

# Services Repair Optimization in a Subcontractor Company Applying Lean- 6 Sigma

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**Abstract** — Increasing competition between industries forced their services to expand to other countries out of their territorial limits. Job cost, planning and quality are the keys to success. This project measured, identified and analyzed the offered services of a subcontractor company to understand and minimize the errors in their process. Also, it includes the control of the margin of profits in each of the different services that it realizes. Also, new procedures will be recommended. The critical incident technique is particularly well-suited to measure perceived service quality because of characteristics common to all services. Services are basically intangible. Thus, the use of Lean Manufacturing in the service departments to obtain: potential for tremendous improvement, improved quality, shorter lead time, Lower cost, higher flexibility and higher degree of job satisfaction. Lean Six Sigma methodologies were applied in the service repair process to identify the wastes, and increased the yield of the process.

**Key Terms** — Lean Six Sigma Methodology Continues Improvement Process, Service Quality, and Service Industry.

## PROBLEM DEFINITION

Due to its importance, the Technical Support Process area relationship with other departments should be identified. The Technical Support area generates the client's work order, executes then, and verified that the work orders are right completed. The map process creation helps understand the relationship between the selling process, the Technical Support area, and the clients (see Figure 1). Actually, the Technical Support area doesn't have standardized procedures,

increasing the labor costs; clients receive incomplete jobs, and longer completion time of the work orders. The project general approach is to focus on the roots of the existing problems. It is looking to extend forward the vision of the service to identify future opportunities for business. In this context, it can be observed that the Technical Process Support area is the major contributor to the earnings from the selling process view.

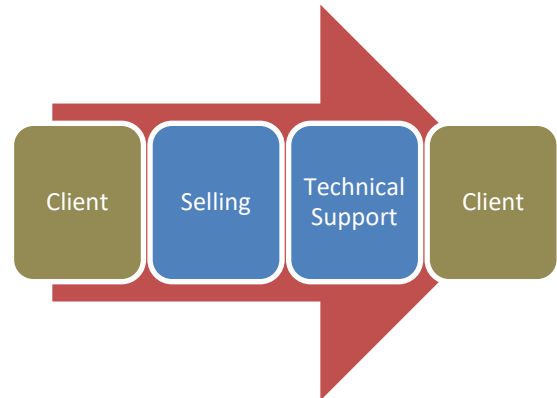


Figure 1  
Macro Process Service Industry

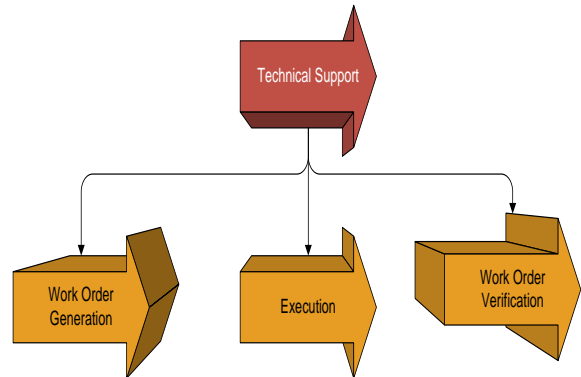


Figure 2  
Technical Support Process

It is possible to appreciate in Figure 2, the process of Technical Support in the following activities:

- **Work Order Generation**  
The objective of this activity is to open a work order or the request of the client in the system for service. The coordinator initiates taking the client's request (by phone/ email) and generates a work Order.
- **Execution**  
The technician establishes contact with the client and work to solve the problem.
- **Work Order Verification**  
The activity consists of the work order verification by the supervisor. The process is initiated by the technician communicating the completion of the job to his supervisor. The activity ends with the technician sending the data for verification.

The company does not have a flowchart to describe each department's function, step by step, to standardize the process to be followed. In a standardize process the employees will have a more extensive knowledge of the work that they are carrying out. The first step is the construction of a flowchart for each department to better understand the operations and to facilitate the process of performance measurements of the activities that are being carried out. These measures imply the elimination of duplicated activities on each department, minimizing costs, and increasing the productivity.

The main problem of the company is that monthly, they are not complying with a quota that is not being reached. Each quarter there is a comparison between the total of work orders on these months versus total work orders closed. It was found that 73% of works were not completed. The next step was a comparison between the quantity of bills charged and the total number of works closed. The result is that 42% in profits are lost with the not closed work orders. The causes are the following:

Work Order Problems - Don't have analysis on time. There are few employees qualified to analyze the results of the information collected. They do not have enough time to carry out the accumulated work, up to the end of the month. There is no

analysis synchronization between the software and the analysis team. Due to this situation some data is lost, and that involves double work because the team has to collect the data again.

- **Administration Problems** - Don't have control to prevent changes in material, no idea of process time, and parts that increases the estimated costs. They register the operations' errors in a Time Sheet Form Entrance Errors. There are no operator or supervisor signatures in some of them. The operation times entered in the form are not always accurate. Lot of paperwork.
- **Coordination Problems** -The person in charge or supervisor does not have control over the employees. There is poor scheduling. They do not have a schedule program that coordinates among services, employees and hours to be worked. Sometimes, the same person is sent to work to different services at the same hours. Also, something unexpected may happen. Insufficient personnel and lack of communication.
- **Client Problems** - Late service attention due to wrong priorities when choosing services. Wrong or unnecessary requirements of information for the job completion.
- **Procedures Problems** - Informal Service. Do not have an established operational procedure to service the clients.

## **METHODOLOGY**

Through information offered by the clients, there is a concern of how well the data being collected via telephone, emails, and letters are worked correctly. This project applied the methodology of Lean - Six Sigma in the Technical Support area beginning on the work order generation up to the closed of the work order. It's adapted to the technical support process to be able to find any deficiencies. The use of this methodology, that will be utilized to improve the quality of the service offered in all the departments, was communicated to each company department

head. The strategy is to solve all the problems that were found. The target with Lean Six Sigma is to find the critical inputs to understand the relation with the output to be able to control and to support them to obtain a major yield of the process. The use of Lean Six Sigma methods and tools to improve performance to continuously lower costs, grow revenue, improve customer satisfaction, increase capacity, and capability, reduce complexity and minimize deficiency and errors.

### DEFINE

An interview with a worker, about the problems in the business, showed a database where the company collects, either via e-mail, letters or telephone, the concerns of its customers about their services. Lean Six-Sigma is the right tool to increase productivity and reduce the manpower. It could use the information from the database of the last three years where the company gathered information about the customers concerns and complaints. Meanwhile, there could be more interviews with employees of the company to obtain an opinion about the work they are carrying out.

The methodology of DMAIC in Six Sigma consists of five steps (see Figure 3):

- Define the problem, the voice of the customer, and the project's goals.
- Measure key aspects of the current process and collect relevant data.
- Analyze the data to investigate and verify cause-and-effect relationships.
- Improve or optimize the current process based upon data analysis.
- Control the future state process to ensure that any deviations from target are corrected before they result in defects.

### ANALYZE

It was collected available data of the reliability of the service process in the Technical Support Area of all the work orders generated from 2008. The total sample was analyzed.

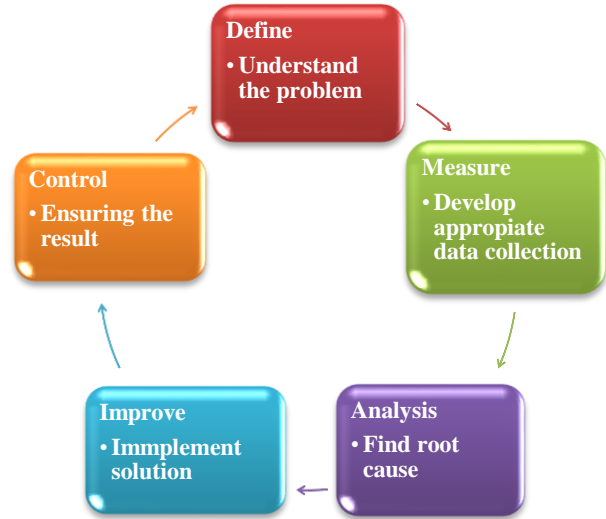


Figure 3  
DMAIC Diagram

In the project was applied the Cause and Effect Diagram to identify the wastes, and the process deficiencies. It was found the problem's causes for Technical Support Area. Figure 4 identifies the causes of the problems. One problem found is the delay on equipment repair with multiple causes. The different causes found are: personal, materials, system information equipment, and procedure.

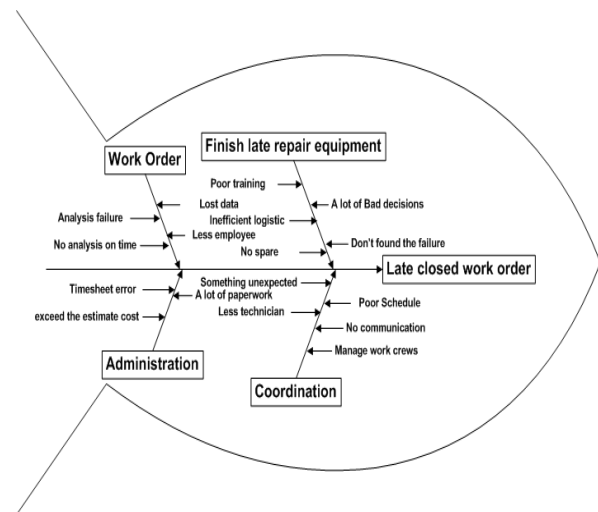


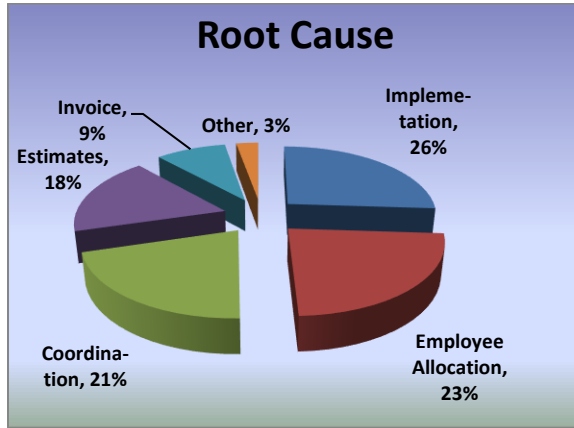
Figure 4  
Cause and Effect Diagram

In the Figure 4 is identified the problems encountered in the Technical Support Area, in which are shown and explained in the following list:

- Work Order Problems
  - Excess inventory and orders waiting on the desk to be process. The employee has a lot of work to do to obtain data to submit to the supervisor. The supervisor has to make an analysis of the data obtained but do not have the time, because they have other priorities, that is why the work accumulates. The supervisor is not able to delegate this task because of the shortage of staff with such skills, due to the small number of employees and lack of knowledge in the area. This results in a lack of synchronization between the equipment and the software. These are the faults that need to be improved for best performance.
- Administration Problems
  - They don't have the knowledge needed to predict failure when something will happen in the service. While examining the equipment failure, the employee, may find another type of hidden failure than induced the initial failure. May happen, that the technician does not have the tools needed to repair the new found failure. There is no adequate communication between departments such as billing coordination of services. The service vision of the company is not completely accordingly with what they are conducting. Sometimes the costs estimates don't match with the kind of service realized.
  - Each service has a fixed cost, but depending of the type of failure, the estimation of the cost varies according to the service being performed. The employee who made the estimates does not have the knowledge of the technical, the equipments, of the parts and labor plus the time required to service. With more time, he also will have more opportunities to perform other services.
- Also too much time is consumed in document reworking. The work done by the technician is analyzed by the supervisor thus wasted time in doing the job twice.
- Coordination Problems
  - The schedule coordinator has no planning skill.
  - Have the same employee in two different services at the same time. The logistics in the coordination area is inefficient because the employee cannot handle booth services at the same time.
- Personnel Problems
  - Each service requires a number of employees to do the job. The technical Support area does not have the necessary number of employees to meet the demand for services.
  - The lack of support of managers is evident to facilitate the work of the employees.
- Client Problems
  - Inadequate customer service. Customers complain about the service provided by the technicians, supervisors and coordinators. Clients have to stop their operations continuously, while waiting the rework of parts that were guaranteed of no failure.
  - The processes are inefficient, and the different type of faults not being classified, so difficult to avoid.
- Procedures Problems
  - The company does not have a culture of quality. The company should provide training on quality because that will help to increase the demand for services.

Figure 5 shows the root cause of problems in the Technical Support area. In the graph we observe that the failure rate is higher in Implementation with a 26%, follows the Employee Allocation with 23%, 21% Coordination, Estimates with 18% and finally the Invoice by 9%. These are the faults that should be improved for better operation of the process in which all departments are included. With

this data the company can improve to be competitive in the world market.



**Figure 5**  
Root Cause

Other problems found, and not necessary in relation with the profit, are the wastes typical to an office scenario. Office wastes refer to the time that is consumed from the estimates up to the closing (job id). Observations during a three months period found some of the following wastes:

- Time consumed in document reworking.
- Unnecessary data.
- Excess inventory and work waiting on desk.
- Unnecessary movement such as looking for files.
- Excessive rework in checking for someone's work.
- Excessive waiting time for approvals or for phone calls and others.
- Excessive procedures within the company that does not add value to the services offered.

According with this project, the company has an ineffective service, ignorance of the employee upon executing the service, client and employee dissatisfied. The application of the methodology of Lean-Six Sigma is the best alternative for the company to improve their procedures.

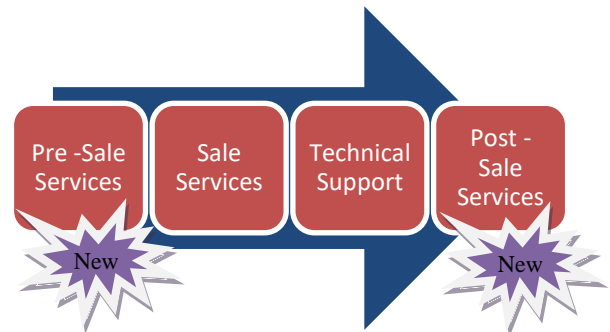
The objectives aim to improve the company's services to customers and reduce service cost.

- Reduce the open tickets services.
- Improve the service and the company image.

- Avoid delay in the service execution.
- Quantify service support.
- Reduce client complaint.
- Adequate service priority.

## IMPROVE

One of the objectives is the improvement of the service process. In the analysis of the current process was observed that many of the problems presented in the support process were generated by an inadequate result on the preceding phase (sale), or the absence of processes that are fundamental to the success of any company (Pre sale and post sale service). However, it is clear that the goal is not a detailed analysis of the process, but rather the rearrangement of the overall process in order to generate a positive impact in the quality of service in the technical support area. The Figure 6 shows the new process generated with the analysis.



**Figure 6**  
New Process

The new process recommended, includes pre-sale and post-sale sub-processes. The emphasis is in the promotion of client's loyalty through all services offered and after.

- Pre – Sale Service - The pre-sale objectives are to realize a marketing strategy, identify new clients, to obtain knowledge about the clients' necessity, to create a security support service area, and to generate a competitive advantage.
- Technical Support  
The Technical Support process will have a new developed programming and control system to

register the reported problems. The Program will document the executed solutions, and will increase the knowledge allowing a reference for subsequent similar problems.

- Post – Sale Services

The new process proposes the following activity: inquiry satisfaction analysis and statistic data analysis in the services generated. The Program will report monthly information to the clients of new additional product and services. Also suggest improvements in the services offered.

The company's objective proposes the improvement of the service process offered to the client and cost reduction on the acquired service. The improvements suggested according to the problems found are the following:

- Work Order Problems

- More training to the employees for doing the analysis. Assign personnel only for the analysis task.
- Improve the software to develop the synchronization between the equipment and the software.

- Administration Problems

- Every employee needs to have the knowledge about each service that the company offers.
- Minimize the paperwork.

- Coordination Problems

- The company should develop a program just for the coordination of services and employees.
- Every supervisor has to be prepared for any unexpected problem.
- The new program will automatically determine the support technician that is assign to generate the service. Also it will generate the calendar date, and estimated time to visit the customers. There is an option of flexibility so the technician may make adjustments to this appointment. The program will also send a remainder to the technician by phone.

- Personnel Problems

- The company should analyze the optimum number of employees needed in the area, according to the services offered.
- Create an information system to integrate sales and support area.

- Client Problems

- Designing a program that prioritizes the services according to the importance of the work, cost estimation and the employee responsible for the services.
- The company should classify the level of severity of the problem and the priority between the different services. Training to the call center employees will be helpful to offer an adequate customer attention.
- The procedure should be defined for a better client service. To provide an adequate atmosphere for the fulfillment of quality attention and a annually quality training. The duty of the administration is to bring together all its employees to share a vision and goals among all. To promote employees participation and opinions, so the employees feel motivated and part of the company. The management should give information to the employees about the market changes and other aspects of the company continuously.

## CONCLUSION

There are different methodologies and tools to allow improving the quality of the strategic processes of a business. It is very important before selecting any of them, to know the reality, vision, mission, priorities and long-term objectives of the business.

The importance is the perception of the client of the service offered. When a company considers client satisfaction, it is in a better position to provide the service that meets those expectations. This in turn results in a higher level of quality service and provides opportunities to be more competitive.

The application of continuous improvement generates values, reduce times, costs and improve quality.

In conclusion, the service improvement began with the adequate synchronization in the process between the technology, employees and departments. The organization need to be synchronizing with the business model evolution and concentrate in common objectives of the whole organization. The employees are the key and the most important resource in the company. They are the ones who are performing daily tasks and they represent the company to the clients. They are a reflection of the organization.

### **RECOMMENDATION**

To implement an oriented process approach, it should be a team expert Multidisciplinary in the processes of the company. Also have with the management commitment, since the projects processes require a large investment in time and / or costs. Another prerequisite for initiate a process improvement project is that it should ensure that both the team responsible for the improvement and management, understand about objectives of the approach to processes, and its benefits:

- Process
  - The company needs to have detailed and precise objectives which are aimed in one direction.
  - To consider all levels of the organization, since management need to have the knowledge of all the functions inside the company.
  - All supervisors and managers need to be focus on process, customers, technology and the employees.
  - Managers and employees should take into account the impact of their labor inside and outside of all departments in the organization. Such as human resources, finance, budget, service area, and others.
  - Evolution orientated needs to be in continuous improvement.

- People
  - All personnel should receive training in motivation, personal growth, health and safety, and others.
  - To establish a definite organizational structure and its implementation, this will sustain the business model in the different evolution phases.
  - Re-definition in the service area and to give participation to the employees to contribute in the elaboration of organizational goals.
- Department
  - Reduce time flow information.
  - Reduction of the lead time by a faster response to the clients' orders.
  - Increase cooperation and communication between departments.
  - Coordination
  - Services report on time.
  - Assign time and resources accordingly to the clients' orders.
  - Specify the numbers of technicians and mechanics necessary to each department.
  - The technician should be assigned in teams of two. One technician and one assistant.
  - Analysis services can only be performed by the technician.
  - Follow up the work order's recommendations from the analysis.

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