	Side 2 infeed cartons magazine stop machine. Clear jam started up machine. Operator forgot to turn on water/reset instead of moving sensor
32oz Carton	10.0	Because cartons are not being filled up. Bottom cases entered in magazine incorrectly/ reverse
Manual Fill 3L	10.0	Label roll kept breaking operator put labels on wrong way.
Coffee Pouch	10.0	Cases went to palletizer without tape.
32oz Carton	10.0	Mechanic adjusting packer-step stool underneath packer preventing elevator from dropping. Non-mechanical.
3 Liter	10.0	Pallet placed upside down in the palletizer
3 Liter	9.0	Operator ran out of labels. Had to go get more in order to do the roller label change. Didn't move enough.
Coffee Pouch	8.0	Waiting for weight computer to restart to put in samples. Shut it off accidentally.
3 Liter	7.0	In the middle of the run someone turned the transfer off during the run.
Coffee Pouch	7.0	Adjusted the ink coder placement and photo eye shut off
3 Liter	6.0	Forklift driver set up the pallets crooked. Pallets had to be taken out to be put on properly.

64oz Carton	5.0	Operator forgot to switch sensor to correct layer.
Coffee Pouch	5.0	Tape was no put on correctly causing boxes to not tape.
3 Liter	5.0	Emergency stop was accidentally pushed
3 Liter	5.0	Trainee accidentally hit e-stop
Manual Fill 3L	5.0	Transfer was accidentally turned off by someone not sure who but was turned off
3 Liter	4.0	Label change, operator did not load the second labeler
3 Liter	4.0	Operator had to readjust labels on the roller bottle labeler due to labels not being put on properly on the bottles.
32oz Carton	3.0	Operator accidentally hit the estop \ conveyor not running
3 Liter	3.0	Operator let bottles go low (lack of bottles in hopper)
3 Liter	2.0	Filler said he couldn't see the palletizer moving.

Human errors classified as a result of not following procedure

Production Line	Duration (minutes)	Comments
32oz Carton	45.0	Gums were not checked before transferring to tank as normal. Gums were undissolved. QA decided to run with double filters and take extra samples.
32oz Carton	40.0	The wrong Nozzles were assembled by sanitation. They did not check the schedule. They assumed we were running coffee as we usually do on Fridays.
3 Liter	35.0	Waiting for pasteurize juice. Blenders pasteurized 64oz first because it was easier but 32oz was priority.
Manual Fill 3L	31.0	Quality stop, low brix, brix wasn't checked before transfer. Drummed off what was in the run bowl,
64oz Carton	25.0	Sanitation put the wrong nozzles for orange batch, switch nozzles. They didn't follow the guide.
32oz Carton	22.0	Mechanic reset filler / weights dropping down / the coffee nozzle were incorrectly assembled
Bag and Box	20.0	Boxes were put in the wrong way which caused the vacuum of the box maker would not vacuum the box properly.
Coffee Pouch	20.0	Different coffee pouches were mixed. Old pouches were not moved out of the line before starting new batch.
32oz Carton	20.0	Containers leaking. Operator didn't stop the filler.
32oz Carton	20.0	We had to stop the line because pump was leaking due to the way first shift set up the pump. They run it like that.
32oz Carton	15.0	Coffee nozzles were assembled incorrectly. operator didn't read the instructions printed by supervisor.
3 Liter	13.0	No glue in glue box. Operator assumed it was enough to finish the order.
32oz Carton	12.0	Human error ran wrong material. Didn't consume before running.
3 Liter	11.0	Filler operator failed to double check brix with blending.
3 Liter	11.0	Running bottles without labels. Operator error. didn't check the first bottle.
3 Liter	10.0	Bottle coder. Bottles running w/out code.
Bag and Box	10.0	Label information on the box incorrect, operator didn't check.
Bag and Box	10.0	Pump was not working, sanitation crew forgot to put the impellers in transfer pump.
32oz Carton	10.0	Sanitation did not put gasket on nozzles, it caused low weights. I need to put gasket and clean machine
3 Liter	9.0	Q/a stop due to low weight
3 Liter	6.0	Bottles running w/ out coder
Bag and Box	5.0	We didn't look all information on boxes

Human errors classified as a result of no standard procedure in place

Production Line	Duration (minutes)	Comments
Coffee Pouch	105.0	QA needed the kosher symbol printed on the cases. Operators don't know how to add it to the new coder. Waiting for IT to support addition of symbol. IT not available, globe coordinator was able to apply kosher symbol to fox-jet coder. 15 extra min waiting for QA to approve batch code and kosher symbol on the cases.
64oz Carton	105.0	Mechanic adjusting sealers due to cartons bad shape. Operator did not like the way the packs looked but packs were not leaking. Made several adjustments thru out the day. cartons were not leaking but operators kept stopping the line. No reference pictures. Packs didn't look good, but not leaking.
64oz Carton	75.0	Unable to achieve weights due to foam. Batch level was at the agitator height causing batch to foam up. Needed to transfer to settle tank but operator did not remember how to do it. It took time to figure it out.
3 Liter	40.0	Sanitation put wrong side filler valve causing the filler to run out of time.
Bag and Box	10.0	Operator put new boxes in the wrong way causing the packer not to respond as it should, as well as jams and the robotic arm dropping boxes. No visual on how to insert boxes.
3 Liter	7.0	1st shift operators left line before my team made it on the floor due to long meeting. Myself & team had to catch ourselves up with everything on the line before running.
Manual Fill 3L	5.0	Rewind bottles labels by hand.
Manual Fill 3L	5.0	Ribbon was stuck in the labeler. Had to cut it to take it out. Didn't know how to unjam it.