Qualitative Study on Barriers/Successes in Integrating Safety and Process Improvement using the Modular Value Stream Safety Map (MOD VSSM)

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This thesis titled

Qualitative Study on Barriers/Successes in Integrating Safety and Process Improvement using the Modular Value Stream Safety Map (MOD VSSM)

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ABSTRACT

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Qualitative Study on Barriers/Successes in Integrating Safety and Process Improvement using the Modular Value Stream Safety Map (MOD VSSM)

Director of Thesis: Diana J. Schwerha

Process improvement and safety are two important factors to any successful manufacturing company. Employees, however, often seem to view them as competing demands. The objective of this research is to understand how employees view safety, process improvement, and the integration of the two.

After a short training on an integration tool aimed to view safety and process improvement simultaneously, the employees provided their perception on safety, process improvement, and the integration of the two. Analysis of the qualitative data showed that there are often conflicting responses and behaviors when it comes to prioritizing safety over production. The research also indicated a divide in the perception of the correlation between safety and process improvement.

Although limited data was collected after the focus group, the MOD VSSM was successful in improving communication across employees and was viewed by participants to be an asset for the company.
This thesis is dedicated to my parents, Luke, Amelia, Jeff, Roscoe, and Zoey for their loving encouragement.
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1 INTRODUCTION

In 2014, serious, nonfatal workplace injuries totaled nearly $60 billion in U.S. workers' compensation costs (Liberty Mutual, 2017). In 2015, manufacturing was one of only three private industries that had over 100,000 days away from work due to incidents. With an increase of 5 percent from 2013, manufacturing alone resulted in 125,990 days away from work. It also had an incidence rate of 99.0 cases per 10,000 full-time workers, higher than the total private industry rate of 93.9 cases in 2015 (BLS, 2015). The significant cost of workplace incidents places safety, especially in manufacturing, as one of the top priorities for companies.

Often, prioritizing safety can be a demanding challenge managers are constantly battling. Employees of manufacturing companies feel pressure to meet production quantity and timeline deadlines while also working safely (Brown et al., 2000). To accomplish both can seem like a daunting task, and often one or the other gets compromised. Managers need a more effective method to tackle this ongoing problem to ensure a successful manufacturing company.

Companies typically look at this problem from isolated areas; safety and production. These are often handled by different silos within the organization that differ in their approach and language to discuss and measure improvements. Each group plans and implements their own projects to improve their individual goals; safety or process improvement. These plans may be established without communication and can be seen as conflicting by the floor employees asked to
utilize both plans. However, by breaking down these silos and connecting the two goals, the company can be more successful in achieving both a safe and effective process.

Safety may be either housed in human resources or an independent safety group. Safety managers have historically been challenged to justify interventions because there is no concrete way to measure if an injury has been prevented due to a specific intervention (Haight, Yorio, Rost, and Willmer, 2014). As such, many safety managers are forced to use lagging indicators to rationalize their use of company money and time. Lagging indicators are factors measured after an event, such as injury rates or near-misses. The use of lagging indicators to justify interventions is complicated because often when injury rates are high, the company allocates more resources to safety prevention and conversely when injury rates are low, the company allocates fewer resources to safety (Haight et al., 2014). Due to this difficulty, safety managers often rely on non-quantitative measures to reduce risk factors, such as looking at procedures and behaviors, to justify safety interventions (Haight et al., 2014).

Production and process improvement are often the role of plant supervisors or quality control. The managers responsible for process improvement typically use key performance indicators (KPIs) to justify their projects (Kang, Zhao, Li, and Horst, 2015). Most KPI relationships are measured using data-based statistical approaches. Some quantitative examples include efficiency, product quality, throughput, and lead time (Kang et al., 2015). These
measures are easily connected to financial savings or gains for the company, and thus the improvements are more relatable to upper management.

Due to the problems in quantifying the benefits of safety interventions, it can be difficult to talk with the same language as production improvement managers. Both sets of improvement groups use different metrics to measure their gains and the results are typically not comparable to one another. Due to this difficulty in communication, it is difficult to break down the two silos and join them to collaborate on a connected intervention to improve both production and safety. Through this research, I will strive to develop a tool that creates an effective method to bridge this gap. This research has three main objectives:

Objective 1: Determine employee baseline perceptions:
   - Objective 1A: of safety-production compatibility
   - Objective 1B: of process improvement and safety integration
   - Objective 1C: differences across employment level
   - Objective 1D: differences across company sites

Objective 2: Determine employee post-training perceptions:
   - Objective 2A: of safety-production compatibility
   - Objective 2B: of process improvement and safety integration
   - Objective 2C: differences across employment level
   - Objective 2D: differences across company sites

Objective 3: Determine whether the integrative tool can influence a person’s perception on SPC.
2 LITERATURE REVIEW

2.1 Safety in the Workplace

In 2014 alone, nearly 3.0 million nonfatal workplace injuries and illnesses occurred in the United States (BLS, 2015). Safety is a critical aspect of work and companies continually should strive to improve their safety programs and initiatives. Two components used to define a company’s safety are their safety management system (SMS) and their safety climate. One study found that there are three dimensions of safety climate that directly impact employee risk behavior; management commitment to safety, priority of safety, and pressure of production (Bosak, Coetsee, Cullinane, 2013). All three of these factors are controlled by the company’s safety management system, or SMS. Thus, by focusing on a company’s safety climate and their SMS we can impact the level or risk behavior employees engage in.

2.1.1 Safety Climate

According to Neal and Griffin (2002), safety climate “refers to the perceptions of policies, procedures, and practices relating to safety in the workplace” (p. 69). It differs from safety culture which is broader and includes all attitudes, beliefs, and perceptions that influence how workers act and react to risks (Hale, 2000). Safety climate has many dimensions and researchers have not agreed on the precise structure of it (Neal and Griffin, 2002). However, popular components of safety climate have been suggested to include management values, management and organization practices, communication,
and employee involvement (Jiang and Probst, 2015; Neal, Griffin, and Hart, 2000). A recent study by Jiang and Probst (2015) evaluated these components specifically through behavioral safety compliance, reporting attitudes, safety knowledge, and safety motivation.

Throughout the years, several studies have shown a direct correlation between safety climate and workplace injuries. A study by Beus, Payne, Bergman, and Arthur Jr. (2010) showed that safety climate and injuries are conjointly related, meaning safety climate is a predictor of workplace injuries, and injuries also affect worker’s perception of safety climate. Clarke’s study in 2010 found that safety climate has a strong connection to safety behavior and psychological well-being, and that both of these are significantly associated with occupational accidents. Thus, both studies support the rationale that safety climate is a strong indicator of workplace injuries.

2.1.2 Safety Management System (SMS)

At work, companies utilize a safety management system (SMS) to manage safety (Frazer et al., 2013). However, establishing a SMS involves several aspects of policy. An article by Frazier et al. suggests ten elements that need to be considered when viewing a company’s SMS: safety policy, training, communication, incident reporting, safety audits, rewards, employee engagement, safety meetings/committees, feedback, and discipline (2013). To create and maintain a successful SMS, a company should strive to include all ten of these aspects in their policies.
The three specific aspects of SMS mentioned earlier that impact safety climate are management commitment to safety, priority of safety, and pressure of production (Bosak, Coetsee, Cullinane, 2013). If a company concentrates their SMS focus onto these three factors they can improve their workplace safety climate, which will reduce workplace risk behaviors. Risk behaviors, such as ignoring safety regulations, non-compliance with policies, or engaging in forbidden activities, have been linked to accident involvement (Bosak, Coetsee, Cullinane, 2013). Thus, by promoting safety culture through SMS the company can ultimately reduce the number of workplace injuries.

2.2 Process Improvement

According to Sutari et al., “process improvement is the systematic approach to closing of process or system performance gaps through streamlining and cycle time reduction, and identification and elimination of causes of below specifications quality, process variation, and non-value adding activities” (2015, p. 3430). In more general terms, it is any orderly initiative to improve a current process. To be competitive in their industry, many manufacturing companies focus their process improvements on improving their production (Sahno et al., 2015). Some measure improvements are decreased cycle time, higher quality products, and less re-work. Two common practices of process improvement are lean and six sigma.
2.2.1 Lean

Lean manufacturing got its start at the Toyota Production System in the 1970s (Čiarnienė and Vienažindienė, 2012). It was developed by the Japanese in an effort to compete with the global automotive market. It is often viewed as both a production and business philosophy that decreases the time between an order and delivery, while reducing waste throughout the system (Womack, Jones, and Roos, 1990).

Lean production is centered on reduction of waste. The principle states that waste comes in many different forms and by reducing it, a company will become more efficient and increase profits. There are seven different types of defects identified by the lean system; overproduction, waiting, inventory, transportation, unnecessary motion, inappropriate processing, and defect (Wahab, 2013). Some of the tools and terminology used by lean professionals include poke-yoke, pull system, value stream, and 5S (sorting, simplification, systematic cleaning, standardization, and sustaining). All of the tools used in a lean intervention are meant to “eliminate activities or processes that consume resources, add cost or require unproductive time without creating value” (Manuele, 2007, p. 28). Lean has become a popular technique among several industries to eliminate waste and improve profit.

2.2.2 Six Sigma

Six Sigma is a process improvement tool that aims to decrease defects. Statistically, the term ‘six sigma’ comes from having only 3.4 million defects per
million opportunities (Antony and Banuelas, 2002). The quality improvement technique was first implemented by Motorola in the 1980s. Although the introductory focus of six sigma was to reduce costs related to product quality defects, such as re-work and wasted material (Antony and Banuelas, 2002), it has over time been applied to many other aspects of business, such as “marketing, engineering, purchasing, servicing, and administrative support” (Kwak and Anbari, 2006, p. 709).

To achieve the overall objective of six sigma of having less than 3.4 defects per million opportunities, the business strategy uses the DMAIC process-Define, Measure, Analyze, Improve, and Control. The first stage, define, ensures the six sigma team conducting the intervention specifically defines the problem and how it is to be measured. From this, the team develops a goal for the end of the project. The second step, measure, involves measuring the current state of things. This baseline measurement will later be used to measure the improved phase. Third, analyze, the team reviews the process and discusses root causes of the problem and potential interventions to improve the current process, and statistically demonstrate the key process input variables. Fourth, the team decides on a solution and implements the process change. Following implementation, they will measure how many defects are produced in the updated process and compare it back to the baseline data. If the program is unsuccessful the first time around, they will repeat steps three and four again until they measure a successful improvement. Once the program is successful
and the defects have been reduced, the team moves on to the final stage and develops a plan to control this new process and periodically check the defects to ensure the process has not slipped back out of control. Throughout these steps, there are numerous statistical tools to assist in analyzing the process.

Six Sigma has consistently shown to be a successful process improvement technique for manufacturing companies. One study at a bicycle chain manufacturing plant implemented this program and had over 80,000 less product defects as a result. Financially, this saved the company $288,000, a substantial amount for a small company in India (Kaushik, Khanduja, Mittal, Jaglan, 2012). In another case study, a helicopter sub-assembly plant utilized the Six Sigma program to reduce their high number of defects. The program resulted in reducing their defects from around 9 percent to virtually 0 percent, and an estimated savings of more than $57,000 for the year (Prashar, 2013). Both of these case studies represent the significant capability a Six Sigma program has to reduce defects and promote financial savings in manufacturing.

2.3 Safety-Production Compatibility (SPC)

Now that safety and process improvement (mainly production improvement for manufacturing companies) have been discussed, we need to investigate the relationship between the two. This relationship is considered the safety-production compatibility (SPC).
2.3.1 What is SPC

Safety-production compatibility was officially described by McLain and Jarrell in their 2007 article *The perceived compatibility of safety and production expectations in hazardous occupations*. It is “a judgement of how far available resources of skill and time will go toward meeting both safety and production demands” (McLain and Jarrell, 2007, p.300). Employees are often forced to juggle the demands of both meeting production deadlines and working safely-two concepts that seem to conflict and lead to the perception that it is impossible to obtain excellence in both.

2.3.2 Pressure to Produce

According to Brown et al., work production pressure is “an employee’s perception that the organization encourages him or her to work around safety procedures in order to meet production quotas, keep up with the flow of incoming work, meet important deadlines, or continue getting paychecks” (2000, p. 448). Employees may make critical safety decisions depending on their perceived level of production pressure. For example, a study conducted at a large steel-manufacturing company heard from workers that “there is an expectation from management that, even though there is low staffing one day, it should not result in less productivity. The worker’s experiences show that when staffing goes down, accidents go up” (Nordlöf, Wiitavaara, Winblad, Wijk, and Westerling, 2015, p. 130). The link between this ongoing conflict is also evident in the demographics of worker injuries and illnesses-most of them are production
workers (Pagell, Johnston, Veltri, Klassen, and Biehl, 2014). Another study found that employees who reported more production pressure also experienced more work-place accidents and were more likely to under-report accidents (Probst and Graso, 2013). This perceived pressure from management to continually produce puts pressure on the workers to take short-cuts that risk their safety, such as using the wrong tool for a job, not using PPE, or forgoing incident reporting.

2.3.3 Pressure to Work Safely

Safety pressure is the compulsion to engage in safe work behaviors that stems from external forces such as management and co-workers (McLain and Jarrell, 2007). Since the pressure arises from outside sources (versus intrinsic factors) it is directly related to the safety climate of the company, as discussed in section 2.1.2. Employees develop their individual perception on the expectations of the company in relation to safety policies, such as wearing proper PPE, reporting near-misses, and providing safety improvement suggestions. Depending on the status of a company’s safety culture, employees may perceive a different level of pressure to work safely.

If a company has a positive safety climate, the work environment naturally becomes a place that enables, supports, and reinforces better safety compliance (DeJoy, Gershon, and Schaffer, 2004). Similarly, integrating safety into the overall management system improves safety-related outcomes (DeJoy, Gershon, and Schaffer, 2004). By carefully sculpting a workplace management system that values safety they can positively impact the safety climate. This positive safety
climate helps develop a healthy level of safety pressure to enable the workers to engage in safe behaviors.

2.3.4 SPC’s in Manufacturing

Throughout the years there have been several studies on the compatibility between safety and production in manufacturing companies. One study that looked at a chemical manufacturing company found that when employees perceived incompatibility between meeting deadlines and following safety procedures, they were more likely to forego safety precautions and engage in risk behaviors than if there was no apparent tension between production and safety (Bosak et al., 2013).

Another study looking at the steel industry showed a direct spike “in accident rates during times of increased production” (Brown et al., 2000). The employees in this case reported a perceived need to prioritize production over safety in order to keep bonuses and their jobs.

2.4 Integration

2.4.1 Current Integration Practices

As discussed earlier, integration of safety and process improvement is a challenge for companies due to the gap in communication. One way to bridge this gap is to translate safety intervention benefits into a business gain for the company, something production readily does already. There are several business arguments for companies to prioritize safety within their organization; injuries can impact industrial competitiveness, increase absenteeism and
defective goods all of which lower productivity and affect the company’s bottom line, (Moatari-Kazerouni et al., 2015, p. 4459).

Although process improvement techniques established their popularity in the 1980s (Williamsen, 2005), integration with safety is still a fairly new concept. As discussed earlier, many of these techniques began with a focus to improve product quality in manufacturing, but have since expanded to several other aspects of businesses. Only recently has literature focused on the integration of process improvements into safety (Ateekh-ur-Rehman, 2012; Hallowell, Veltri, and Johnson, 2009; Williamsen, 2005). By integrating these two concepts, it is possible to encourage discussion between operational management and safety professionals. Through these discussions, we can improve safety-production compatibility and thus improve workplace safety for all employees.

An example of this integration occurred at a steel manufacturing company in Saudi Arabia. This company implemented the DMAIC (define, measure, analyzed, improve, and control) program in order to set and improve an accident prevention system (Ateekh-ur-Rehman, 2012). Through the use of the traditional process improvement technique, Six Sigma, in their safety department, the company was able to identify critical safety concerns leading to injuries at the workplace and develop solutions to implement and improve the company’s safety.
2.4.2 Integration Tools

Currently, safety and process improvement integration tools are scarce. One of the only ones currently researched is the ErgoVSM (Jarebrant, Winkel, Hanse, Mathiassen, and Öjmertz, 2015). This integration tool was developed from a traditional value stream mapping (VSM), a tool to be utilized during lean interventions at a company. The tool documents a production map of a current process at a company, including details “such as cycle time, changeover time, work-in-process (WIP) levels, and equipment reliability data” (Atieh et al., 2016, p.1574). From this visualization, the lean team can observe areas to focus their production improvements on.

The ErgoVSM differs from a traditional VSM because it incorporates work related physical exposure in the overview of the process. To add these ergonomic elements, the tool includes aspects of physical work such as manual working time, physical exposure, posture, weight/force, and other elements of labor that are risk factors for musculoskeletal disorders (MSDs). The tool was tested at a Swedish manufacturing company by production engineers and experienced operators (Hanse, Jarebrant, Mathiassen, Öjmertz, and Winkel 2015). The tool proved successful in generating a process in which both ergonomic and production can be viewed from the same lens. Although no quantitative improvements came from the research, the authors believe this tool establishes a potential pathway for production managers to view ergonomics conjointly with process improvement.
Due to the lack in current integration tools, an Ohio Bureau of Worker’s Compensation research funded grant project has undertaken the task of developing and testing several new tools. Through discussion with several manufacturing companies around Ohio about their current level of integration and gaps in communications, integration tools to connect the two fields have been developed and tested. The tools are one-page excel sheets that can be understood and completed by any level of worker at a manufacturing company. One of the primary tools developed through the grant research is the Modular Value Stream Safety Mapping Tool (Mod VSSM).

2.4.3 Modular Value Stream Safety Mapping (Mod VSSM)

The Mod VSSM will be the tool utilized in the company focus groups to introduce the concept of safety and process improvement integration. The Mod VSSM is derived from a traditional value stream map (VSM), as discussed in section 2.4.2.

The Mod VSSM differs from the traditional VSM because it looks only at a specific part of an entire process. This concentrated view allows the improvement team to identify more specific problems in a task that may be overlooked in a traditional VSM. Another difference between this tool and a traditional VSM is the inclusion of ergonomic/safety problems of the task. Instead of looking solely on production concerns, the team will also focus on problems of the task that compromise employee safety. From this one page sheet the team can discuss
production and safety concerns with the current task and develop a plan to improve both issues simultaneously.
3 METHODOLOGY

To accomplish my three main objectives (as described in the introduction section) I conducted individual interviews and training focus groups. One manufacturing company and three of their sites in the Midwest were selected to participate in the entirety of the research. To begin, I conducted individual interviews with employees at each site to gauge their baseline perception of process improvement, safety, and their integration. Second, training focus groups were held at each site. This group included training on the Mod VSSM integration tool and practical examples. After the training and practice on the tool was conducted, a follow-up questionnaire was distributed to capture their current perceptions on safety, process improvement, integration, and the Mod VSSM tool.

3.1 Individual Interviews

Six to seven employees at each location were individually interviewed in the first stage of the project. Approximately half of each sample group at each location was management and half was non-management. The distribution of employees is illustrated in Table 1. Participants were recruited by an IRB approved document distributed at each location. The interviews took between 4-37 minutes, with an average of 10 minutes, and were audio recorded in a private area. There were approximately 10 questions (depending on how some were initially answered) that focus on the individual's baseline perception of SPC and safety and process improvement integration at their work.
Prior to the start of the interview, participants were given a basic introduction on the study and the research goals. They were also informed of what they would be asked to participate in (the individual interview and the training focus group) and the approximate time demands. Individuals participated on an informed consent basis and the experiment was approved through the Ohio University Institutional Review Board. The Ohio University Consent form was provided after the introduction and the participant had ample time to read, understand, and ask any questions they had. Once they felt comfortable with the study and consent, they signed the form and were given a copy to keep for their records. After this process, the interview began. The following questions were asked:

Introductory Questions:

1. How do you describe, or think about, safety at your workplace?

<table>
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<th>Location #2</th>
<th>Location #3</th>
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<tr>
<td>Non-Management</td>
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<td>3</td>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>Total</td>
<td>6</td>
<td>6</td>
<td>7</td>
<td>19</td>
</tr>
</tbody>
</table>
2. How do you describe, or think about, productivity at your workplace?

Questions on Baseline SPC:

3. How do you think productivity and safety are related?

4. How do you deal with safety if you are behind schedule?

5. How do you think safety and the amount of work you are able to complete is related?

6. How do you think customer service quality and safety are related?

7. How do you think safety and doing a good job are related?

Questions on Baseline Process Improvement and Safety Integration:

8. What sort of process improvement initiatives are you aware of that occur at this organization?
   
   If no → Proceed to question 9.
   
   If yes → Are you personally involved in any of these?

9. What sort of safety improvement initiatives are you aware of that occur at this organization?
   
   If no → Proceed to question 10.
   
   If yes → Are you personally involved in any of these?

10. Are you aware of any initiatives that integrate both safety and process improvement?
   
   If no → Conclude interview.
   
   If yes → Can you describe some of them?
   
   If yes → Are you personally involved in any of these?
3.1.1 Industry and Location

One manufacturing company with several locations around the Midwest was selected to conduct the individual interviews and focus group training. Three locations within one company were chosen instead of several companies because I wanted to compare the SPC and integration perceptions within one business across different locations.

3.1.2 Management v. Non-Management

During the study, I received an equal amount of input from both management and non-management employees at each location. Non-management employees are primarily focused on work on the production floor and completing the manual day-to-day operations. Management includes any worker with from shift supervisor to upper-management. I was reliant on the plant managers at each location to help distinguish each participants standing. I anticipated that perceptions on safety-process compatibility (SPC) and the integration of the two would differ between the two groups.

3.1.3 Data Validity

To ensure data validity when conducting the baseline interviews, I followed the interview protocol refinement (IPR) framework suggested by Castillo-Montoya in the article *Preparing for Interview Research: The Interview Protocol Refinement Framework* (2016). I used this four-part framework to strengthen the reliability of the interview questions and the quality of the data.
The first step in the IPR is to ensure the interview questions align with research questions. Each question asked should have a direct reasoning behind it and should directly lead to developing an understanding for what is being studied. I reduced McLain and Jarrell’s original nine SPC questions to only five to maintain the scope of the questions to understanding each participant’s baseline perception of SPC at their company. The second set of questions were directly focused on safety, process improvement, and the integration of the two. Each of the twelve questions serves a direct purpose in supporting my research goals.

The second step in the IPR is to guide an inquiry-based conversation. To do such, Castillo-Montoya suggests four things: writing interview questions differently than research questions, following social rules of ordinary conversation, asking a variety of questions, and including follow-up and prompt questions. To observe these rules, I developed questions that will be easy to understand and relatable by both management and non-management manufacturing workers. They also cover a few topics such as how they feel towards safety and doing a good job but also how the company handles safety and process improvement initiatives. The questions were developed to provide variety but also stay concise and focused on the research topic. Finally, there are follow-up questions (such as, can you describe them or were you personally involved with) to gather as much detail and information as possible.
The third step in the IPR is receiving feedback on interview protocols. I have shared my initial questions with the one of the original authors of the SPC-David McLain- and my research advisor, Dr. Diana Schwerha.

The fourth and final step in the IPR was piloting the interview protocol. The stage finalizing the baseline interview questions involved mock sessions. I tested the questions with three individuals who had work experience and answered the questions from their personal background. The answers were not recorded or used for the study but instead helped to clarify the time it would take to answer the questions and receive input to make any positive changes to improve conversation or more directly answer the research questions.

3.1.4 Baseline SPC

The first five questions asked during the interview are related to the baseline perception each employee has on the safety production compatibility at their workplace. The questions are derived with permission from the original set used in the study The perceived compatibility of safety and production expectations in hazardous occupations (McLain and Jarrell, 2007). The original set of questions was altered to better fit the demands of the manufacturing industry and to prompt longer answers than the original yes/no design.

3.1.5 Baseline Integration

There are three questions designed to understand the employee’s perception of integration at their company. They are designed with the same IPR framework as described in section 3.3.1.
3.1.6 Analysis Technique

The narratives of each employee were coded for common themes using the Inductive Qualitative Analysis as described by David R. Thomas in *A General Inductive Approach to Analyzing Qualitative Evaluation Data* (2006). There are five steps in the approach: initial reading of the text, identifying specific segments related to the objective, creating categories from the segments, reducing the categories, and finally creating a model based on the more important categories. This method has been chosen among other because it provides a simple, analytic approach that still evaluated the objectives of the questions (Thomas, 2006). Using this approach on the individual narratives will equip me to achieve my first objective:

Objective 1: Determine employee baseline perceptions:

Objective 1A: of safety-production compatibility

Objective 1B: of process improvement and safety integration

Objective 1C: differences across employment level

Objective 1D: differences across company sites

3.2 Focus Groups

Three focus groups were held, one at each of the locations. The focus groups involved most of the participants that were involved in the baseline interviews (two individuals who completed the interviews were unavailable for the focus groups). The goal of the focus group is to provide training on the Modular
Value Stream Safety Mapping tool, to incorporate it into a familiar task, and gain individual feedback after the training and usage.

3.2.1 Mod VSSM Training

The training for the Mod VSSM training consisted of a twenty-two slide PowerPoint. The first few slides are an introduction to the BWC project, its goals and completed work so far. The next few slides introduce safety/ergonomics and process improvement. These slides were meant to provide a basic understanding of these concepts and the challenges they face in the manufacturing industry. Next, the presentation included a few brief slides on integration and the potential benefits a company may receive from looking at the two concepts simultaneously. Finally, the training ended with a step-by-step guide to the Mod VSSM- the goal, what each section means, and how to fully complete one.

3.2.2 Task Training Video

Once a group was fully trained on the purpose and instructions of completing the Mod VSSM tool, they were walked through an example. They were shown a video of a task conducted at a job with which they are all familiar. After the video, we worked through the Mod VSSM together. Since it was the first time the employees completed one, I provided suggestions on improvements and risks to input into the tool, answering questions as they arose.

After the group completed their first Mod VSSM, I showed another task video. This time I asked them to complete the Mod VSSM with limited help from
This second time solidified their knowledge in the tool and increased their confidence completing it.

### 3.2.3 Follow-up Individual Questions

After the second Mod VSSM was completed, I distributed an individual follow-up questionnaire. The questions were open-ended and meant to show if there were changes from the baseline interviews. The questions centered on their perception of safety, productivity, integration, and the use of this tool at their company. The following are the specific questions that were asked:

1. How do you think productivity and safety are related?
2. How do you deal with safety if you are behind schedule?
3. How do you think safety and the amount of work you are able to complete is related?
4. How do you think customer service quality and safety are related?
5. How do you think safety and doing a good job are related?
6. What did you like about the integration training?
7. What did you dislike about the integration training?
8. What do you think about integrating this training (or a similar tool) into this company*?
9. Do you have any suggestions for integrating safety and process improvement at this company*?

*The company name has been replaced with ‘this company’ for privacy reasons.
3.2.4 Code Narratives- Common Themes

Once the three focus groups were conducted, I followed the Inductive Qualitative Analysis technique described in section 3.3.6. to analyze for common, significant themes. Coding the post-training group comments enabled me to accomplish my second research objective:

Objective 2: Determine employee post-training perceptions:

   Objective 2A: of safety-production compatibility
   Objective 2B: of process improvement and safety integration
   Objective 2C: differences across employment level
   Objective 2D: differences across company sites

Once the five steps of the Qualitative Analysis technique were completed, each participant had codes for significant perceptions at two time points: baseline and post-training group. Once this step was done, I compared the codes of each of the following:

   a. Individual participant at baseline to post-training
   b. Each site at baseline to post-training
   c. Group of management or non-management at baseline to post-training

I compared these three groups to determine if there was a significant change from the baseline perceptions to post-training group perceptions on integration. From this analysis, I was able to achieve my third and final research objective:
Objective 3: Determine whether the integrative tool can influence a person’s perception.
4 RESULTS

4.1 Individual Interviews

There was a total of 19 employees who participated in the individual interviews, 10 were management level and 9 were non-management level. Two main elements were investigated in these initial interviews - the compatibility between safety and production and the current level of integration of these two components. A summary of all the responses collected during the interviews is shown in Table 2.
Table 2

*Interview Responses*

<table>
<thead>
<tr>
<th>Interview Questions</th>
<th>Responses</th>
<th># Participants</th>
<th>% Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>How do you describe, or think about, safety at your workplace?</td>
<td>Very important, top priority</td>
<td>14</td>
<td>73.7%</td>
</tr>
<tr>
<td></td>
<td>Pretty safe, has improved</td>
<td>5</td>
<td>26.3%</td>
</tr>
<tr>
<td>How do you describe, or think about, productivity at your workplace?</td>
<td>Discussed money, measurement metrics, or bottom line</td>
<td>7</td>
<td>36.8%</td>
</tr>
<tr>
<td></td>
<td>Fast and/or busy</td>
<td>5</td>
<td>26.3%</td>
</tr>
<tr>
<td></td>
<td>Mentioned something specific about employees (i.e. needing more employees)</td>
<td>4</td>
<td>21.1%</td>
</tr>
<tr>
<td></td>
<td>Good and/or room for improvement</td>
<td>3</td>
<td>15.8%</td>
</tr>
<tr>
<td>How do you think productivity and safety are related?</td>
<td>Compatible</td>
<td>12</td>
<td>63.2%</td>
</tr>
<tr>
<td></td>
<td>Incompatible</td>
<td>7</td>
<td>36.8%</td>
</tr>
<tr>
<td>How do you deal with safety if you are behind schedule?</td>
<td>No change</td>
<td>15</td>
<td>79.0%</td>
</tr>
<tr>
<td></td>
<td>More unsafe acts to try and get back on schedule</td>
<td>4</td>
<td>21.0%</td>
</tr>
</tbody>
</table>
Table 2: continued

<table>
<thead>
<tr>
<th>How do you think safety and the amount of work you are able to complete is related?</th>
<th>Compatible</th>
<th>Incompatible</th>
<th>No Relationship</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>12</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>63.2%</td>
<td>15.8%</td>
<td>21.0%</td>
</tr>
</tbody>
</table>

How do you think customer service quality and safety are related?

<table>
<thead>
<tr>
<th>Compatible</th>
<th>Incompatible</th>
<th>No Relationship or “I don’t know”</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safe practices → improved customer service quality</td>
<td>5</td>
<td>26.3%</td>
</tr>
<tr>
<td>Unsafe practices → lower customer service quality</td>
<td>8</td>
<td>42.1%</td>
</tr>
<tr>
<td>No Relationship or “I don’t know”</td>
<td>6</td>
<td>31.6%</td>
</tr>
</tbody>
</table>

How do you think safety and doing a good job are related?

<table>
<thead>
<tr>
<th>Compatible</th>
<th>Incompatible</th>
<th>No Relationship</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety is part of doing a good job</td>
<td>18</td>
<td>94.8%</td>
</tr>
<tr>
<td>Can do a good job and still be unsafe</td>
<td>1</td>
<td>5.3%</td>
</tr>
</tbody>
</table>

What sort of process improvement initiatives are you aware of that occur at this organization? Are you personally involved in any of these?

<table>
<thead>
<tr>
<th>Described an initiative</th>
<th>Involved in initiative</th>
<th>Not involved in initiative</th>
<th>Not able to recall</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3</td>
<td>9</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>15.8%</td>
<td>47.4%</td>
<td>36.8%</td>
</tr>
</tbody>
</table>
Table 2: continued

<table>
<thead>
<tr>
<th>What sort of safety improvement initiatives are you aware of that occur at this organization? Are you personally involved in any of these?</th>
<th>Described an initiative</th>
<th>Involved in initiative</th>
<th>1</th>
<th>5.3%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Not involved in initiative</td>
<td>12</td>
<td>63.2%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Not able to recall</td>
<td>6</td>
<td>31.6%</td>
</tr>
<tr>
<td>Are you aware of any initiatives that integrate both safety and process improvement? Can you describe some of them? Are you personally involved in any of these?</td>
<td>Described an initiative</td>
<td>Involved in initiative</td>
<td>2</td>
<td>10.5%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Not involved in initiative</td>
<td>3</td>
<td>15.8%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Not able to recall</td>
<td>14</td>
<td>73.7%</td>
</tr>
<tr>
<td>Do you have any additional comments on safety, productivity, or the integration of the two? Do you have any general comments you would like to add before concluding this interview? *</td>
<td>Safety improvement idea</td>
<td>3</td>
<td>15.8%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>General safety comment</td>
<td>3</td>
<td>15.8%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>No additional comments</td>
<td>13</td>
<td>68.4%</td>
<td></td>
</tr>
</tbody>
</table>

*Although these questions were asked separately, they were combined in the table due to the lack of diverse responses.
When asked how safety and productivity were related there were a mix of responses, shown in Table 2. The majority of participants (12) saw a compatible relationship between safety and productivity; although their rationales behind this were split. The breakdown of responses can be seen in Table 3. Seven of the participants described unsafe actions as an indicator of productivity; meaning that unsafe behaviors on the job lead to absenteeism or re-work that negatively impact productivity. The other five participants described that working safe on the front end improves productivity mainly because the task is completed right the first time and not need to be re-done. The other seven participants described an incompatible relationship between safety and productivity. Five of them described that an increase in production led to a decrease in safety because the workers are moving faster and feel more temptation to forgo safety regulations in lieu of getting more done. The other two described that due to safety regulations, employees were not as able to produce as much because of the safety tasks they are required to do (i.e. wearing PPE or inspecting equipment prior to its use).
Table 3

Interview Question #3 Responses

<table>
<thead>
<tr>
<th>Question</th>
<th>Responses</th>
<th># Responses</th>
<th>% Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>How do you think productivity and safety are related?</td>
<td>Compatible</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Unsafe practices → Decreased productivity</td>
<td>7</td>
<td>36.8%</td>
</tr>
<tr>
<td></td>
<td>Safe practices → Increased productivity</td>
<td>5</td>
<td>26.3%</td>
</tr>
<tr>
<td>Incompatible</td>
<td>Increased productivity → Unsafe practices</td>
<td>5</td>
<td>26.3%</td>
</tr>
<tr>
<td></td>
<td>Safe practices → Decreased productivity</td>
<td>2</td>
<td>10.5%</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>19</td>
<td>99.9% (due to rounding)</td>
</tr>
</tbody>
</table>

4.1.2 Baseline Process Improvement and Safety Improvement

When asked about different process improvement initiatives and safety initiatives, most employees were able to discuss different projects that had recently occurred or were currently ongoing. Most often, employees recalled ongoing training as a means of safety improvements. However, when asked about projects that aimed to integrate both safety and process improvement, many participants were unaware of any. Figure 1 show the distribution of responses. The graph illustrates the dramatic decrease in employees who are unaware of any projects aimed at integrating both safety and process improvement. The responses further support the preliminary literature findings that very few companies are integrating these two areas.
4.1.3 Differences between Employee Level and Company Location

When analyzing the results from all interviews, there was no clear distinction between employee level and company location. However, in two questions, one asking about the relationship between safety and production and the other relating safety and the amount of work able to complete, all employees who saw an incompatible relationship between those two factors were from one specific location (see Table 4). When asked about safety and the amount of work able to complete, one employee said that if given more work to do, the employee will be more likely to rush leading to a higher probability of safety issues. Two other employees at that location said that by working unsafe (bypassing safety
regulations put in by the company) will allow the workers to accomplish more work.

Table 4

Interview Question #5 Responses

<table>
<thead>
<tr>
<th>Question</th>
<th>Responses</th>
<th># Responses</th>
<th>% Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compatible</td>
<td>Unsafe practices → Decreased productivity</td>
<td>7</td>
<td>36.8%</td>
</tr>
<tr>
<td>Compatible</td>
<td>Safe practices → Increased productivity</td>
<td>5</td>
<td>26.3%</td>
</tr>
<tr>
<td>Incompatible</td>
<td>Increased productivity → Unsafe practices</td>
<td>1</td>
<td>5.3%</td>
</tr>
<tr>
<td>Incompatible</td>
<td>Unsafe practices → increased productivity</td>
<td>2</td>
<td>10.5%</td>
</tr>
<tr>
<td>No Relationship</td>
<td></td>
<td>4</td>
<td>21.0</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>19</td>
<td>99.9% (due to rounding)</td>
</tr>
</tbody>
</table>

Although the number of respondents who described this inverse relationship (7/19 or 36.8% for relationship between productivity and safety and 15.8% or 3/19 for safety and amount of work) is relatively small, it is worth noting because these employees all come from the same location. A probable explanation of this not directly asked in the interview questions is related to safety climate (as described in section 2.1.1.). As discussed earlier, safety climate relates to who employees perceive and act regarding the safety policies,
procedures, and practices brought down by upper management. Since the only three participants who described this incompatible relationship, all work at one location, it can be suggested that their perception of a negative impact safety has on amount of work completed is due in some part to the safety climate at that location.

4.1.4 Reoccurring Themes

Throughout the interviews, there were several reoccurring themes that employees mentioned. Some of the themes that surfaced during the interviews were that of rushing, showing off for supervisors and fellow co-workers, and conflicting safety priorities.

4.1.4.1 Rushing and Hurrying

One of the reoccurring themes throughout the interviews was the concept of hurrying and/or rushing. Although these words were not used in the interview questions, they were brought up nine and four times, respectively.

Some of the employees noted that when rushing they are likely to bypass safety any other (i.e. quality) procedures and can lead to more injuries. In two instances, the employee interviewed relayed the theme of rushing to get work done leading to injuring their self on the job. Another employee who personally says he does not rush and would rather be safe than in a hurry narrated that other employees have rushed causing a scenario in which he was injured due to the pace of another worker. Overall, this reoccurring theme of rushing to get
more work done leads employees to forego safety practices in lieu or working faster.

Interestingly, at two of the locations, the theme of rushing was brought up by at least half of the employees and was linked to personal injuries sustained while working. However, at the third location, this theme was only brought up by one of the employees (1/7 or 14.3%). This difference in responses can again be attributed to safety climate. Based on the responses it appears that the third location would have a more positive safety climate in which the employees do not perceive they are rushed by their management.

4.1.4.2 Showing Off

Another reoccurring theme was that of ‘showing off’. In the interviews, employees attributed some of the rushing and poor safety behaviors to employees ‘showing off’ to both fellow co-workers and supervisors. In two instances, the interviewee mentioned competition between co-workers in seeing who can get the most work done. In both instances the interviewee did not attribute this competition to pressure from upper management but more a self-developed competition between the two employees for bragging rights.

In another instance, an employee mentioned a safety and quality hazard that was left by one of their fellow co-workers. When asked why the situation occurred and was not fixed, the employee attributed it to the original employee not wanting to look bad to their manager. They would rather put a fellow employee in harm’s way than to take the chance of looking bad to a manager by
admitting they had made a quality and safety error. A third employee mentioned a similar incident but sustained an injury due to another employee not following proper procedure because they were focused on finishing more work than a fellow co-worker.

4.1.4.3 Conflicting Safety Priorities

A third theme that came up numerous times during the interviews was the confliction of safety’s priority at work. When asked the first question, “How do you describe or think about safety at your workplace” the overwhelming majority of employees described safety as very important at their company (see Table 2). Some employees went as far as to say it was the top priority of their company, they are constantly thinking about it, and everything they do revolves around safety. A small section of the employees described safety as “pretty good” or mentioned a new safety initiative that had happened, or talked about how they’ve seen it improve since they’ve been there. There were no employees who spoke negatively about safety within the company.

Although the clear majority of participants described safety as a high priority at their work, other questions prompted conflicting results. Four of the fourteen employees who initially said safety is one of the top priorities for the company later described situations in which this was not true. One participant said that when behind schedule he has personally taken safety shortcuts to get things done faster. Another participant said that he would like to see a safety improvement initiated but they are too busy with production improvements to use
resourced for the safety improvement. Others described the motto of the company as “go go go” and said that when busier parts of the work day occur more people are willing to skip some safety practices. One participant who did not say that safety is a top priority but did say it is “pretty good” later reported that safety behaviors change based on how much work they need to get done and when behind schedule safety gets placed on a backburner behind productivity.

These responses show the conflict between how safety is perceived and how it is implemented in the work place. Most often, employees have the gut reaction when asked about safety to say it is a top priority and very important to the company. This probably stems from the safety culture driven by management including safety training and safety practices. However, in practice this ideal view of safety does not always come to fruition. Due to other work demands, primarily production, safety practices are skipped in favor of completing more work.

4.2 Focus Groups

4.2.1 Post-Training Perceptions

After the focus group was conducted, a questionnaire was distributed to each participant to gather information on how their current perception of safety, production, the integration of the tool, and their opinion of the Mod VSSM training. A summary of the results is illustrated in Table 5. Due to the nature of gathering their post-training perception, little data was gathered. Throughout several questions, relationships were not defined or the answers written were not relevant to the question asked. For example, when asked about the relationship
between safety and the amount of work completed, nine of the participants (50.0\%) either said they were not related or their answer did not include anything about the relationship. When asked the same question in the interviews, only four participants (21.1\%) said there was no relationship. This lack of detailed and relevant responses was evident throughout the questionnaire. During the interviews, participants sometimes gave similarly short answers, but through later discussions and natural conversation they discussed more details that later developed into themes.
Table 5

*Focus Group Responses*

<table>
<thead>
<tr>
<th>Focus Group Questions</th>
<th>Responses</th>
<th># Participants</th>
<th>% Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>How do you think productivity and safety are related?</td>
<td>Compatible</td>
<td>5</td>
<td>27.8%</td>
</tr>
<tr>
<td></td>
<td>Unsafe practices $\rightarrow$ decreased productivity</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Safe practices $\rightarrow$ increased productivity</td>
<td>2</td>
<td>11.1%</td>
</tr>
<tr>
<td></td>
<td>Incompatible</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Increased productivity $\rightarrow$ unsafe practices</td>
<td>1</td>
<td>5.6%</td>
</tr>
<tr>
<td></td>
<td>Safe practices $\rightarrow$ decreased productivity</td>
<td>1</td>
<td>5.6%</td>
</tr>
<tr>
<td></td>
<td>No relationship defined or they are not related</td>
<td>9</td>
<td>50.0%</td>
</tr>
<tr>
<td>How do you deal with safety if you are behind schedule?</td>
<td>No change</td>
<td>18</td>
<td>100.0%</td>
</tr>
<tr>
<td>How do you think safety and the amount of work you are able to complete is related?</td>
<td>Incompatible, unsafe practices $\rightarrow$ increased productivity</td>
<td>3</td>
<td>16.7%</td>
</tr>
<tr>
<td></td>
<td>Positive correlation, safe practices $\rightarrow$ increased production</td>
<td>6</td>
<td>33.3%</td>
</tr>
<tr>
<td></td>
<td>No relationship defined or they are not related</td>
<td>9</td>
<td>50.0%</td>
</tr>
</tbody>
</table>
Table 5: continued

| How do you think customer service quality and safety are related? | Compatible, safe practices → improved customer service quality | 8 | 44.4% |
| How do you think customer service quality and safety are related? | No relationship defined or they are not related | 10 | 55.6% |
| How do you think safety and doing a good job are related? | Compatible, must be safe to do a good job | 13 | 72.2% |
| How do you think safety and doing a good job are related? | N/A or did not describe a relationship between the two | 5 | 27.8% |
| What did you like about the integration training? | Increased communication, new ideas | 9 | 50.0% |
| What did you like about the integration training? | Interesting/Informative | 4 | 22.2% |
| What did you like about the integration training? | Better understanding of a process | 3 | 16.7% |
| What did you like about the integration training? | It was okay | 2 | 11.1% |
| What did you dislike about the integration training? | Nothing | 14 | 77.8% |
| What did you dislike about the integration training? | Too short | 2 | 11.1% |
| What did you dislike about the integration training? | Problem Solving | 1 | 5.6% |
| What did you dislike about the integration training? | Coming together as a team | 1 | 5.6% |
Table 5: continued

<table>
<thead>
<tr>
<th>Question</th>
<th>Response</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>What do you think about integrating this training (or a similar tool) into 'Company's Name'?</td>
<td>Would be valuable/helpful</td>
<td>16</td>
<td>88.89%</td>
</tr>
<tr>
<td></td>
<td>No personal preference</td>
<td>2</td>
<td>11.1%</td>
</tr>
<tr>
<td>Do you have any suggestions for integrating safety and process improvement at 'Company's Name'?</td>
<td>No comments</td>
<td>12</td>
<td>66.7%</td>
</tr>
<tr>
<td></td>
<td>Improved communication across work groups</td>
<td>2</td>
<td>11.1%</td>
</tr>
<tr>
<td></td>
<td>Monthly and/or more meetings</td>
<td>2</td>
<td>11.1%</td>
</tr>
<tr>
<td></td>
<td>Standardize Work</td>
<td>1</td>
<td>5.6%</td>
</tr>
<tr>
<td></td>
<td>Process suggestion to look at</td>
<td>1</td>
<td>5.6%</td>
</tr>
</tbody>
</table>

*The company’s name has been redacted for privacy reasons.
4.2.2 Influence of the Mod VSSM

Although little data was gathered on post-training perceptions of safety, production, and their integration, there was a majority of support in favor of the Mod VSSM training group. Sixteen employees (88.89%) said that they thought the tool would be valuable and/or helpful to utilize across the company and 14 employees (77.8%) said there was nothing they disliked about the training. Two employees (11.1%) mentioned that it was too short and they would have liked to see more time spent on the beginning part where process improvement and safety tools were described. I believe given more time this would have been a beneficial improvement to ensure all members of the group understood what improvement factors to look for when analyzing a task.

When initially asked during the interviews how they viewed the relationship between safety and production, seven participants (36.8%) stated an incompatible relationship. However, from the post-training questionnaire, the number who still saw this incompatible relationship was reduced to only two. Although these numbers are relatively small, they do suggest that the training was successful in changing some perception on safety and production incompatibility.

To support the conclusions, a chi-squared test for association was completed on the baseline (responses used were 12 compatible, 7 incompatible, and 0 no relationship defined or not related) and post-focus group SPC perceptions (responses used were 7 compatible, 2 incompatible, and 9 no
relationship defined or not related). The null hypothesis ($H_0$) is that there is no relationship between SPC perception and the focus-group training. The alternate hypothesis ($H_1$) is that there is a relationship between the SPC perception and the focus-group training. After the analysis was run, the p-value was 0.001, which means the $H_0$ is rejected and can conclude that the focus-group training does influence the SPC perception, supporting the previous conclusion.

4.2.3 Observational Themes

During the focus groups, there were notable behavioral and conversational themes that occurred throughout all of the locations. Although this was not measured on the questionnaire, these themes provide valuable insight into the how the training session was perceived by participants and its level of success. Two of these major themes were the effect management had on the discussion and level of participation in the group and the breaking down of silos through cross-communication and idea sharing.

4.2.3.1. Management Influence during Focus Groups

In all focus groups, the participants were fairly split between management and non-management. However, the level of participation by management employees differed based on location. In the groups where management was less engaged in the brainstorming and collaboration to analyze the task through the Mod VSSM, non-management employees mirrored their actions and were also less engaged. In some instances, non-management employees perceived that their opinions were not valued or that their efforts to brainstorm solutions
were futile. This was evident when employees were asked their opinion on something and they constantly deferred to management. Some of these employees were less likely to engage in solution brainstorming because they thought that actions would never be taken to establish these solutions and that it was out of their control.

However, at a location in which upper management was heavily involved in the training and solution discussion, non-management employees were more involved and vocal in sharing their opinions and ideas. I believe in these instances they saw that management was committed to hearing their opinions and genuinely prepared to implement changes based on the discussion. The engagement of upper management was vital in stimulating discussion and new ideas from all employees and was evident when looking at the possible solutions brainstormed and enthusiasm for improving the process.

4.2.3.2 Communication

Another theme that arose through the focus groups was communication across different employees that would typically not interact. When asked on the questionnaire what they liked about the training, nine participants (50.0%) said that it increased communication and stimulated new ideas. Having participants with diverse industry background and knowledge of different parts of the company was a significant benefit to the group. Typically, when conducing safety or process improvements, the employees responsible are from one isolated silo (either production or safety managers) and conversation across these groups
rarely happens. Bringing together diverse employees enabled more diverse solution ideas, a better understanding of the process, and a comradery founded on improving the process for everyone.
5 DISCUSSION AND CONCLUSION

5.1 Ideal SPC Perception

Employee’s perception of safety and production compatibility was measured through the preliminary interviews and post-training questionnaire. Prior to the research, I anticipated to hear descriptions of both compatible and incompatible relationships described, but the rationale between their answers was interesting. As discussed in section 4.1.1, most employees in the preliminary interviews described a compatible relationship. In a company, the least desired mentality is that of an incompatibility between safety and production. This perception of incompatibility leads employees to believe they have to choose between safety and production.

As discussed in section 4.1.4.3., most employees said that safety is a top priority and that it never gets compromised for productivity, but when it comes down to actual behaviors this is not always the case. One management employee even said that they have personally ignored critical safety rules in order to speed up production. This overall perception of incompatibility leads employees to choose between production and safety and overall one will ultimately suffer.

Companies should strive for a compatible SPC perception. Although this mentality is not shared between all employees, it is a goal that companies should aim for and can be promoted through integration tools such as the Mod VSSM. Although limited data was gathered due to the lack of detailed responses in the
questionnaire, the integration tool aims to promote the perception of compatibility. Through brainstorming solutions to improve both a task’s process and safety employees can begin to shape their viewpoint to no longer see them as isolated concepts but as an aspect of the job that works in tandem with each other.

Although this perception of compatibility is what companies should strive for, they should also focus on the underlying rationale for this belief. The majority of participants who described this positive correlation supported their belief with the argument that doing something unsafe resulted in injury or re-work and thus led to decreased production. This concept is not ideal because the employee is basing this perception off a negative experience they witnessed or experienced (such as telling a story about how someone was hurt on the job thus the company was short-staffed and production suffered). Instead of this negative experience, companies should strive to promote that safe practices lead to improved production. This is the preferred perception because it does not rely on anything going wrong at work to promote safe practices. Overall companies should strive to promote the compatibility between safety and production, but also should be considerate of the underlying rationale employees hold for this belief.

5.2 Integration Feedback

The integration training was well received. There was plenty of discussion across co-workers and engagement with the tool. As the instructor, I facilitated the initial training and lead the participants in the completion of the tool but was
less involved in the discussion of current practices and solution development. The group turned to each other for expertise on different aspects of the task process and to bounce solution ideas off.

After leaving one location, the group was enthusiastic to go re-observe the task and immediately implement the solutions they discussed. The tool not only stimulated conversation and reflection on how safety and production interact, but also was a connecting experience for the co-workers. They were genuinely interested in each other's opinions and improving the process for their co-workers. The training group was successful in teaching the participants about Mod VSSM tool but also gave the employees a platform to engage and discuss across silos, something that rarely happens. If the company continues to implement integration training groups I believe not only will safety and production benefit, but so will co-worker relations.

5.3 Recommendations

To improve employee’s perception of SPC and outlook on the integration of safety and process improvement, I recommend establishing regular meetings with a cross-functional team. The meetings should include multiple employee levels and work expertise to maximize communication, understanding of the operations, and diverse ideas. One of the main benefits of conducting the focus groups was establishing a forum for employees who routinely do not interact, to collaborate and share their knowledge of the company’s processes and generate new ideas to improve safety and process improvement.
In the groups, the employees should utilize the MOD VSSM or other integration tools. Using these tools provides a foundation to look at operations and analyze safety and process improvement holistically. While discussing the current process and safety status, employees may generate new ideas to improve the task. Although ideas to improve both safety and the process may not develop, it still encourages employees to view them together and improve their outlook on the compatibility of the two.
6 LIMITATIONS AND FUTURE RESEARCH

The most prominent limitation in the research was the lack of complex answers in the post-focus group questionnaire. During the initial phase of individual interviews, participants were able to talk openly and thus more themes and concepts were developed from their conversation. Providing only a questionnaire post-focus group training severely limited the concepts written about and thus less information was able to be gathered after the training.

A second limitation was the lack of participants. Although a total of 19 participated in the interviews and 18 in the focus group, a greater number of participants would potentially have led to more diverse responses or greater support for the current themes observed. Also, with a greater amount of participants, a difference between the employment level and/or location may have been observable.

The third limitation was minor but was due to scheduling conflicts. Since the individual interviews required less than 30 minutes of each participant’s time, they were easy to be accommodated within their normal work schedule. However, asking all the entire group of participants to spend 1-2 hours at the same time for the focus group was more demanding. At one location, one participant was not at work that day and was replaced by another participant who did not do the initial interview. At another location, one of the employees was unable to leave their work and thus was absent for the focus group. Although the absence was
understandable, it limited the results for two participants’ pre and post focus group training.

This research was the first steps in understanding the impact of integrating process improvement and safety on employee’s perception of SPC, specifically when using the Mod VSSM. However, it was only tested in one company and long-term results were not measured. Future research should investigate both long term effects of integration and also consider other integration tools.
WORKS CITED


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