Database for Collection of Defects in Main Line Production in Electrical Manufacturing

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Abstract – *This project was developed in order to create a database to analyze of the major defects identified when the quality representative realizes inspections in the main line of an Electrical Manufacturing firm. A database is a collection of information organized to provide an efficient retrieval. This information could be in different formats like electronic, graphic, audio, and statistical. Also, its content can easily be acceded, managed, and updated. The purpose of a database is to analyze operating process, define problems and constraints, and define scope and boundaries. An effective database is one which has been engineered to meet the actual present and future needs of the company. The interface must be usable and understandable by all persons which will be directly accessing the database and must provide reports and exportable data which meets the users. In order to improve manual data collection process the DMAIC Methodology was used. DMAIC is an acronym for a series of steps used to measure defects in business processes and improve profitability. The term DMAIC stands for the five main steps in the process; Define, Measure, Analyze, Improve and Control. This research allows a team to develop the project from its inception. DMAIC methodology brings a structure and the tool to identify problems in a production assembly line.*

Key Terms - Database, Defects, DMAIC, Inspection.

INTRODUCTION

In this era of globalization, as competition intensifies, providing quality products and services has become a competitive advantage and a need to ensure survival. Quality is one of the most significant performance measures that can considerably influence the manufacturing competitiveness. High quality products are influenced by two important factors. One of them is the quality of the product design. The other is the degree of conformance of the manufactured products to the design specifications.

Since quality assurance precedes data collection, its main focus is **prevention** (forestalling problems with data collection). Prevention is the most cost-effective activity to ensure the integrity of data collection. This proactive measure is best demonstrated by the **standardization of protocol** developed in a comprehensive and detailed manual procedures for data collection. Poorly written manuals increase the risk of failing to identify problems and errors early in the research endeavor. Consequences from improperly collected data include [1]:

- Inability to answer research questions accurately.
- Inability to repeat and validate the study.
- Distorted findings resulting in wasted resources.
- Misleading other researchers to pursue fruitless avenues of investigation.
- Compromising decisions for public policy.
- Causing harm to human participants.

PROBLEM STATEMENT

The problem had identified that the manual report and the data entry is spend much time for the recollection and the data analysis is causes that the data is not accurate and cannot had a good interpretation it. Also, uncertainty about the timing, methods, and identify of person responsible for reviewing data, vague description of data collection instruments to be used in lieu of rigorous step-by-

step instructions on administering tests, failure to identify specific content and strategies for training or retraining staff members responsible for data collection.

RESEARCH DESCRIPTION

In manufacturing is important to have the better's tools to maintain the quality products while it's manufacturing at the beginning to final stage, with high quality production meet the customers' expectations because this is one of the most important criteria's for have a better competitive volume in sales in the market and gain contracts for long time. This provide a strong competitive advantage. Quality helps you to win business from competitors who are not able to match your standards and gives you the opportunities in market sectors where quality is critical. Also, quality makes an important contribution to the company reputation, positive reviews and comments can reinforce the marketing efforts is for that quality problems can have a damaging effect on the reputation of the company. A major quality issue, such as a product recall, may also attract media attention, causing further damage.

This research is about identifying a database tool for data collecting in order to have the report result to attack production problems and classified in categories for better analysis approach. Production of high quality statistics depends on the assessment of data quality. Without a systematic assessment of data quality, the statistical office will risk to lose control of the various statistical processes such as data collection, editing or weighting.

RESEARCH OBJECTIVES

The most critical step in developing a database for any application is to develop a clear and accurate understanding of the needs the database is being created to fulfill. A company will have many internal customers of a project of this nature. Without an accurate understanding of what will make the internal customer happy, the completed database has virtually no chance of making those internal customers happy.

RESEARCH CONTRIBUTIONS

This project was focused on utilizing a tool that helps with data collecting and can classification by defects. Obtaining information that contribute for better approach and can help to reduce defects in main production line. It's important because doing without data quality assessment would result in assuming that the processes cannot be further improved and that problems will always be detected without systematic analysis and this is negative for the company. Data quality assessment is a precondition for informing the users about the possible uses of the data, or which results could be published with or without a warning. Indeed, without good approaches for data quality assessment statistical institutes are working in the blind and can make no justified claim of being professional and of delivering quality in the first place.

LITERATURE REVIEW

Electrical industry are facing an aggressively competitive environment in order to attack new customers but at the same time, to retain the existing customers. The poor quality of the software information can negatively impacts the business at different levels:

- Revenue decreases and increases spending.
- Increases risk.
- Causes a reduction in confidence, both inside and outside the organization.

A proactive approach for both information and the data quality enables early identification of errors or defects that can be corrected in time, eliminating root biggest problems. The positive effects begin to be felt and their benefits increase in a cycle of continuous improvement led by the control of software quality metrics. This facilitates monitoring evaluate:

- The product quality.
- Performance development team.
- The rationale for using new tools or solutions.

Product quality of statistics is assessed quality components. Quality assessment helps to solve the problem of trade-offs between different components of quality. It is becoming more and more important to analyses interactions between the different quality components example: accuracy – timeliness; relevance – comparability over time and therefore it is necessary to have the right quality assessment methods in place. Then it is possible to analyses the influence of the different dimensions on the achieved total data quality. These components are central for any assessment of product data quality in statistics:

Relevance - is the degree to which statistics meet current and potential user needs. It refers to whether all statistics that are needed are produced and the extent to which concepts reflect user needs.

Accuracy - in the general statistical sense denotes the closeness of computations or estimates to the (unknown) exact or true values. Statistics are never identical with the true values because of variability and bias. A basic distinction is between sampling and non-sampling errors, which are both subject to variability.

Timeliness - reflects the length of time between its availability and the event or phenomenon it describes.

Coherence - When originating from different sources, and in particular from statistical surveys of different nature and/or frequencies, statistics may not be completely coherent in the sense that they may be based on different approaches, classifications and methodological standards.

Compatibility - aims at measuring the impact of differences in applied statistical concepts and measurement tools/procedures.

Accessibility - refers to the physical conditions under which users can obtain data: where to go, how to order, delivery time, clear pricing policy, convenient marketing conditions.

General Concepts of DMAIC Methodology

DMAIC is an abbreviation of five improvements steps: Define Measure, Analyze, Improve and Control. DMAIC refers to a data-driven improvement cycle used for improving, optimizing and stabilizing business processes and designs. The DMAIC cycle is the core tool that is used to manage the Six Sigma projects. All of the DMAIC process steps are required and always proceed in the given order. DMAIC can be used to any improvement project or application. DMAIC is an extremely structured approach, this implies that it analyzes a process carefully before trying to implement any improvements. Among the common reasons some businesses fail to execute improvements is the failure to perform the analysis process before they implement the improvement. This will result to failure to deliver the improvements properly, and can even worsen the existing system. (See Figure 1).

Figure 1
DMAIC Process Steps

Define Phase is the first phase of the Lean Six Sigma improvement process. In the DMAIC process focuses on selecting high-impact projects and understanding which underlying metric(s) will reflect project success [2]. In this phase, the leaders of the project create a Project Charter, create a high-level view of the process, and begin to understand the needs of the customers of the process. This is a critical phase of Lean Six Sigma in which the teams defines the outline of their

efforts for themselves and the leadership of the organization.

Measure Phase is critical throughout the life of the project and as the team focuses on data collection initially they have two focuses: determining the start point or baseline of the process and looking for clues to understand the root cause of the process. Since data collection takes time and effort it is good to consider both at the start of the project. The measure phase involves more numerical studies and data analysis than the define phase [2]. This phase focuses on measurement system validation and gathering root causes.

Analyze Phase is often intertwined with the Measure Phase. The data collection team may consist of different people who will collect different sets of data or additional data. As the team reviews the data collected during the Measure Phase, they may decide to adjust the data collection plan to include additional information. This continues as the team analyzes both the data and the process to narrow down and verify the root causes of waste and defects. In this phase statistical reviews are done to the groups of deviation or variation in order for project owners to identify which are the considerable contributors to the output. The focal point of this phase is to identify and analyze the root cause/s of imperfection [3]. This phase consists of several steps which also require several tools. The phase usually starts by organizing the experimentation schedule to identify which of the potential KPIV's (key performance indicator variables) is the real origin of defects. Sufficient amount of data is also required. This set of data will be analyzed using an appropriate statistical procedure.

Improve Phase when the project teams are satisfied with their data and determined that additional analysis will not add to their understanding of the problem, it is time to move on to solution development. The team is most likely collecting improvement ideas throughout the project, but a structured improvement effort can lead to innovative and elegant solutions.

Control Phase is a mini version of process management. The team has been building a form of infrastructure throughout the life of the project, and during the Control Phase they begin to document exactly how they want to pass that structure on to the employees who work within the process.
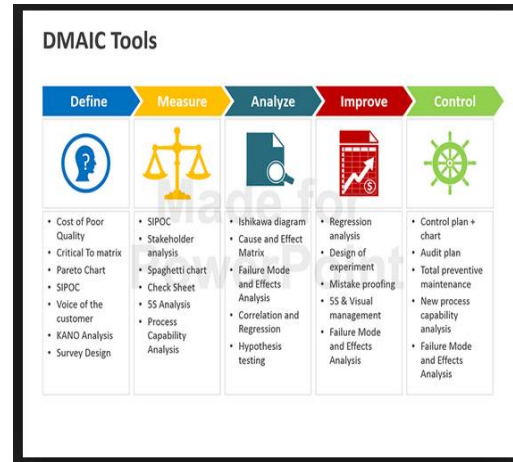

Figure 2
DMAIC Tools

RESULTS AND DISCUSSION

The results obtained through the five phases of the DMAIC methodology follows.

Define: identified issues that involve the collection and analysis of the problem stated, specify the customer, identify the goals, and outline the target process. A tool that can used for the Define Phase is the Thought Process Map. This is a visual representation of a Black Belt, team leaders, or an entire team thoughts, ideas and questions relative to accomplishing the project goal. Presents a structure of information and helps a team progress thought the DMAIC process. A Process Map helps to provide a visual map that tracks the development of ideas and issues. (See Figure 3)

Measure: Create and develop a data collection plan for the process, you shall collect data from many sources to determine types of defects and metrics. Voice of the Customer An important element of Six Sigma is understanding your customer. By doing this, it allows you to find all of the necessary information that is relevant between your product/process and the customer. The

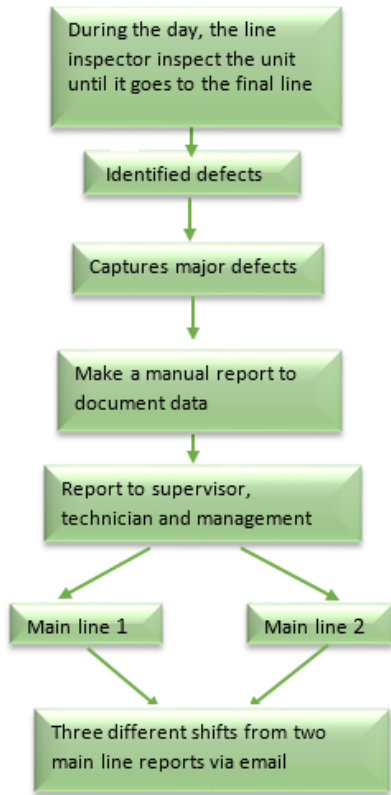customer requirements for satisfaction with your product or service are presented in Table 1.

Figure 3
Process Map

Table 1
VOC

Voice of the Customer	Key Customer Issues	Critical Customer Requirements
What does the inspectors wants?	Ensure data collection to be analyze	Develop a tool
Quality Team wants to be capable for generate an excellent quality reports	Reduce time and efforts of making a quality reports	Training

Analyze: The data collected is analyzed to determine root causes of defects and opportunities for improvement. In this Phase, gaps are identified between current performance and goal performance. It also helps identify the sources of variation and prioritize opportunities to improve. A Pareto chart was created with the intention of obtaining a visual indicator of the issues that are affecting the collection data. (See Figure 3). This chart will help to identify those requirements that are causing problem and will help identify the needs to be worked. This chart represents the quantity defects generated by the inspectors on both lines when collect data. The main line 2 has 18 incorrect data collection versus main line 1 that has 14 defects.
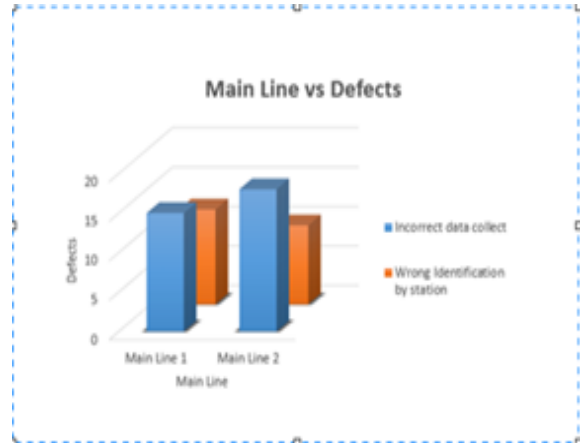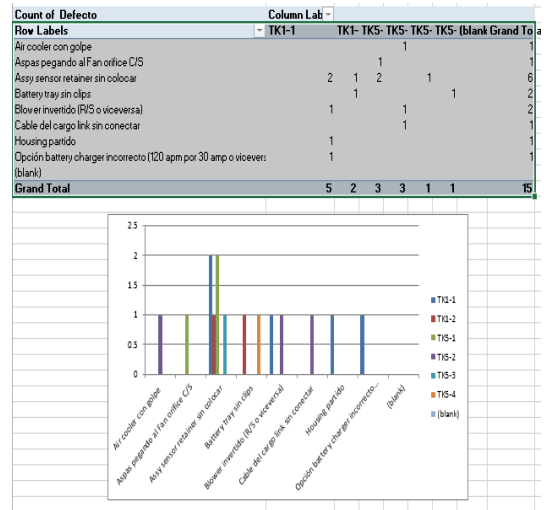

Figure 4
Main Line vs Defects

Figure 5
Pivot Graph and Table

Improve: In this phase was to identify a solution to the problem that the project aims to address. A better solution is to create a database for collecting the data during the physical, visual, measurements inspections. With this information it can develop a systematic report and ensure data collection (and measurement) repeatability, reproducibility, accuracy and stability. Also, the

quality representative can develop the skills for make a better report and make changes when it's necessary. This tool can analyzed the data via Pareto charts, Pivot Tables (See figure 5).

Control: Referring back to the question of whether or not the data collection and measurement systems are reproducible, repeatable, accurate, and stable, the project lead should check to see that the results (data and measurements) are reasonable and that they meet the criteria. If the results are not meeting the criteria, then the project lead should determine where any breakdowns exist and what to do with any data and/or measurements that are suspect. Reviewing the operational definitions and methodology with the participants should help to clear up any misunderstandings or misinterpretations that may have caused the breakdowns.
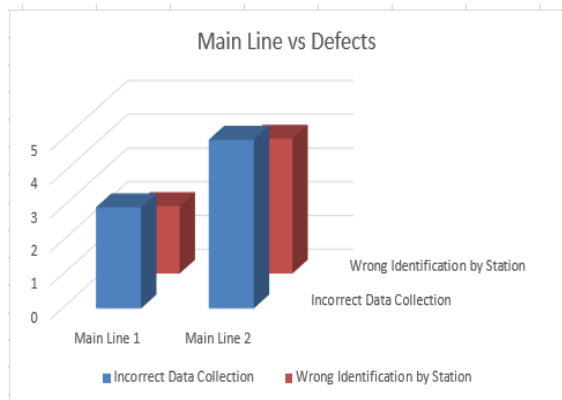

Figure 6
Pareto Graph: Results after Implementation Database Tool

CONCLUSION

The project realization was performed during the last month of September and the defects were decrease in both lines. The main line 1 was reduced by 5 defects in incorrect data collection and the main line 2 reduce by 3. Also, the main line 1 reduce the wrong identification by station by 2 defects and the main line 2 reduced by 4. The quality team will use the data to arrive at a process accuracy measure, which may be included in the final rolled throughput yield calculation. The quality team may also use the data to populate a concentration diagram. Also can perform a

quantitative graphs, differentials graphs, to contribute to better analysis of defects identified during inspections. When had an organized information this could help to identify those stations that have issues and decrease the DPPM and increase the FPY. With this tools the quality engineering can classified the defects, stations, main lines, turns, and quantity by days, categories.

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