Standardize and Establish Voice of the Customer Process using DMAIC Methodology

Leida V. Martínez Dávila
Master in Manufacturing Competitiveness
Carlos González, PhD.
Industrial Engineering Department
Polytechnic University of Puerto Rico

Abstract — *This research project was focused in the Voice of the Customer process robustness. Voice of the Customer process does not have a clear procedure to creates a standardize survey and analyze the data that has been collected. In order to understand the issues happening at the Engineering department an investigation project was developed. This investigation was documented using the DMAIC methodology. This methodology have a lot of tools that are very helpful to document and analyze all the data regarding the process. In the Define phase the tool used was the Project Charter. It was used to document the project title, area affected, problem statement and benefits of the project. The tools used in the Measure phase were the Thought Process Map, the SIPOC and the Process Map. During this phase it was identified the current baseline as the basis for improvement. This baseline was compared to the performance metric at the conclusion of the project to determine objectively whether significant improvement have been made. The actual process metrics were used in the Analyze phase to evaluate the process. The Cause and Effect Matrix and the 7 Waste analysis were also performed during this phase. These tools helped to identify the root causes of the problem, and the possible actions needed to resolve it. The major problem was that the voice of the customer process was not documented properly and all the department areas had their own way to do it. In the Improve phase it was defined that an internal procedure will be created to document this process and all the impacted areas will need to follow it. The Control phase data demonstrates that the actions implemented were effective because all the engineering department areas have a VOC data and a robust analysis of this data.*

Key Terms — DMAIC, Voice of the Customer.

PROBLEM STATEMENT

During 2015, an access tool was created to gather and track customer feedback data. Currently, Voice of the Customer process does not have a clear procedure to create a standardize survey and analyze the data that has been collected. Not having a standard process creates discrepancies and confusion between different groups of what is required regarding voice of the customer. These differences impede interpretation of data as a whole, thus not allowed the Engineering department to adequately improve interactions with the costumer. The goal is to create a procedure aligned with all the Engineering department areas. The procedure will have a template with the same survey questions and will document the data analysis and negative comments process. A consistent data analysis process would facilitate interpretation of customer feedback. Customers will have the opportunity to see improvements based on their feedbacks and a better final product. In order to achieve this goal the DMAIC project methodology will be used.

RESEARCH DESCRIPTION

This research is about how effective is the Voice of the Customer process in the Engineering department. In order to identify the areas of opportunity, the actual surveys were reviewed and updated to have only one template aligned with the area needs. The data analysis process will be reviewed to identify the better way to do it and to be document as a department process. It is important to have a robust data analysis process. This will help the department to track customer positive and negative feedback. This will help in the improvement process and the customer will

have the opportunity to see that management cares about their opinion.

RESEARCH OBJECTIVES

The objective of this project is to acquire consistent data analysis process through Engineering Test Services in order to facilitate interpretation of customer feedback. Customers will have the opportunity to see improvements based on their feedbacks and a better final product.

RESEARCH CONTRIBUTIONS

The research discussed in this article will contribute to the engineer department to robust and increase its Voice of the Customer process. In addition, the research contributes to increase the customer satisfaction. The goal of this project is to define the goals and key drivers of each project. Having a clear understanding of the customer expectation is essential to maintain a high customer satisfaction level. A good understanding means that you can properly plan the survey design and administration process to capture customer feedback that provides meaningful data, which can be analyzed and confidently presented to management and to the customer. The engineering department will increase its capacity to send, receive and analyze the voice of the customer. This project seeks to increase customer satisfaction and maintain or increase the actual engineering projects. This will improve the company to get new customers and help to get more projects. It also will help to gather new customers and projects. This will maintain our actual profits of approximately $350,000 per year and will increase it significantly.

LITERATURE REVIEW

The voice of the customer is a process used to capture the requirements and feedback from the customer (internal or external) to provide the customers with the best in class service/product quality. This process is all about being proactive and constantly innovative to capture the changing requirements of the customers with time. The voice of the customer is the term used to describe the stated and unstated needs or requirements of the customer. The voice of the customer can be captured in a variety of ways like direct discussion or interviews, surveys, focus groups, customer specifications, observation, warranty data, field reports and complaint logs. This data is used to identify the quality attributes needed for a supplied component or material to incorporate it in the process or product [1].

To become a leader and a "Best in Class" company it is very important to listen to the customer needs and perception. Customer-perceived quality is the leading driver of business success. Having an effective voice of the customer process will allow the company to connect and engage with customers at key points in the customer journey. When the customers share their voice in real-time with the organization, they expect you to listen, act and report back to them. The key to creating an effective VOC process is to gather and use information in a timely way that helps you to improve the processes. Organizations often have multiple touch points with the customer that occur all across the organization, including sales, support, and warranty and accounting interactions.

DMAIC METHODOLOGY

DMAIC is a data-driven quality strategy used to improve processes. It is an integral part of a Six Sigma initiative, but in general can be implemented as a standalone quality improvement procedure or as part of other process improvement initiatives such as lean [2].

DMAIC (Lean Six Sigma) is also a management system that results in a steady pipeline of projects that are ready for improvement. There are obstacles to smooth operations in any business, and Lean Six Sigma provides guidelines to help you select the right projects at the right time. Once projects are selected, you and your improvement

team can use DMAIC to further refine the projects and deliver quantifiable, sustainable results [3].

The DMAIC problem solving method is a roadmap that can be used for any projects or quality improvements that needs to be made. The term DMAIC stands for the five main steps in the process; Define, Measure, Analyze, Improve and Control (see Figure 1).

DMAIC is an acronym for a series of steps used to measure defects in business processes and improve profitability. It is one of two key methods used to implement Six Sigma, a quality improvement program introduced in 1986 by Motorola, a U.S. technology and communications company. By identifying defects, a company can eliminate errors and accurately determine quality. Then, the company can use those findings to figure out a solution to a detected problem. Today, Six Sigma methods are used across a broad range of industries to improve both processes and profitability.

Figure 1
DMAIC

Each step in the cyclical DMAIC Process is required to ensure the best possible results. The process steps are:

- **Define**: The purpose of this step is to clearly articulate the business problem, goal, potential resources, project scope and high-level project timeline. In Six Sigma it is imperative that the problem is specifically defined. Saying that business is slowing down is a poorly defined problem. Instead, the problem should be

clearly established in quantitative terms. This information is typically captured within a project charter document. Seek to clarify facts, set objectives and form the project team. Define the following:
  - o A problem
  - o The customer(s)
  - o Voice of the customer (VOC) and Critical to Quality (CTQs) — what are the critical process outputs?
  - o The target process subject to DMAIC and other related business processes
  - o Project targets or goal statement
  - o Project boundaries or scope
  - o A project charter is often created and agreed upon during the Define step.

- **Measure:** The purpose of this step is to objectively establish current baselines as the basis for improvement. This is a data collection step, the purpose of which is to establish process performance baselines. The performance metric baseline from the Measure phase will be compared to the performance metric at the conclusion of the project to determine objectively whether significant improvement has been made. The team decides on what should be measured and how to measure it. It is usual for teams to invest a lot of effort into assessing the suitability of the proposed measurement systems. Good data is at the heart of the DMAIC process:
  - o Identify the gap between current and required performance.
  - o Collect data to create a process performance capability baseline for the project metric, that is, the process Y(s) (there may be more than one output).
  - o Assess the measurement system (for example, a gauge study) for adequate accuracy and precision.
  - o Establish a high level process flow baseline. Additional detail can be filled in later.

- **Analyze**: The data is analyzed using statistical tools to assess whether the problem is real (and solvable) or random, which makes it unsolvable within the Six Sigma framework. The purpose of this step is to identify, validate and select root cause for elimination. A large number of potential root causes of the project problem are identified via root cause analysis. The top 3-4 potential root causes are selected using multi-voting or other consensus tool for further validation. A data collection plan is created and data is collected to establish the relative contribution of each root causes to the project metric. This process is repeated until "valid" root causes can be identified. Within Six Sigma, often complex analysis tools are used. However, it is acceptable to use basic tools if these are appropriate. Of the "validated" root causes, all or some can be:
  - List and prioritize potential causes of the problem
  - Prioritize the root causes (key process inputs) to pursue in the Improve step
  - Identify how the process inputs (Xs) affect the process outputs (Ys). Data are analyzed to understand the magnitude of contribution of each root cause, X, to the project metric, Y. Statistical tests using p-values accompanied by Histograms, Pareto charts, and line plots are often used to do this.
  - Detailed process maps can be created to help pin-point where in the process the root causes reside, and what might be contributing to the occurrence.

- **Improve**: If the problem is real, the Six Sigma team identifies solutions to improve the process based on the data analysis. The purpose of this step is to identify, test and implement a solution to the problem; in part or in whole. This depends on the situation. Identify creative solutions to eliminate the key root causes in order to fix and prevent process problems. Use brainstorming or techniques like Six Thinking Hats and Random Word. Some projects can utilize complex analysis tools like DOE (Design of Experiments), but try to focus on obvious solutions if these are apparent. However, the purpose of this step can also be to find solutions without implementing them.
  - Create
  - Focus on the simplest and easiest solutions
  - Test solutions using Plan-Do-Check-Act (PDCA) cycle
  - Based on PDCA results, attempt to anticipate any avoidable risks associated with the "improvement" using Failure Mode and Effect Analysis
  - Create a detailed implementation plan
  - Deploy improvements

- **Control**: The purpose of this step is to sustain the gains. Control planning, including data collection and control mechanisms, is required to ensure that the solutions are sustainable and deliver peak performance. It also ensures that early deviations from the target do not materialize into process defects. Monitor the improvements to ensure continued and sustainable success. A Control chart can be useful during the Control stage to assess the stability of the improvements over time by serving as a guide to continue monitoring the process and provide a response plan for each of the measures being monitored in case the process becomes unstable.

RESULTS AND DISCUSSION

In order to achieve the goal of having an effective Voice of the Customer process in the Engineering department that helps to identify the opportunity areas based on the customer needs the DMAIC tools project methodology was used.

At the Define phase the following tools were used:

- **Project Charter**: Is a statement of the scope, objectives and participants in a project. A project charter describes what your project is

and how you will approach it, and it lists the names of all stakeholders. When you start a project, you must define what needs to be accomplished and decide how the project is going to proceed. Each project begins with an idea, a vision, or a business opportunity. That is the starting point that must be associated with your organization's business objectives. It is a critical component of the project management initiation and planning phases, and you will refer to it throughout the life of the project. It provides a preliminary delineation of roles and responsibilities, outlines the project objectives, identifies the main stakeholders, and defines the authority of the project manager. It serves as a reference of authority for the future of the project. The project charter below documents the project title, area affected, problem statement and benefits of the project.

Table 1
Project Charter

Element	Project Information
Project Title	Standardize and establish VOC Process
Area of Focus or Function:	Engineering Department
Problem Statement	During 2015 an access tool was created to gather and track customer feedback data. Currently Voice of the Customer process does not have a clear procedure to creates a standardize survey and analyze the data that has been collected. Not having a standard process creates discrepancies and confusion between different groups of what is required regarding voice of the customer. These differences impede interpretation of data as a whole, thus not allowing the Engineering department to adequately improve interactions with the costumer.
Benefit to Customers:	Consistent data analysis process through ETS would facilitate interpretation of customer feedback. Customers will have the opportunity to see improvements based on their feedbacks and a better final product.

- **Thought Process Map**: Is a graphical tool used to communicate the thought process used in developing the strategy to solve a problem, and how the process improvement results were obtained. The Thought Map is a living document that evolves from an initial state of recording knowledge, questions and actions to a tool used to communicate the thought process used to develop the strategy to solve a problem. This tool helps to organize your thoughts regarding what you know and what you do not know about your opportunity, and develop an action plan [4]. There were documented the tools used on each step of the DMAIC project and how they will help to understand the problem and identify the actions to solve it. Figure 2 shows a Thought Map of this project.

Stage	Question	Tool	Expected Result
Define	What are the problem, goal, milestones, scope and team members?	Project Charter	Clear project definition
	How will we solve this problem? What do we do first? What do we know and what don't we know?	Though Process Map	Identify tools to approach the problem
	What are the boundaries of this activity, capabilities of suppliers and needs of customer groups?	SIPOC	Identify boundaries, stakeholders and their requirements
Measure	What does the current process looks like? What are the inputs and outputs of the process?	Current Process Map	To create common understanding of the current process project
	How does the future process should look like? What are the inputs and outputs of the process?	Future Process Map	Have a detailed description of project expectation.
	What information do we need to gather from our customers to improve ourselves?	VOC Survey	Detailed costumer feedback
Analyze	Where does the Non Value Added time and waste occur in the process?	7 Wastes	Identifies waste and opportunities.
	How can I prioritize which process steps to focus on?	Cause and Effect Matrix	Prioritized action plan
Improve	How can we translate costumer needs into process requirements?	Customer Focused Quality Function Deployment (QFD)	Incorporate costumer needs into process requirements
	How can I quickly identify the root cause of a problem?	5 Why	Identify Root Cause and define corrective actions
Control	What metrics will we track and report?	VOC Survey	VOC Survey results will support our ability to make improvements.
	How can we measure progress and detect problems with the new process?	Control Plan	List of key controls to ensure success

Figure 2
Thought Process Map

At the Measure phase the following tools were used:

- **SIPOC**: Is a tool used by a team to identify all relevant elements of a process improvement project before work begins. It helps define a complex project that may not be well scoped, and is typically employed at the Measure phase of the Six Sigma DMAIC methodology. It is similar and related to process mapping and 'in/out of scope' tools, but provides additional detail. This tool summarizes the inputs and outputs of one or more process. The acronym SIPOC stands for Suppliers, Inputs, Process,

Outputs, and Customers. A SIPOC of the project is shown in Figure 3.

Figure 3
Process SIPOC

- **Process Map**: Is a detailed flow diagram of the process using color coded symbols that drill further into the high level map generated on the SIPOC. The purpose is to visually represent the process as it is in reality. Complete the current state map by walking and experiencing the process. This is a valuable learning experience, the team will quickly gain insight about the actual flow. The process flow map in Figure 4 shows the actual process. When the Improve phase is completed an updated flow map that will show the new process steps will be presented.
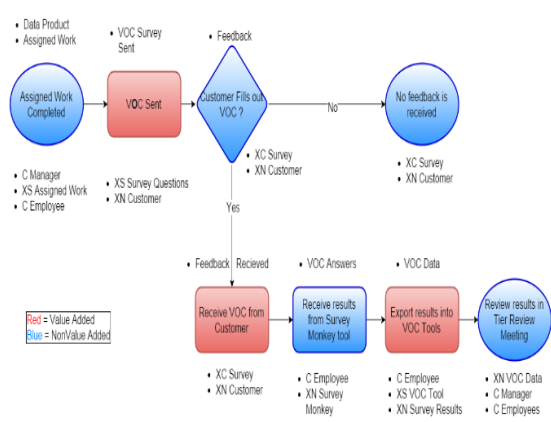
Figure 4
Process Flow Map

At the Analyze phase the following tools were used:

- **VOC Process Metrics**: VOC data can be obtained on reactive and/or proactive way with customer surveys, customer interviews, market

research, release evaluations, feedback forms and even daily/weekly stand-up meetings.

- The current VOC data was collected and analyzed. The engineering department is divided in 12 areas. These areas are divided based on the processes that are manage on each area. The Figure 5 shows that only 5 areas are using the VOC process. Only 42% of the engineering department projects send customer satisfactions surveys. The other 52% of the engineering department are not using the VOC process to evaluate their customer satisfaction. The Figure 5 helps to understand the percent of response by the customer and how satisfied they are with the job completed.
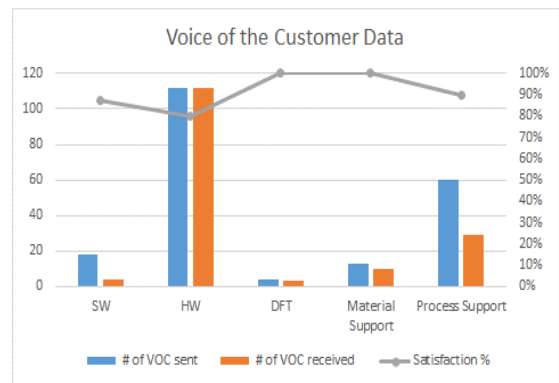

Figure 5
VOC Metrics

- **Cause and Effect Matrix**: This tool can be used to evaluate and document relationships between input and output variables. This tool helps to prioritize process inputs by determining which ones have the greatest impact on the customer CTQs [4]. It is a great tool for prioritizing a long list of possible things you could do to improve a process during your DMAIC project. The matrix shown in Figure 6 demonstrates that the Engineer assigned to complete the project is the main contributor. Because this project do not have control to assign an engineer to a project, we will use the second main contributor that is VOC data received thru the surveys. The actual process do not consider a process to manage and analyze the survey

results. This process is not properly documented and each area use a different survey with their own questions. Once the results are received, each manager creates a chart or table to present it on the staff meetings. The VOC data varies from manager to manager, because of the different questions on the survey. The Senior Manager do not have the method to do a general analysis of the Engineering department. In order to have a robust analysis of the VOC data it is important to have one survey template for all the areas with the same questions. Once the survey is align, then a data analysis process will be implemented.

Figure 6
C&E Matrix

Figure 7
Waste Identification and Elimination

- **7 Wastes**: A waste is any activity done during a process that consumes resources but does not add value, in the eyes of the customer. This concept is used to segment waste into categories to expose where improvement opportunities exist [4]. Observed wastes will be segmented into categories that are aligned with improvement tools. Figure 7 illustrates the Waste Identification and Elimination for this project.

At the Improve phase there were defined the actions to be taken in order to resolve the problem described in this investigation project. From the results obtained in the analysis phase it was determined that the voice of the customer process is not properly documented. Based on the analysis, there were identify the root causes of the problem. These root causes are:

(1) No controlled survey template,
(2) No process to send the survey and follow up answers from customers,
(3) No process to manage the results, and
(4) No process to analyze and report the results.

In order to resolve these issues identified during the DMAIC process there were some actions implemented. The actions to be implemented were all addressed thru the creation of a new procedure to document the Voice of the Customer process to be followed in the engineering department. The document will be an internal procedure for the department and it will have a training aligned to it. The procedure and training will applied to all the Managers, Supervisors and Project Leads. The owner of this procedure will be the Quality Engineer of the area.

At the Control phase the VOC procedure and training were deployed. The first metric that was tracked was that all the employees impacted with the new procedure will take the training. As part of the deployment a survey was created for each area. The managers and supervisors will have access to send the surveys to their customers. But only the Quality Engineer will download the survey answers and manage it using the excel spreadsheet created.
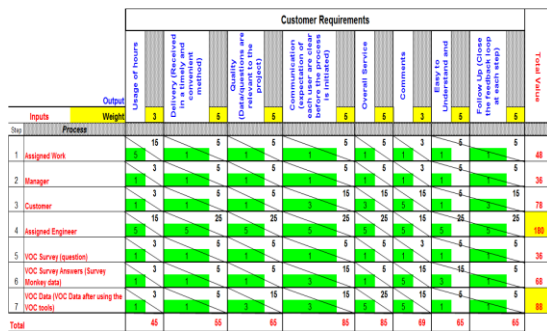
The results are being analyzed in a monthly basis and report on the staff meetings. The Figure 8 shows how the answer ratio from the customers increase from 76% to 91%, and the follow up process to answer the survey decrease significantly. Other company departments are implementing the use of the VOC procedure in their area.
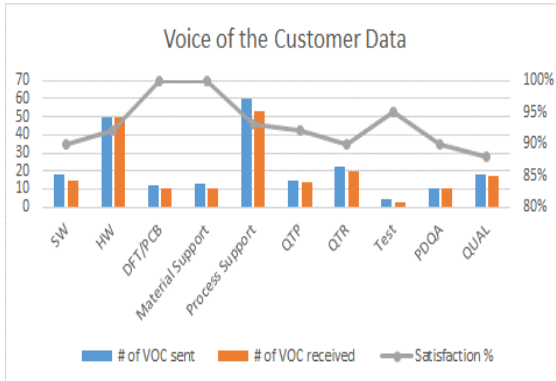

Figure 8
VOC Metrics

CONCLUSION

Quality is important to the success of any process driven activity. Whether the task consist of making a simple cup of coffee to start the day or executing complex software designs. In order to achieve a good output of your process you need to establish SMART goals. This goals needs to be defined based on your customers and their needs. The tool use to gather the customer needs information is the Voice of the Customer process. The first step to begin a project or task is your customer. A robust voice of the customer process will lead the organization to establish the correct goals for the output of the product or process. It is also important to maintain a good communication strategy with the customers to track their satisfaction after the product or process is delivered. This is the most important part of the voice of the customer process. The surveys needs to be specific and relevant to the process. It is important that the data to be collected is measurable. Once the survey answer are received, it is important to have an analysis process that helps to identify the needs of the customers. The actions to be taken needs to be attainable and to be completed on a specific timeframe. Having a robust Voice of the Customer process will demonstrate the customers that they were listen and that their feedback is important for the company.

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