

Improvement of Operational Controls to Prevent Avoidable Legal Compliance Situations which could Adversely Impact Company Performance

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Abstract — *Ineffective organizational controls could result in a variety of unexpected consequences for an organization as they could contribute to unclear direction and insufficient control mechanisms. The efforts of this project were centered on exploring an event where a business risk was materialized at a small company due to ineffective operational controls, the exploration of root causes that drove it to realization, and the implementation of potential risk mitigation efforts that could minimize the probability of occurrence and severity of consequence of similar future events. The DMAIC cycle in conjunction with industry standard quality tools and project management methods were leveraged to perform an improvement effort while demonstrating the value of structured process to company management. As a result, the importance of operational controls as a value-added risk mitigation technique was demonstrated. Various improvements related to policies, procedures, and management information systems were properly implemented while ensuring that an adequate cost-benefit approach was followed.*

Key Terms — *5 Whys, Cause-and-Effect Diagram, Cost Analysis, DMAIC, Ishikawa Diagram, Lessons Learned, Management Functions, Project Management Methods, Quality Toolbox, Risk Management, Risk Measurement, Voice of the Customer*

I. INTRODUCTION

The principal motivation for this work is the fact that, in some businesses, operational controls could be considered an afterthought rather than a potential competitive advantage. Due to this

perception, some businesses fail to establish adequate control mechanisms which in turn results in experiencing unexpected situations. Control is one of the primary management functions, and should be viewed as an essential part of business performance.

The primary objective of this work is to demonstrate the importance of effective operational controls. This will be achieved by performing an improvement effort, to address a business situation (from this moment forward, **The Problem**) which resulted due to inefficient operational controls. The improvement effort was handled as an improvement project following industry-standard approaches. Adequate methodology, tools, and project management techniques were leveraged.

In order to achieve the primary objective, the efforts of this project were centered on improving the existing set of operational controls to establish a cost-benefit justifiable set of improved guidelines, processes, and/or tools. The set of guidelines, processes, and/or tools were focused on addressing situations related to **The Problem**.

An adequate combination of procedural guidelines for programmed decisions and policies to address non-programmed decisions were pursued on the following areas:

- Employee Responsibility
- Management Responsibility
- Employee Performance Situations

The procedural guideline improvements was focused on addressing root causes to lower probability of occurrence of future similar events as well as on activities performed as a result of **The Problem** that has occurred in order to lower the severity of consequence.

Alternatives related to Management Information systems were analyzed as part of the improvement initiatives. This will aid in the identification of necessary modifications to existing systems as well as implementation of new ones. Management Information Systems improvements were focused on providing support to the improved operational controls that were pursued.

II. LITERATURE REVIEW

Control is one of the 4 management functions **Error! Reference source not found.** Effective Operational controls are a key factor to ensure that consistent direction and adequate verification methods exist for the execution of operational activities. Thus, operational controls (including policies, procedures, and information systems) are essential to every organization.

This effort was strategically focused on utilizing industry standard knowledge to drive the execution of work. The results yielded information that was used to justify the improvement work that was performed and to verify achievement of the improvement project goals.

One of the primary goals of this effort was to pursue improvements which could minimize the probability of occurrence and severity of consequence of similar problems. This resulted in the need to leverage on the concepts of risk management. In "A Risk Management Implementation" [2] the author presents a high level perspective regarding risk analysis. The author begins by defining risks and risk management concepts in accordance with the Project Management Body of Knowledge (or PMBOK). Afterwards, a specific implementation is discussed. The specifics include how to perform risk management, what tools to use, how to use them and an overall process to manage risk items. Maintaining and reporting aspects of risk management are also discussed. Overall, the article provides a useful introduction to risk management. The concepts discussed in this article guided the

execution of risk management activities related to this particular project.

The remaining primary goals of the improvement effort are centered in ensuring that expectations of the various stakeholders are met with regards to execution of work activities. Both management expectations for performance and employee satisfaction with direction were addressed. For these purposes, Voice of the Customer (VOC) activities were pursued. Voice of the Customer is a research technique that produces a detailed set of customer wants and needs [4], organized into a hierarchical structure. These are prioritized in terms of relative importance and satisfaction with current alternatives. For the purposes of this effort, VOC will consist of surveys and one-on-one conversations with the different stakeholders in order to measure perceptions regarding the work environment within the business entity under study.

The DMAIC methodology provided the guidance for execution of the overall project activity. **DMAIC** refers to a data-driven improvement cycle used to improve the effectiveness and efficiency of organizational processes across industry [4].

In support of the various phases of the DMAIC cycle, various quality tools such as 5 Whys and Ishikawa Diagrams were used to ensure that root causes are adequately identified. This approach ensures the focus remains on root causes rather than on symptoms.

The 5 Whys tool is a basic root cause analysis tool. By recursively asking and answering the question "why," teams are able to determine the root cause of an issue. This allows for the development of corrective action plans or direction for a detailed analysis that will address the systemic issue and mitigate the need for future intervention [5].

Another root cause analysis tool is the fishbone diagram. The fishbone diagram (or Ishikawa Diagram) identifies many possible causes for an effect or problem. It can be used to structure a brainstorming session. It immediately sorts ideas

into useful categories **Error! Reference source not found.**

Adherence to the concepts and techniques identified above will result in execution of work following industry standard techniques and methods. This approach provides empirical data to drive the most adequate solution to the problem under consideration without the need to rely on work previously performed on other businesses.

By focusing the tasks on the specific data of the subject company being worked with, the probability of buy-in from project sponsors and stakeholders related to proposed solutions was increased. The buy-in was achieved by demonstrating the potential benefits that could be attained on this specific scenario, not by justifying pursuing a solution based on what another organization implemented. This is a strategic pursuit as the team was focused on increasing awareness from company management with regards to the managerial concepts being utilized as well as pursuing the implementation of solutions to the identified problem.

III. METHODOLOGY

Selecting an adequate methodology is essential for any improvement effort, as this ensures that the focus remains in performing improvement activities rather than on “how” to drive the execution of tasks. For the purposes of this project a variety of industry standard methods and techniques were leveraged. The principal methodology used was the DMAIC method which forms part of Six Sigma. The DMAIC cycle is an industry standard workflow for performing improvement initiatives. DMAIC is a methodology that consists of 5 stages, defined as follows:

- **Define** – clearly define the problem that the work will be attempting to address
- **Measure** – establish adequate measurement baselines for improvement
- **Analyze** – based on previous steps, adequately identify **root causes** for improvement

- **Improve** – identify, verify, implement, and validate an adequate solution
- **Control** – sustain the improvement to ensure continuity

This effort was focused primarily on the initial 4 stages due to time constraints. Nevertheless, some work was performed during the Control stage in order to sustain the improvement, and measure project outcomes. Figure 1 displays the DMAIC “wheel” and its corresponding stages.



Figure 1
The DMAIC Cycle Process Wheel

During each stage of the DMAIC cycle, industry standard tools/processes were leveraged in order to perform the corresponding work activities. A high level representation of the relevant tools and/or processes within the context of each stage of the DMAIC cycle is depicted in Figure 2.

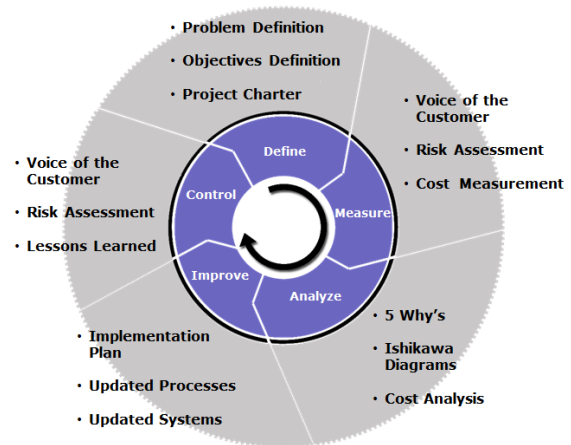


Figure 2
The DMAIC Cycle Process Wheel with Corresponding Quality Tools & Techniques by Stage

Quality tools such as 5 Whys, Voice of the Customer, and Ishikawa Diagrams were utilized during the ANALYZE stages of the DMAIC methodology to ensure that root causes are properly identified. Voice of the Customer is the primary means of establishing a measurement baseline as well as for measuring improvement for objectives 2 and 3.

5 Whys is a technique for pursuing root causes for a problem or unexpected consequence driven by asking the question “why?” over subsequent findings. The first question asked is “Why did the problem occur?”. After that question yields several answers, the team proceeds to ask “Why did those conditions occur?”. By subsequently asking why, the team focuses on pursuing the true causes of a problem. A sample 5 Whys diagram is available in Figure 3.

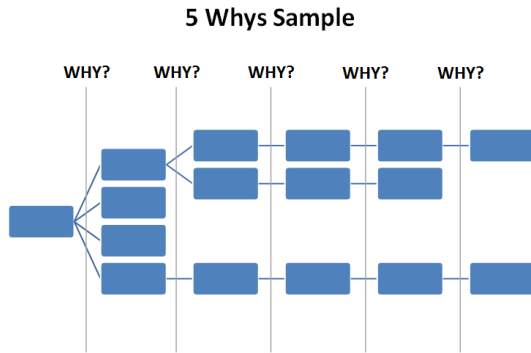


Figure 3
5 Whys Sample Diagram

Ishikawa diagrams are a similar technique that can be utilized to decompose the causes that could drive a problem to occur. Categories are defined (such as Measurement, Materials, Methods, Environment, Manpower, Machines) as shown in Figure 4. Areas pertaining to each category are evaluated for their potential related to the problem under investigation.

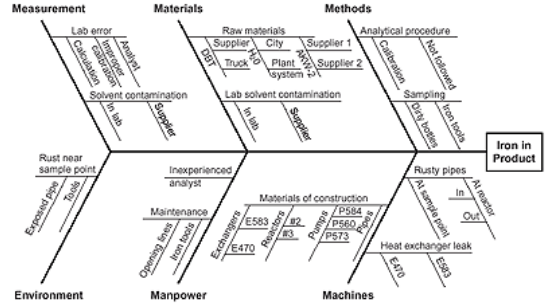


Figure 4
Sample Cause-and-Effect Diagram

Given that one critical area of attention is the risk mitigation of potential similar future events, the risk (which has materialized as *The Problem*) was defined and analyzed utilizing probabilistic risk assessment (PRA). Probabilistic Risk Assessment is a methodology to quantify risks based on their probability of occurrence and severity of consequence. This quantification aids in both the measurement baseline as well as in measuring improvement targets.

A cost-benefit analysis was performed to ensure that any solution that was to be pursued to address the root causes and mitigate the risk (of a similar *Problem* occurring in the future) is economically feasible.

The combination of all these concepts and methods leveraged during the execution of this effort were instrumental in achieving the desired outcomes.

IV. PROJECT EXECUTION

A. Stage 1 – Define

The primary objective of the Define stage is to define the problem clearly. Without defining the problem adequately, a picture of “what does success look like” cannot be established.

To define the problem, discussions were held with management representatives of the company under study in order to clearly define *The Problem*. The problem is summarized by the following statements:

- Company being sued by former employee X

- Records are scarce and/or difficult to obtain and consolidate
- A small company, less than 10 employees
- Company may have not complied fully with certain labor law requirements

The previous statements define *The Problem* that was the focus of the improvement effort. The following adverse effects were experienced by the organization as a result.

- Company incurred in unexpected rework costs
- Company incurred in unexpected additional labor costs and legal fees
- Company could have to incur in financial penalties for not complying with certain labor law requirements

After clearly defining the problem and corresponding adverse effects, the objectives were established.

Objective 1 - Lower the probability of occurrence and/or severity of consequence of future occurrences of similar events.

What does it mean?

- Prevent similar situations from occurring again
- Minimize the impact on the organization if a similar situation does occur in the future

Objective 2 – Achieve improved employee understanding of expectations related to their function

What does it mean?

- Ensure that employees are aware of their responsibilities to minimize any potential confusion in the future

Objective 3 – Achieve improved company owner satisfaction with regards to employee performance

What does it mean?

- Improve the level of employer satisfaction regarding how employees are performing their duties

A project charter was generated with the corresponding project specifics to ensure initial agreements are properly documented. The project charter contains the following details:

- Project Title
- Business Case
- Problem Statement
- Scope (In-Scope and Out-of-Scope)
- Goals and Objectives
- Team Members
- Major Schedule Milestones

As part of the project charter, a high level schedule was established defining the major milestones in alignment with the DMAIC stages. The high level schedule is included in Figure 5.

High Level Schedule

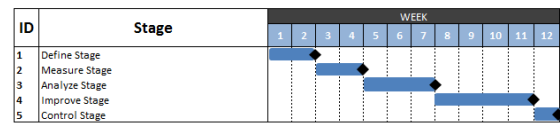
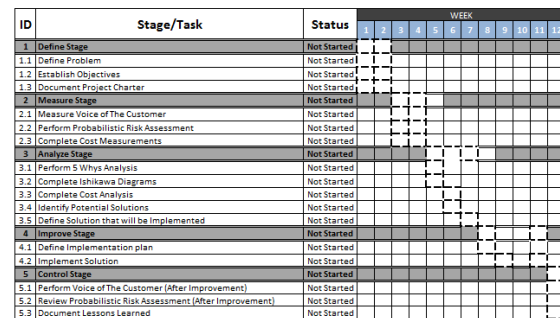


Figure 5
High Level Schedule

In addition to the high-level schedule, a detailed schedule was developed to keep track of all project tasks. Figure 6 contains the detailed schedule which augments the high-level schedule to include the detailed tasks for each of the project phases in alignment with Figure 2. Project duration was established as 12 weeks. The detailed schedule worksheet was utilized to keep track of project task progress.

Detailed Schedule



Color/Icon Legend
 [Dashed Box] Plan Start/End [Green Box] On Schedule [Red Box] Delayed [Checkmark] Complete

Figure 6
Detailed schedule

Based on direction from the project sponsors, the following are additional constraints were to be adhered to during project execution:

- There was no “cost constraint” for work that related to completing project activities
- There had to be a net \$0.00 cost impact to company operations in recurring costs
- Net Present Value equal or higher than 0

The Define stage resulted in a clearly defined and structured foundation to drive project activities. The problem was clearly defined, corresponding adverse effects identified, a project charter was agreed between all the stakeholders, and high level and detailed schedules were defined based on the major milestones of the methodology utilized. A solid foundation to be used to drive project execution was successfully achieved.

B. Stage 2 – Measure

The measure stage is essential as it is during this stage that measurements are obtained to gather the data that will be used to further analyze the problem and define potential solutions. The focus during the Measure stage should be on measuring, not analyzing the measures. Measurements were performed in alignment with the 3 project objectives.

Objective 1

Lower the probability of occurrence and/or severity of consequence of future occurrences of similar events.

To measure for Objective 1, a risk assessment was performed. To adequately quantify the risk, and assign a corresponding risk factor, the probability of occurrence and severity of consequence needed to be determined in numeric terms. A scale of 1 to 5 was defined for each characteristic (probability of occurrence and severity of consequence). Severity of consequence levels were defined based on % of net margin for costs that represent the unexpected costs related to **The Problem**. The risk factor is obtained by multiplying the level for probability of occurrence

(PoO) times the level for severity of consequence (SoC).

$$Risk\ Factor = PoO \times SoC$$

A cost measurement worksheet was created in Microsoft Excel™ to perform calculations relevant to the costs that were incurred by the business in addressing **The Problem**. The costs were categorized according to the following areas:

- Rework costs
- Management work to address **The Problem**
- Legal fees
- Settlements and fees (Penalties)

For each cost area, measures were identified (such as total time, resource allocation, cost per resource) in order to determine accurate cost totals.

From the results, it was determined that the organization traditionally achieves a 20% net margin, and that the unexpected costs amount to 9.10% of target revenue for the year, as displayed in Figure 7.

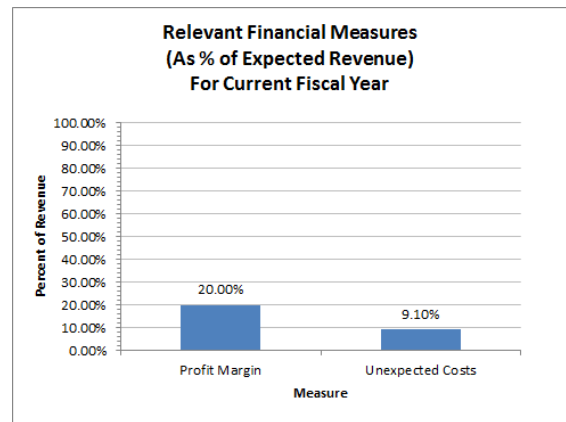


Figure 7
Cost Measures

To establish the unexpected costs as % of net margin, the ratio of unexpected costs to net margin from the figure above was obtained from the figure above as follows:

$$\frac{[unexpected\ cost\ \% \ to\ revenue]}{[profit\ margin]} = \frac{9.10}{20} = 0.455 = 45.5\%$$

From this measured 45.5% unexpected cost ratio to net margin, the severity of consequence is established as “High” based on the previously defined scale. The probability of Occurrence is defined as “Possible”. The resulting risk matrix is presented in Figure 9.

		Probability of Occurrence					
		Rare	Unlikely	Possible	Likely	Certain	
		1	2	3	4	5	
Severity of Consequence	Very High	>75% Margin	5	Yellow	Red	Red	Red
	High	31% - 75% Margin	4	Yellow	Yellow with X	Red	Red
	Medium	15% - 30% Margin	3	Green	Yellow	Yellow	Red
	Low	3% - 15% Margin	2	Green	Green	Yellow	Yellow
	Very Low	< 3% Margin	1	Green	Green	Green	Yellow

Figure 8
Initial Risk Assessment (Before Improvement)

Based on the risk matrix of Figure 8, the risk factor is obtained utilizing the previously identified formula:

$$Risk\ Factor = PoO \times SoC$$

$$Risk\ Factor = 3 \times 4$$

$$Risk\ Factor = 12$$

The risk matrix in Figure 8 and the corresponding risk factor were used as the measurement baselines for measuring Objective 1 results during the Control stage of the project.

Objective 2

Achieve improved employee understanding of expectations related to their function

To perform measurements related to Objective 2, Voice of the Customer activities were performed on the employee population. VOC consisted of surveying the population on 6 previously defined statements to measure the perceptions of the labor force. For each statement, a 5 point scale (Strongly

Disagree, Disagree, Neutral, Agree, and Strongly Agree) was provided in order to provide feedback. Statements were designed where “agreeing” was always the desired response.

The results of the VOC exercise are included below (Figure 9 to Figure 14). Data is displayed in % terms (for each of the potential response alternatives) in order to not disclose company confidential information.

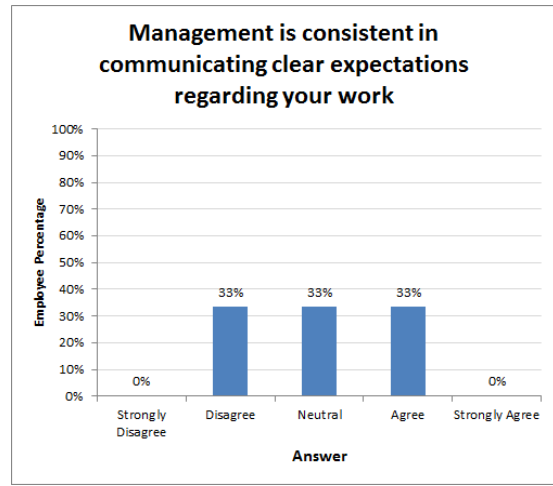


Figure 9
VOC, Employee, Statement 1

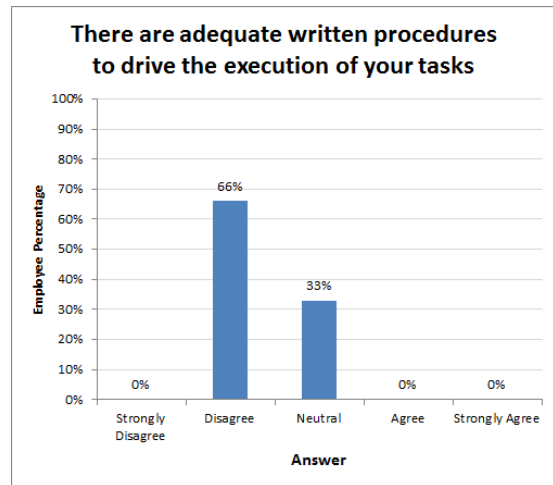


Figure 10
VOC, Employee, Statement 2

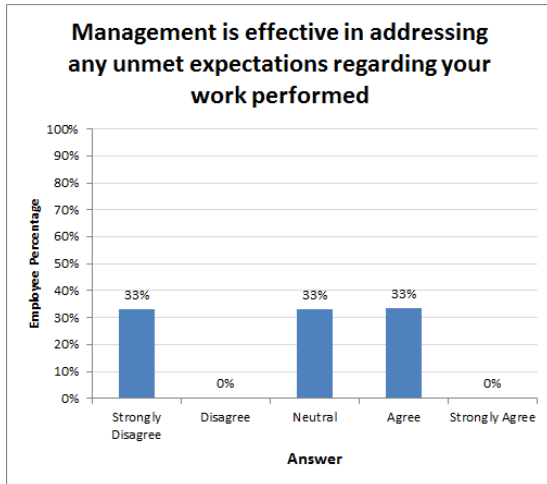


Figure 11
VOC, Employee, Statement 3

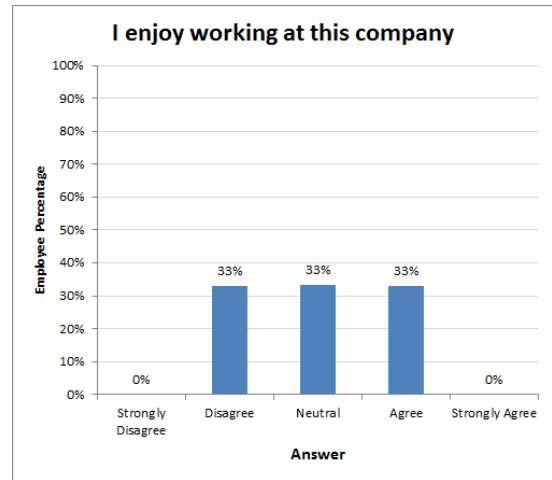


Figure 14
VOC, Employee, Statement 6

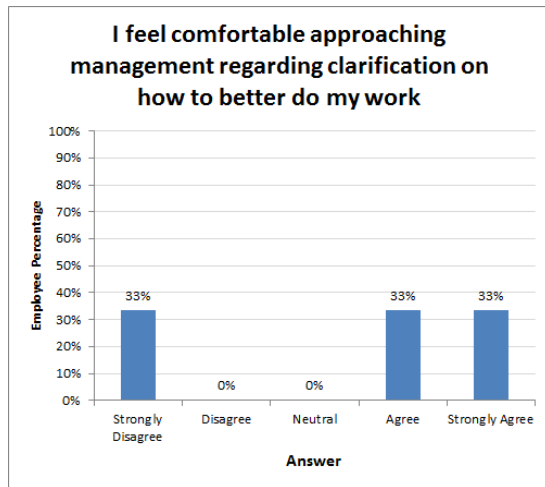


Figure 12
VOC, Employee, Statement 4

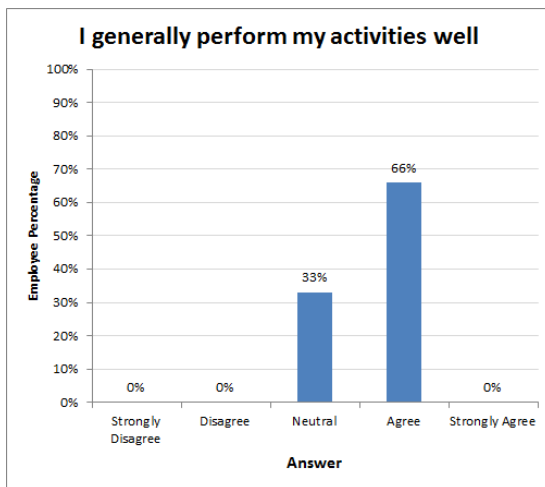


Figure 13
VOC, Employee, Statement 5

The VOC result charts available between Figure 9 and Figure 14 were used as the baseline for measuring Objective 2 results. Additionally, they provided information that was used during the Analyze stage in order to identify root causes.

Objective 3
Achieve improved company owner satisfaction with regards to employee performance

To perform measurements related to Objective 3, a Voice of the Customer activity was performed on the company owner/management population. The VOC consisted on surveying the population on 6 previously defined statements to measure the perceptions of the company owners. For each statement, a 5 point scale (Strongly Disagree, Disagree, Neutral, Agree, and Strongly Agree) was provided in order to provide feedback. Statements were designed where “agreeing” is always the desired response. It is noted that the 6 statements that form part of the management/owner VOC are complementary to the 6 statements that form part of the employee VOC. This is part of the strategy to ensure that differences in perceptions are duly highlighted during the VOC exercises.

The results of the management/owner VOC exercise are included below (Figure 15 to Figure 20). Data is displayed in % terms (for each of the potential answers) in order to not disclose company confidential information.

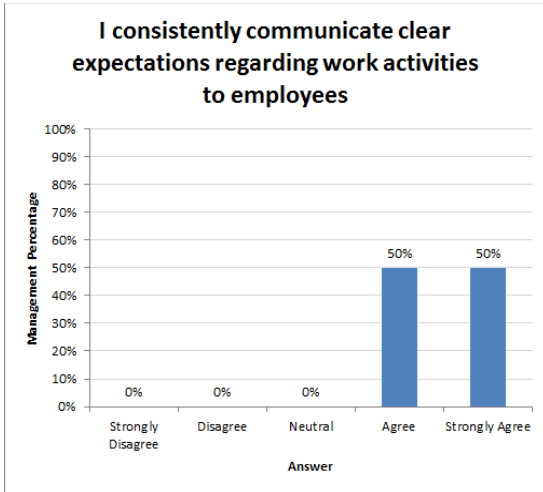


Figure 15
VOC, Owner, Statement 1

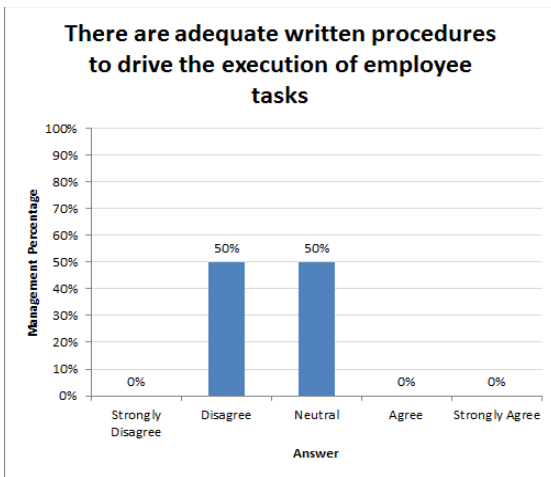


Figure 16
VOC, Owner, Statement 2

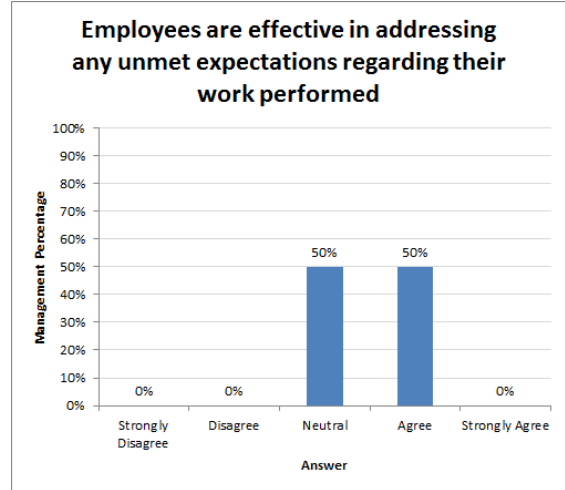


Figure 17
VOC, Owner, Statement 3

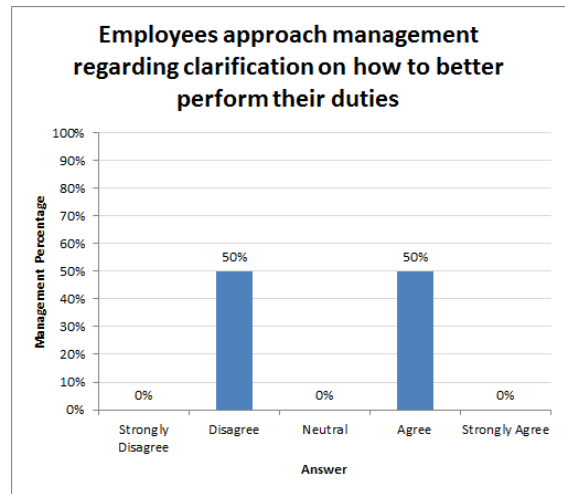


Figure 18
VOC, Owner, Statement 4

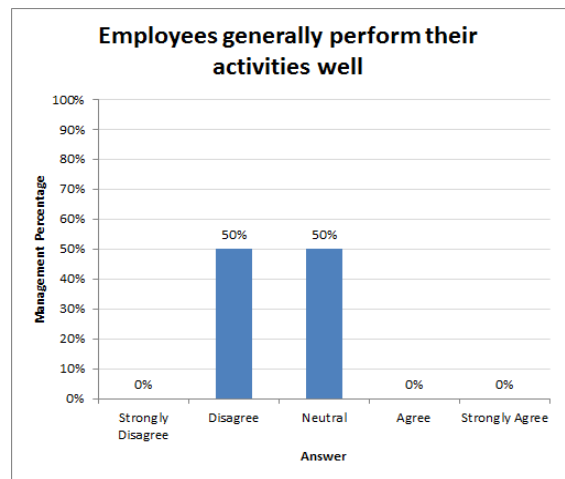


Figure 19
VOC, Owner, Statement 5

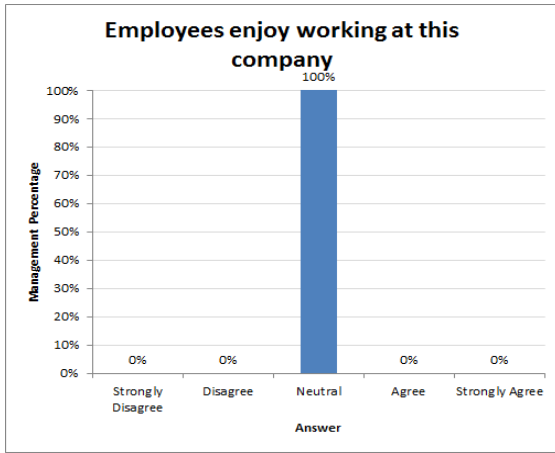


Figure 20
VOC, Owner, Statement 6

The VOC result charts available between Figure 15 and Figure 20 were used as the measurement baseline for measuring Objective 3 results. Additionally, they provide information that was used during the Analyze stage in order to identify root causes.

During the measuring stage, relevant data was gathered in order to perform further analysis for each of the 3 improvement project objectives. This data was utilized during the Analyze stage to define potential root causes that formed the basis of final implementation of improvement activities. Additionally, this data constitutes the measurement baseline that was used during the Control stage to verify that the 3 Objectives identified during the Define stage are met.

C. Stage 3 – Analyze

During the Analyze stage, data obtained during the measuring stage is leveraged to perform detailed analysis of root causes. A series of previously identified tools were leveraged to perform the analysis activities.

The first approach pursued to identify adequate root causes was to perform a 5 Whys analysis. During the 5 Whys analysis, a team of stakeholders asks the question “Why?” subsequently in order to identify why a situation occurred. It starts with the problem at the first level.

Two different 5 Whys exercises were performed in order to address the problem and its associated adverse effects. They were defined as:

- “Why” did employee X pursue legal action
- “Why” did the unexpected costs occur

Figure 21 provides the resulting 5 Whys diagram for 5 Whys exercise #1.

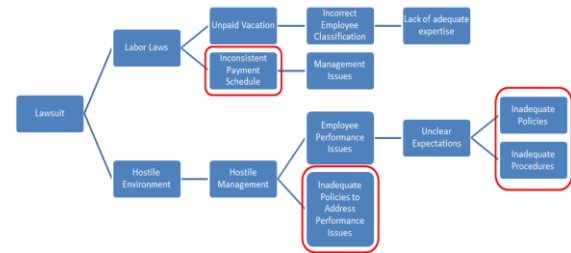


Figure 21
5 Whys #1 – Legal Action

Figure 22 provides the resulting 5 Whys diagram for 5 Whys exercise #2.

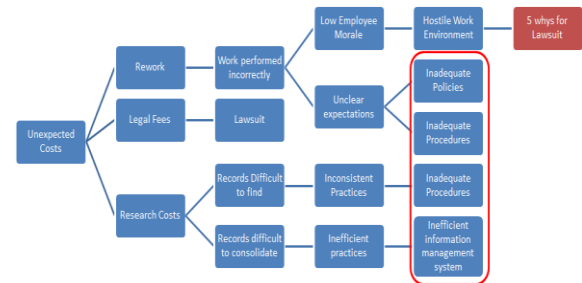


Figure 22
5 Whys #2 – Unexpected Costs

The summary results for the 5 Whys exercises are consolidated in Table 1.

Table 1
5 Whys Identified Root Causes

Exercise	Situation	Root Causes
1	Legal Action	<ul style="list-style-type: none"> • Inconsistent payment schedule (payroll) • Inadequate policies to address performance issues • Inadequate policies to establish employee work expectations • Inadequate procedures to drive employee execution of tasks.
2	Unexpected	<ul style="list-style-type: none"> • Inadequate policies to

Costs	<p>establish employee work expectations</p> <ul style="list-style-type: none"> Inadequate procedures to drive employee execution of tasks. Inefficient management information systems to track employee work, and provide mistake proofing mechanisms
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From the 5 Whys analysis, the following root causes were identified:

- Inadequate policies to address performance issues
- Inadequate policies to establish employee work expectations
- Inadequate procedures to drive employee execution of tasks.
- Inefficient management information systems

These were corroborated via the subsequent analysis activities.

The next step in performing root cause analysis was to develop cause-and-effect diagrams. Two different cause-and-effect diagrams were documented, in analogous fashion to the 5 Whys analysis:

- Legal action
- Unexpected Costs

A sample representation of the Ishikawa diagrams is shown in Figure 23. Each was similar in terms of High level structure. Only difference is the “problem” node.

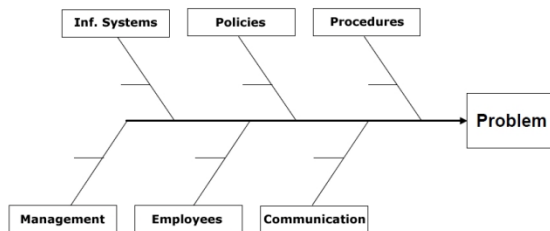


Figure 23
High Level Ishikawa Diagram

Table 2 summarizes the results of the Ishikawa diagram corresponding to the “legal action” problem.

Table 2
Ishikawa Diagram Identified Root Causes for Legal Action Problem

Area	Root Causes
Information Systems	N/A
Policies	<ul style="list-style-type: none"> Inadequate policies to establish work expectations Inadequate policies to address employee performance issues Inadequate policies to establish employee work expectations
Procedures	<ul style="list-style-type: none"> Inadequate procedures to drive execution of employee tasks.
Management	<ul style="list-style-type: none"> Inconsistent payment schedule (payroll) Lack of experience dealing with employee performance issues Insufficient expertise in labor law requirements. Inconsistent direction
Employees	<ul style="list-style-type: none"> Minimal initiative to address unclear expectations
Communication	<ul style="list-style-type: none"> Reliance on informal communication methods (Management & Employees)

Table 3 summarizes the results of the Ishikawa diagram corresponding to the “unexpected costs” problem.

Table 3
Ishikawa Diagram Identified Root Causes for Unexpected Costs

Area	Root Causes
Information Systems	<ul style="list-style-type: none"> Ineffective labor reporting system Ineffective performance issues documentation system Mistake-proofing information management software (lack of)
Policies	<ul style="list-style-type: none"> Inadequate policies to establish work expectations Inadequate policies to establish employee work expectations
Procedures	<ul style="list-style-type: none"> Inadequate procedures to drive execution of employee tasks.
Management	<ul style="list-style-type: none"> Ineffective direction
Employees	<ul style="list-style-type: none"> Minimal initiative to address unclear expectations
Communication	<ul style="list-style-type: none"> Reliance on informal communication methods (Management & Employees)

As evidenced by the corresponding Ishikawa diagrams, the root causes for the situation experienced by the business under study appeared to be consistent. From the cause-and-effect diagrams, the following root causes were identified:

- Inadequate policies to address performance issues
- Inadequate policies to establish employee work expectations
- Inadequate procedures to drive employee execution of tasks.
- Inefficient management information systems

The next step during the Analyze stage was to perform a detailed cost analysis considering the data gathered during the measure stage. It was augmented to include a Net Present Value (NPV) analysis of “benefit” achieved driven by potential improvements. The potential improvements were identified based on the previously identified root causes. The improvements could be grouped into 3 categories:

- Improve policies
- Improve procedures
- Improve management information systems

The quantification of each improvement in terms of NPV was performed based on the impact each would have in terms of cancelling the negative cost impact related to the adverse effects resulting from *The Problem*. For example: If currently unexpected “rework costs” were quantified as \$10,000 based on data obtained during the measuring stage, then the “benefit” of improving the root causes that drove the “rework costs” is equivalent to the same amount. Similar calculations were performed for each improvement area. In addition to this, performance gains obtained via the improvements that could be performed were quantified as well and included in the resulting estimates.

As an outcome of further analysis, it was determined that the optimal grouping structure for cost analysis would be:

- NPV of improving policies and procedures

- NPV of improving the corresponding management information systems

The NPV calculations were performed across a period of 10 years, with an ROR of 10%. The results are provided in Figure 24.

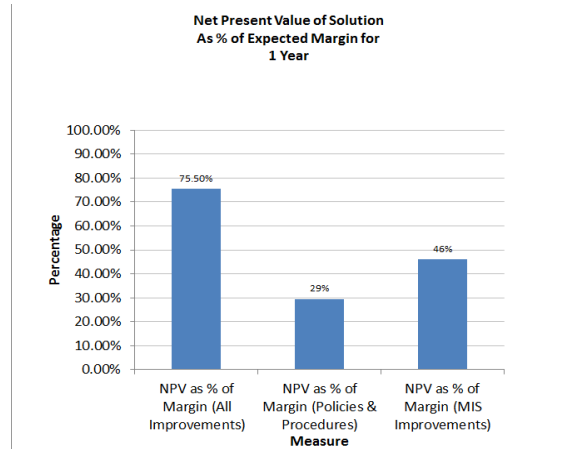


Figure 24
Cost Analysis Measures for Potential Improvements

To maintain a consistent approach, NPV is expressed as % of margin, in order to not document company confidential information as part of this effort. After identifying the associated NPV for potential solution sets, the final identification of potential solutions could be performed. The discrete identification of improvements per specific area is included in Table 4.

Table 4
Areas to Improve w Detailed Improvements

Area	Improvements
Policies	<ul style="list-style-type: none"> • Administration & human resources • Work requirements / expectations
Procedures	<ul style="list-style-type: none"> • General work direction, cadence of activities • Use of computer systems in performing work
Management Information Systems	<ul style="list-style-type: none"> • ERP (for labor reporting, open source) • Management software (improve audit trails, reports)

Based on the data in Table 4, a truth table of potential solutions was established to document all potential scenarios. Table 5 presents the 4 potential

alternatives that make up the truth table in the context of the affected areas. (Remember that Policies and Procedures have been combined as 1 potential area of improvement in terms of cost structure).

Table 5
Potential Solutions Truth Table

Alternative	Update/Create Policies & Procedures	Update Management Information Systems
1	NO	NO
2	NO	YES
3	YES	NO
4	YES	YES

Based on the data in Table 5, Table 6 establishes the Cost vs. Benefit of each potential alternative in terms of NPV (As Percent of 1 Year Net Margin).

Table 6
Potential Solutions Table (Cost vs. Benefit)

Alternative	Net Present Value (As Percent of 1 Year Net Margin)
1	0%
2	46%
3	29%
4	75%

Alternative 4 was selected as the selected path forward after discussion with project sponsors. Table 7 summarizes the selected option, with its NPV, improvement area, and specifics.

Table 7
Selected Alternative

NPV	Area	Specifics
29%	Policies	<ul style="list-style-type: none"> Administration & human resources Work requirements / expectations
	Procedures	<ul style="list-style-type: none"> General work direction, cadence of activities Use of computer systems in performing work
46%	Information Systems	<ul style="list-style-type: none"> ERP (for labor reporting, open source) Management software (improve audit trails, reports)

The activities performed during the Analyze stage enabled the identification of problem root causes, and the selection of corrective and preventive actions which include an acceptable path forward for improvement.

D. Stage 4 – Improve

Actual improvement efforts occur during the Improvement stage. During this stage of the project, an adequate implementation plan is defined and the improvements identified during the Analyze stage are implemented.

A high-level implementation plan / schedule had to be defined to drive the improvement activities work. The implementation plan, including essential activities is available on Figure 25.

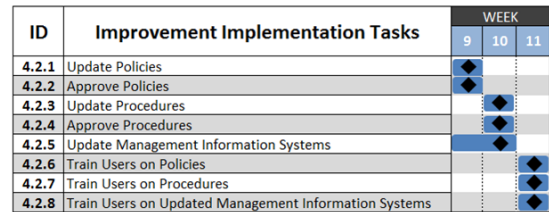


Figure 25
High Level Implementation Plan

The improvements implemented were driven by the results obtained and corresponding decisions made during the Analyze stage. The summary of implemented improvements is available in Table 8.

Table 8
Summary of Improvements Performed

Area	Discrete Improvements
Policies	<ul style="list-style-type: none"> Update policy – General Administration Update policy – Human Resources Update policy – Work Requirements / Expectations
Procedures	<ul style="list-style-type: none"> Update procedure – General Work Direction, Cadence of Activities Update procedure – Use of Computer Systems in Performing Work
Information Systems	<ul style="list-style-type: none"> Implemented new ERP solution (for labor reporting, open source, installed locally) Improved internally developed software used to manage work activity in order to improve audit trails (user activity) and develop new reports.

Other	<ul style="list-style-type: none"> • Re-trained employees in updated policies, procedures, and systems. • Re-trained management in updated policies, procedures, and systems.
-------	---

All improvement activities were completed on schedule and in accordance with previously identified requirements and constraints.

E. Stage 5 – Control

The objective of the control stage is to measure the post-improvement state and sustain the improvement. These measurements provided data to verify if the objectives established during the Define stage of the project were successfully achieved.

First, the Voice of the Customer activity was revisited for both the employee group as well as for the management group. The results of the exercise are included in the following Figure 26 to Figure 37. The VOC exercises utilized the same questionnaires as those utilized during the Measure stage.

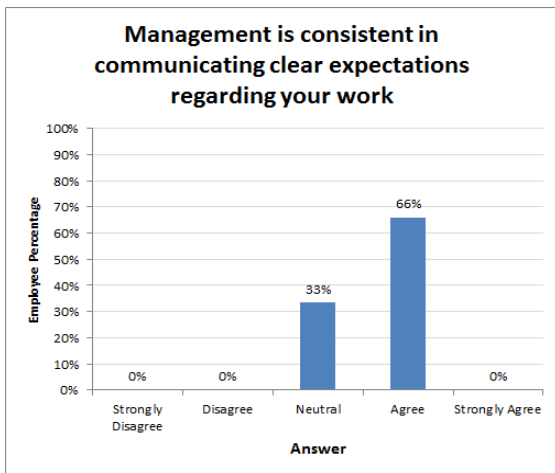


Figure 26
VOC, Employee, Statement 1 (After Improvement)

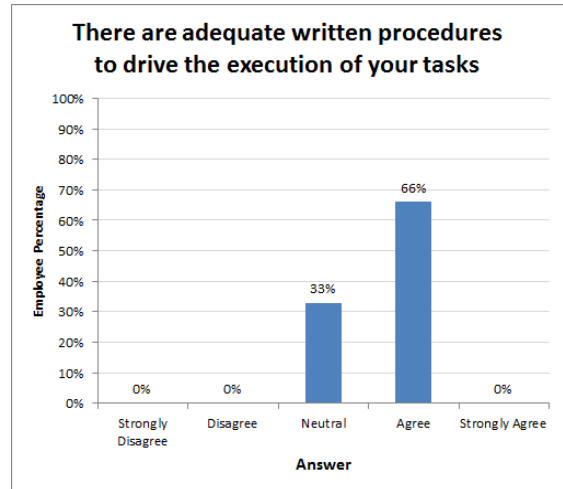


Figure 27
VOC, Employee, Statement 2 (After Improvement)

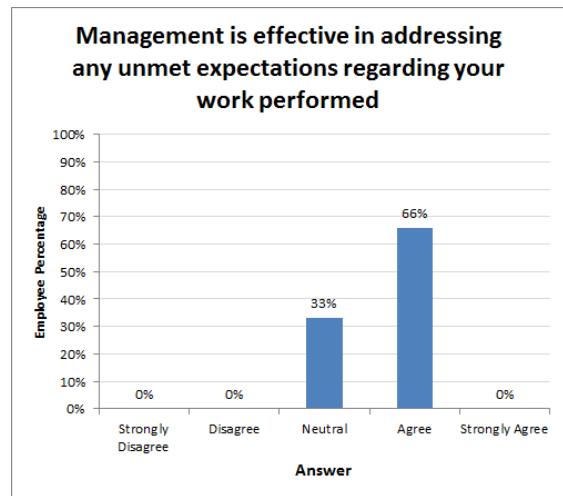


Figure 28
VOC, Employee, Statement 3 (After Improvement)

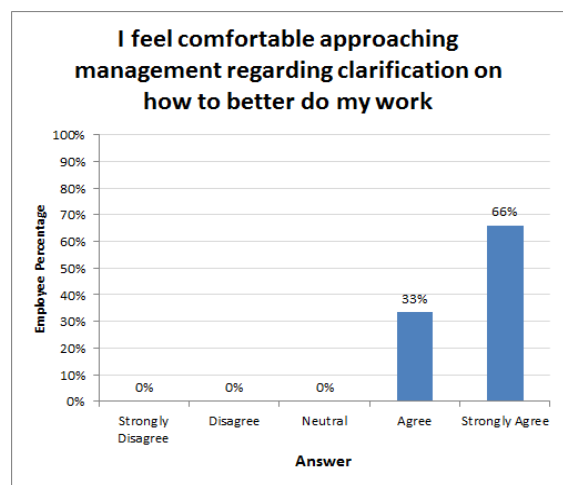


Figure 29
VOC, Employee, Statement 4 (After Improvement)

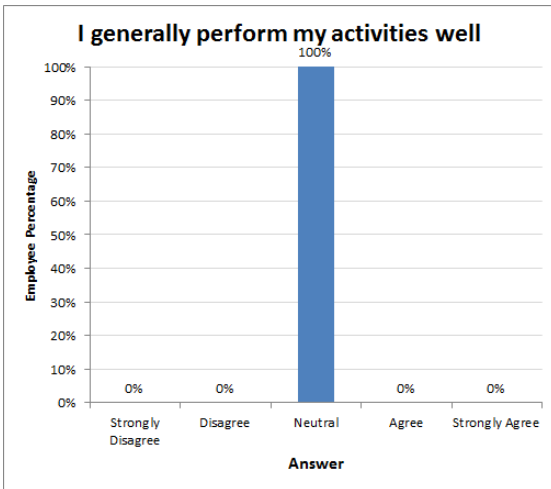


Figure 30
VOC, Employee, Statement 5 (After Improvement)

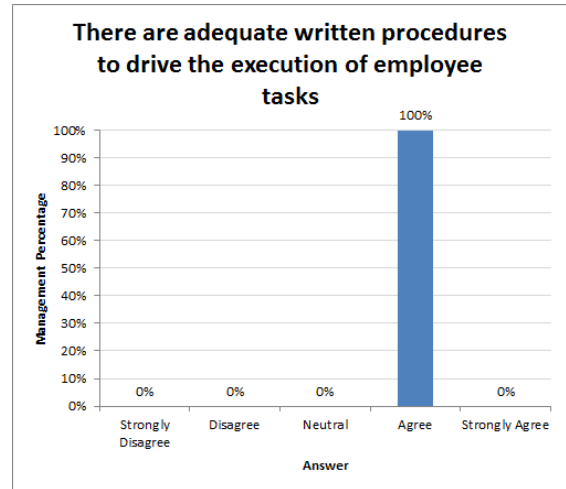


Figure 33
VOC, Management, Statement 2 (After Improvement)

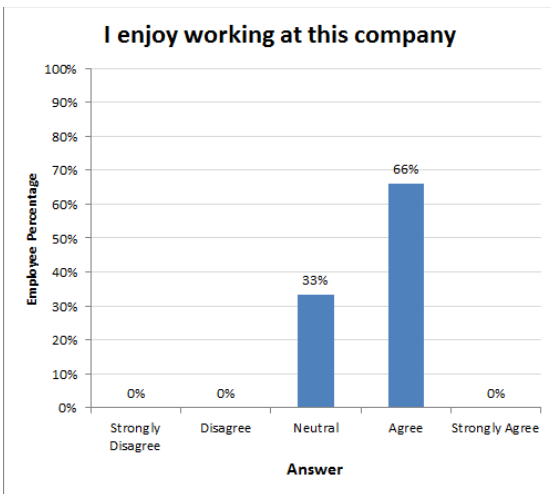


Figure 31
VOC, Employee, Statement 6 (After Improvement)

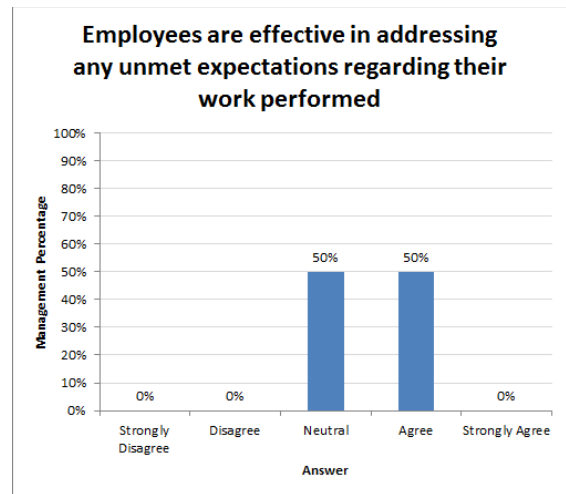


Figure 34
VOC, Management, Statement 3 (After Improvement)

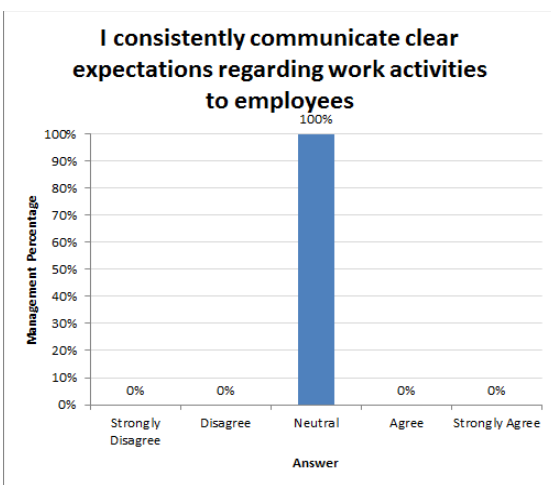


Figure 32
VOC, Management, Statement 1 (After Improvement)

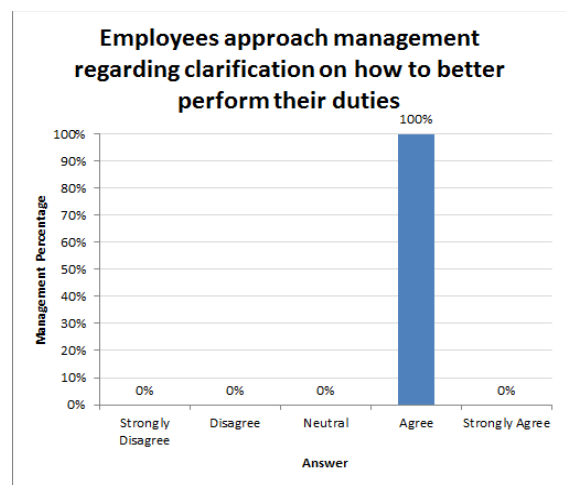


Figure 35
VOC, Management, Statement 4 (After Improvement)

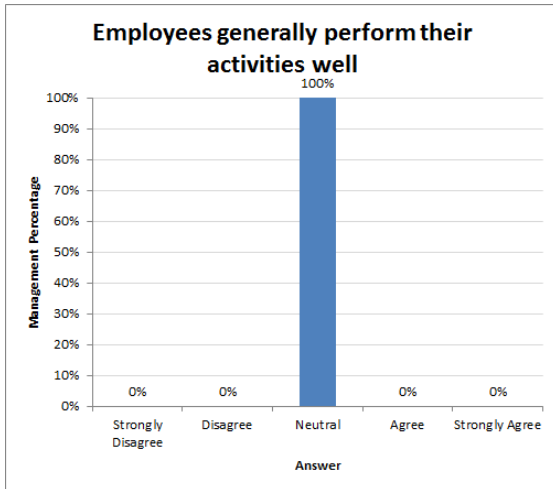


Figure 36
VOC, Management, Statement 5 (After Improvement)

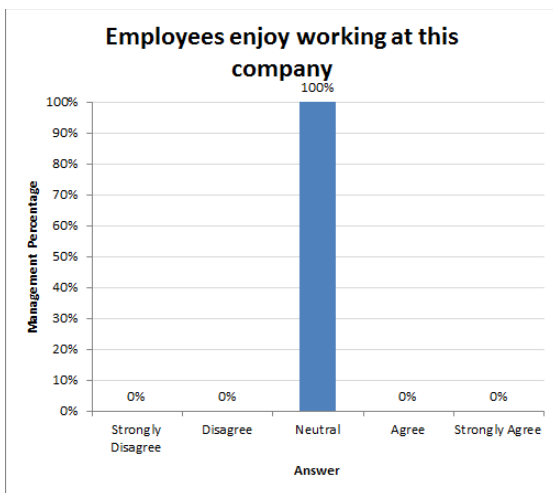


Figure 37
VOC, Management, Statement 5 (After Improvement)

The risk assessment performed during the Measure stage of the project was revisited as part of the Control stage. The same process was followed to perform the risk assessment after the improvement efforts were completed. Figure 38 provides the results of the risk assessment performed post-improvement.

		Probability of Occurrence					
		Rare	Unlikely	Possible	Likely	Certain	
		1	2	3	4	5	
Severity of Consequence	Very High >75% Margin	5	Yellow	Yellow	Red	Red	Red
	High 31% - 75% Margin	4	Yellow	Yellow	Yellow	Red	Red
	Medium 15% - 30% Margin	3	Green	Yellow	Yellow	Yellow	Red
	Low 3% - 15% Margin	2	Green	X	Yellow	Yellow	Yellow
	Very Low <3% Margin	1	Green	Green	Green	Yellow	Yellow

Figure 38
Risk Assessment (After Improvement)

Based on the risk matrix on Figure 38 we obtain the revised risk factor utilizing the previously identified formula:

$$Risk\ Factor = PoO \times SoC$$

$$Risk\ Factor = 2 \times 2$$

$$Risk\ Factor = 4$$

Lessons learned were documented as part of the Control stage of the project. Lessons learned provide a means of documenting valuable insights obtained during the execution of a project. The goal is to ensure that the lessons are leveraged in future efforts in order to maximize the probability of success.

Lessons learned during this project effort include:

- Continual communication is a requirement to maximize the probability of successful project outcomes
- Improvement projects need to be discussed in terms of financial benefit to an organization to increase the probability of success
- Selecting the right methodology aids to drive project activity effectively
- When dealing with improvement initiatives, there needs to be constant focus on change management

The work performed during the Control stage provides the measures that were contrasted with those obtained during the Measure stage. This

allowed for the verification that the Objectives were successfully achieved.

decreased. The risk factor was lowered from 12 to 4. The objective was successfully achieved.

V. RESULTS

A. Objectives Review

As part of the objectives review, each of the 3 previously identified objectives identified during the Define stage was properly analyzed.

Objective 1

Lower the probability of occurrence and/or severity of consequence of future occurrences of similar events.

To adequately verify Objective 1, a comparison between the risk assessment performed during the Measure stage (prior to improvement implementation) and the risk assessment performed during the Control stage (after improvement implementation) was performed. Figure 39 displays a comparison of the 2 risk assessment activities.

		Probability of Occurrence					
		Rare	Unlikely	Possible	Likely	Certain	
		1	2	3	4	5	
Severity of Consequence	Very High	>75% Margin	5				
	High	31% - 75% Margin	4		X1		
	Medium	15% - 30% Margin	3		X2		
	Low	3% - 15% Margin	2				
	Very Low	< 3% Margin	1				

Figure 39
Risk Assessment Comparison
 X1 = Before Improvement
 X2 = After Improvement

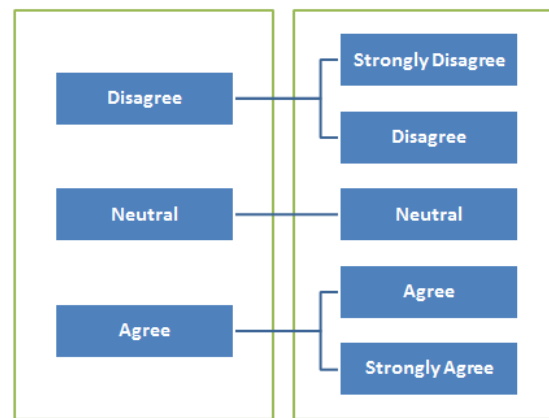
Figure 39 provides evidence that the risk factor was lowered as a result of the improvement efforts. Both the probability of occurrence (from 3 to 2) and the severity of consequence (from 4 to 2)

Objective 2

Achieve improved employee understanding of expectations related to their function

To adequately verify Objective 2, a comparison between the VOC activity performed with the employee population during the Measure stage (prior improvement implementation) and the VOC activity performed during the Control stage (after improvement implementation) was performed.

In order to measure for improvement based on the VOC, the responses were grouped according to Figure 40. The focus of measurement for improvement will be on the deltas for the “agree” grouping. If the delta for the agree grouping is positive (comparing post-improvement VOC vs. pre-improvement VOC) it means that there was a positive improvement towards the “agree” perception. If the delta is negative, the opposite is true.



Improvement Measurement Groupings **VOC Responses**

Figure 40
Transformation of VOC Responses
to Improvement Measurement Groupings

An analysis on the delta of “agree” responses was performed on each of the 6 statements.

Positive deltas highlight improvement. Figure 41 presents the delta analysis for the VOC activity.

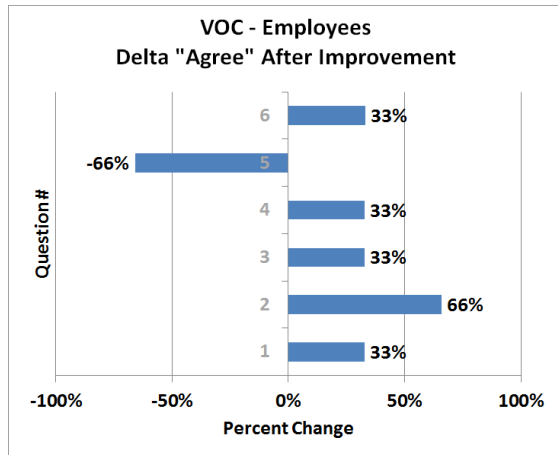


Figure 41
VOC Comparison (Employees)

Based on the data, improvement can be demonstrated as all questions, except one, experienced a positive delta for the “agree” group of responses. Nevertheless, question # 5 (“I generally perform my activities well”) experienced a negative delta. Responses to this question moved from the “agree” side to the “disagree” or “neutral” side. This demonstrates that employees are more open to direction, and understand that they might not always perform in accordance to expectations. Although statement 5 responses did not experience a positive delta for the “agree” group, it can be defined as a positive outcome for the objective under consideration. Thus, the objective was successfully achieved.

Objective 3

Achieve improved company owner satisfaction with regards to employee performance

To adequately verify Objective 3, a comparison between the VOC activity performed with management during the Measure stage (prior improvement implementation) and the VOC activity performed during the Control stage (after

improvement implementation) was performed. As with objective 2, grouping of answers for verification was performed according to Figure 40.

An analysis on the delta of “agree” responses was performed on each of the 6 statements. Positive deltas highlight improvement. Figure 42 presents the delta analysis for the VOC activity.

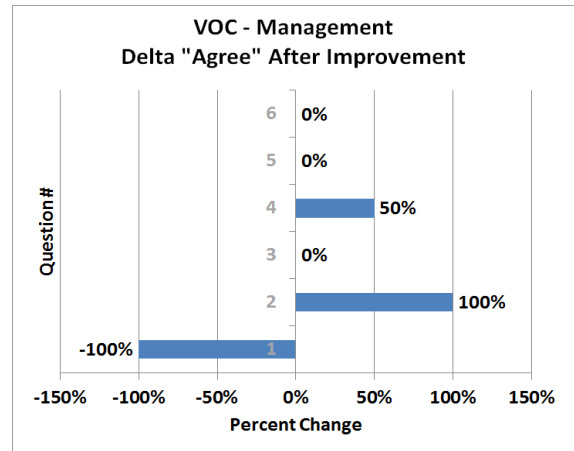


Figure 42
VOC Comparison (Management)

Based on the data, improvement can be demonstrated as there was improvement in the statements focused on evaluating management expectations on employees (2 and 4). Additional time will be needed to effectively evaluate improvement in statements 3 and 5. Statement 1 (“I consistently communicate clear expectations regarding work activities to employees”) experienced a substantially negative delta. Responses to statement 1 moved from the “agree” side to the “disagree” or “neutral” side. This demonstrates that management is more open to realize that adequate direction to employees might not always be provided. Although this statement did not experience a positive delta on the “agree” response group, it is considered a positive outcome as self-awareness regarding potential ineffectiveness in direction by part of management has occurred. Thus, the objective was established as successful.

B. Results Summary

Table 9 summarizes the results of the improvement efforts.

Table 9
Objectives Met / Not Met

Objective	Met?
1	YES
2	YES
3	YES

In addition to the 3 Objectives defined during the Define stage, there were various additional project constraints. Table 10 highlights adherence to previously identified constraints:

Table 10
Summary of Improvements Performed

Constraints	Met / Not Met?
No discrete "cost constraint" related to project related work	Yes, all work performed for the project is considered \$0 cost.
Required \$0.00 cost impact to company operations (no net recurring cost increase)	Yes, no recurring cost increase, this drove the selection of open source software
Net Present Value equal or higher than 0	Yes, NPV = 75% of net income for 1 year

VI. DISCUSSION

A. Results Discussion

On every project effort, there are situations that could contribute to the success of the effort and others that could prevent success. Some success limiting factors that surfaced during this improvement effort are identified as follows:

- Decreased sense of urgency in addressing the problem
- Delay of legal proceedings
- Delayed decision regarding path forward
- Resistance to the VOC activity by some members of the employee population.
- Difficulty maintaining objectivity during root cause analysis

Some of the success aiding factors experienced during the improvement efforts included:

- Genuine desire to do the right thing (both employees and management)
- Defining the problem effectively
- Defining the objectives effectively
- Effective selection of project methodology
- Leverage of industry standard tools

Communication proved to be essential during the execution of the improvement project. Initially, there appeared to be communication problems between the personnel and management (as discovered during the Analyze stage). These problems proved to be factors that contributed to the unexpected legal situation that the company is currently experiencing. As a result of project execution, both management and employees were able to understand that effective communication is a critical success factor.

Overall, all project Objectives were successfully achieved. The methodology utilized to perform project activities proved strategically useful to ensure focus on the critical work that needed to be performed and to structure tasks in a manner that provided continual visibility to the project stakeholders. In addition, the structured process ensured that the experienced success limiting factors did not substantially affect project outcomes negatively.

B. Methodology

In addition to demonstrating the value of operational controls, this effort successfully demonstrates the value of selecting an adequate methodology for an improvement project. The DMAIC methodology proved to be a positive influence factor during project execution.

Regardless, in every project there are decisions that result to be positive and others that result not as positive. Positive decisions of this effort include:

- Selection of the DMAIC methodology
- Selection of tools
- Project management concepts implementation
- Communication mechanisms

There were no decisions that resulted in negatively affecting the project outcomes.

The selected project management methods ensured that project activities were performed in accordance with the agreements reached during the Define stage. The project charter was considered the project “contract” and it was referenced throughout the improvement efforts when conflicts surfaced. This ensured that project execution was performed focused on the initial commitments.

A project journal was created to monitor significant facts throughout the course of project execution. The project journal consisted of a worksheet used to maintain issues, situations, and decisions taken throughout the project to ensure that any potential risks were mitigated, and agreements were adequately captured for future reference. The project journal proved to be a very useful mechanism to ensure that issues were continually monitored and discussed.

The detailed schedule proved to be an essential mechanism to monitor project progress. It was used as both as a monitoring mechanism as well as a communication tool. Progress was consistently discussed in terms of the project schedule with project sponsors. It provided a consistent way to manage progress and framed the conversations regarding project status around the specific project activities that were being performed. The final detailed schedule with the corresponding execution summary highlighted is available in Figure 43.

Detailed Schedule w Execution Summary

ID	Stage/Task	Status	WEEK													
			1	2	3	4	5	6	7	8	9	10	11	12		
1	Define Stage	Complete	█	█	█	█	█	█	█	█	█	█	█	█	█	█
1.1	Define Problem	Complete	█	█	█	█	█	█	█	█	█	█	█	█	█	█
1.2	Establish Objectives	Complete	█	█	█	█	█	█	█	█	█	█	█	█	█	█
1.3	Document Project Charter	Complete	█	█	█	█	█	█	█	█	█	█	█	█	█	█
2	Measure Stage	Complete	█	█	█	█	█	█	█	█	█	█	█	█	█	█
2.1	Measure Voice of The Customer	Complete	█	█	█	█	█	█	█	█	█	█	█	█	█	█
2.2	Perform Probabilistic Risk Assessment	Complete	█	█	█	█	█	█	█	█	█	█	█	█	█	█
2.3	Complete Cost Measurements	Complete	█	█	█	█	█	█	█	█	█	█	█	█	█	█
3	Analyze Stage	Complete	█	█	█	█	█	█	█	█	█	█	█	█	█	█
3.1	Perform 5 Whys Analysis	Not Started														
3.2	Complete Ishikawa Diagrams	Not Started														
3.3	Complete Cost Analysis	Not Started														
3.4	Identify Potential Solutions	Not Started														
3.5	Define Solution that will be implemented	Not Started														
4	Improve Stage	Complete	█	█	█	█	█	█	█	█	█	█	█	█	█	█
4.1	Define Implementation plan	Complete	█	█	█	█	█	█	█	█	█	█	█	█	█	█
4.2	Implement Solution	Complete	█	█	█	█	█	█	█	█	█	█	█	█	█	█
5	Control Stage	Not Started														
5.1	Perform Voice of The Customer (After Improvement)	Not Started														
5.2	Review Probabilistic Risk Assessment (After Improvement)	Not Started														
5.3	Document Lessons Learned	Not Started														

Color/icon Legend
 █ Plan Start/End █ On Schedule █ Delayed ✓ Complete

Figure 43
Project Tasks Monitoring

From an improvement project perspective, the results of this effort and the data contained within these results could potentially be leveraged as an aid when researching strategies to performing any improvement initiative.

VII. CONCLUSIONS

The work performed during this improvement effort resulted in several main conclusions.

Effective Operational controls have to be considered a competitive advantage

The principal functions of management are Planning, Organizing, Directing, and Controlling. Control mechanisms are essential to ensure that work is performed in alignment with business strategies and direction. Ineffective operational controls can result in unexpected costs related to rework, unexpected compliance and/or legal situations, and other unexpected labor costs.

Effective operational controls establish consistent direction, and provide adequate means to perform the 4th management function effectively. This translates to a more efficient operation, lowered costs, and thus increased margins. The lowering of costs could be translated to more competitive price structures than those of competitors increasing the probability of more successful business outcomes.

There can be a substantial financial benefit in terms of reduced rework and avoidance of penalties in having effective operational controls

As evidenced through the results of this effort, there is a financial benefit to having effective operational controls. Lack of operational controls resulted in an unexpected legal situation for the business under study. This in turn resulted in unexpected costs for the organization. Costs were quantified to 45% of net income for the present year. This is a substantial amount when it is in the context of a small business operation or a large

business operation. In addition to this, the improvement of existing operational controls was quantified to offer an expected NPV (over 10 years, at 10 ROR) of 75% of net income for 1 year on performance improvements and unexpected cost avoidances. The 75% NPV demonstrates substantial financial benefit.

Some small businesses could be under the erroneous impression that pursuing effective operational controls could result in negative cost impact to business operations. Based on the results of this study, that perception can be established as potentially erroneous. The studied business can be considered a small business and their example can be utilized as a counter-argument to the negative cost impact perception.

**When pursuing an improvement project,
selecting the right methodology is a factor that
influences probability of success**

At first impression, there was a perception from the project sponsors that the methodology and structure proposed for the effort could have been unnecessary. As time progressed, the structure proved to be the key driver of project performance. The structure drove the execution of work, the discussion of status, and the focus on previous agreements. This had a major impact in achieving a successful outcome. The value of methodology and structure cannot be underestimated.

This was a relatively small effort, but still benefitted from the utilized methodology and structure. The most important fact is that the structure was tailored to the effort, and did not follow a prescriptive process. This allowed for the selection of the most valuable and adequate techniques in terms of methodology, tools, and project management methods within the context of the specifics of the project.

Due to scope and schedule limitations, the contents of this work could only provide a brief introduction to some of the concepts related to various industry bodies of knowledge (or BOKs) such as the Project Management Body of

Knowledge (PMBOK) and the Quality Body of Knowledge (QBOK). These bodies of knowledge offer vast amounts of resources to aid in the execution of projects based on years of documented practical experience and results. As initiatives grow in scope and complexity, additional tools and methods can be leveraged to augment the scope of activities related to the DMAIC improvement cycle. Regardless, the simple basic structure of the DMAIC cycle is consistently applicable. Readers are strongly encouraged to pursue additional resources related to the subjects discussed as part of this work. Increased understanding and exposure to these managerial concepts is essential to any professional on today's highly competitive business environment.

VIII. REFERENCES

- [1] Lussier, R, N, "What do Managers Do?", *Management Fundamentals: Concepts, Applications, Skill Development*, 4e, 2009, pp. 11-13
- [2] PM Hut, "A Risk Management Implementation", *THE.PROJECT.MANAGEMENT.HUT*, June 13, 2012, retrieved on September 09, 2013 from <http://www.pmhut.com/a-risk-management-implementation>
- [3] iSixSigma, "Voice of the Customer (VOC)", *iSixSigma.com*, retrieved on October 26, 2013 from <http://www.isixsigma.com/dictionary/voice-of-the-customer-voc/>
- [4] Villanova University Website, "Six Sigma: DMAIC Methodology", *Villanovau.com*, retrieved on October 26, 2013 from <http://www.villanovau.com/six-sigma-methodology-dmaic>
- [5] ASQ Service Division, "5 Whys", *American Society for Quality*, retrieved on September 10, 2013 from <http://asq.org/service/body-of-knowledge/tools-5whys>
- [6] ASQ, "Fishbone (Ishikawa) Diagram", *ASQ.org*, retrieved on September 10, 2013 from <http://asq.org/learn-about-quality/cause-analysis-tools/overview/fishbone.html>