MANAGEMENT IMPROVEMENT USING SIX SIGMA METHODOLOGY

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Abstract-Project Management (PM) is the application of knowledge, tools and techniques to effectively manage all aspects of a project to achieve high quality, deliver project on-time and within budget which leads to customer satisfaction.
Many companies and service organizations have adopted and implemented Six Sigma methodologies to their projects and reduced cost, cycle time, deliver high quality projects, achieved customer satisfaction and increase the profits. Six Sigma is a quality and business improvement tool aims to eliminate defects and achieve customer satisfaction.
A detailed literature review is conducted about the implementation of Six Sigma to the achieve customer satisfaction. The literature survey did not reveal the implementation of Six Sigma methodology to minimize errors in billing systems to reduce cost, cycle time and achieve customer satisfaction.
In this paper, Six Sigma methodology is implemented to a customer service system project to reduce customer service time and improve service quality to achieve customer satisfaction. First, general overview about PM and Six Sigma is presented. Second, the Six Sigma DMAIC methodology is implemented to a real case study at the General Electricity Company of Libya (GECOL). Finally conclusion and recommendations also presented. Many software's and applications as Minitab Statistical, Visio and Excel Sheet are also used.
The methodology provides several benefits to the top project management and management team at the GECOL. It can be used to identify all suspected problems and issues preventing of achieving customer satisfaction. It also can be used to rank all identified problems and issues and select the issues with higher priority which leads to cost saving and higher productivity. Furthermore, the methodology can also be used to validate the higher rank problems using statistical and probability analysis. The methodology also presented several solutions to improve and control those problems.

I. INTRODUCTION

Project Management

Project management is the application of knowledge, skills, tools, and techniques to meet the project requirements. Project life cycle includes five phases as illustrated in Figure 1.

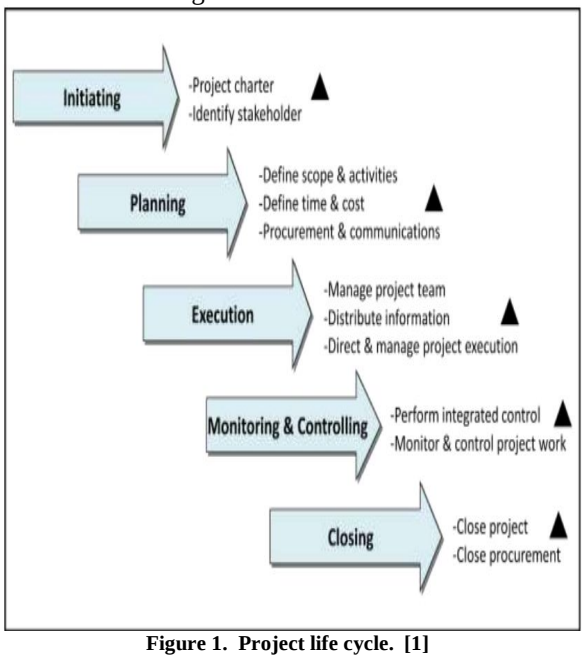


Figure 1. Project life cycle. [1]

The initiating phase consists of those processes performed to define a new project by obtaining authorization to start the project. The planning phase consists of the processes performed to establish that total scope of the effort, define and refine the objectives and develop the course of action required to obtain those objectives The execution phase consists of those processes performed to complete the work defined in the project management plan to satisfy the project specifications. The monitoring and controlling phase consists of the processes required to track, review, and regulate the progress and performance of the project. The closing phase consists of the processes performed to finalize all activities across all project management process groups to complete the project. [2]

Six Sigma methodology

Six Sigma methodology is an improvement quality tool aims to eliminate defects, reduce costs, and achieve customer satisfaction which leads to significant strengthening of both a financial and competitive market position. Six Sigma began as a process that would produce no more than 3.4 defects per million opportunities. However today, Six Sigma is basically the art of producing a product that satisfies the customer. Six Sigma was first invented by Motorola in the mid-1980s and popularized by General Electric (GE) in the 1990's [3 and 4]. Several manufacturing companies and service organizations including Honeywell, Bechtel, Citigroup, Motorola, Starwood Hotels, DuPont, Dow Chemical, American Standard, Kodak, Sony, IBM and Ford have implemented Six Sigma methodology to their business operations and achieved significant quality

improvement and cost saving. Table 1 summarizes the cost saving gained from Six Sigma program for some of these companies.

Table 1. Cost saving gained form six sigma program. [5, 6].

Company	Starting of Six Sigma program	Study period	Revenue ($B)	Saving ($B)
Motorola	1986	1986-2001	356.9	16.1
Allied Signal	1994	1998	15.1	0.52
GE	1995	1996-1999	382.1	4.43
Honeywell	1998	1998-2000	72.3	1.84
Ford	2000	2000-2002	43.9	1.6

Moreover, organizations who adopted the Six Sigma methodology gained the following benefits:

- Improved customer and supplier satisfaction.
- Changed culture from fighting mode to prevention mode and increased employee morale.
- Reduced cycle time.
- Eliminated any non-value added step in the process.
- Improved quality of products and services and reduced cost of poor quality (COPQ) by reducing number of defects.
- Improved teamwork across the entire organization.
- Increased awareness of various problem solving tools and techniques.
- Improved profit margin and reduced cost.

Motorola made famous through its high-profile implementation at general electric (GE), Six Sigma is a program that has been successfully applied to quality assurance and cost control Figure2 presents, GE's savings from implementing Six Sigma program

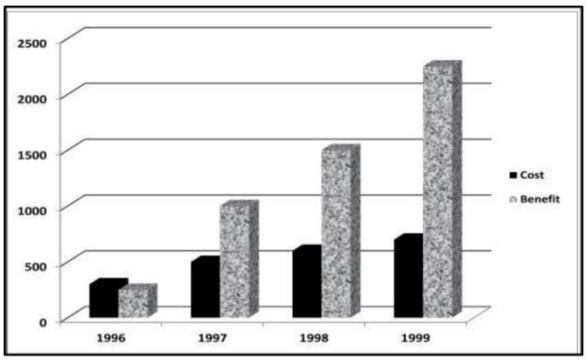


Figure 2. Costs and benefits in GE from six sigma in millions dollars. [7]

Six Sigma methodology have been extensively used to improve project management over the last decade. Currently, there is a growing interest in using Six Sigma to improve project efficiency. Many researchers have aggressively implemented Six Sigma to organizations and solved many problems and achieved improve customer satisfaction. [8, 9].

Paper Objectives

In this paper, Six Sigma methodology will be implemented to real IT customer service project at GECOL to provide strategic tools; gives organizations the means to practice established and time-tested practices of IT project management to help them to achieve successful outcomes.

The main goals in this paper can be summarized as follows:

- Obtaining knowledge of IT project management technically and scientific theories.
- Use Six Sigma methodology to improve the deliverables of IT projects.
- Use Six Sigma methodology in the role of change management in the IT projects especially
- in decision-making.
- Use of appropriate tools, modern methods of data collection and analysis.
- Implement Project Management and Six Sigma tools to a real IT customer service project.
- Enhance the customer satisfaction.
- Reduce mistakes in readings and in billing invoices.
- Improve the reading procedures.
- Increase revenue, reduce cost and improve efficiency.
- Improve the employee productivity.

II. SIX SIGMA DMAIC METHODOLOGY AND CASE STUDY

Six Sigma use DMAIC to solve the problems and to improve productions or services. DMAIC is an abbreviation for the five phase processes; define, measure, analyze, improve and control. DMAIC is the backbone of Six Sigma and it's considered so because it provides the fundamental structure and processes from which Six Sigma activity is to be radiated and developed. Figure 14 illustrats DMAIC phases and tools used in case study.

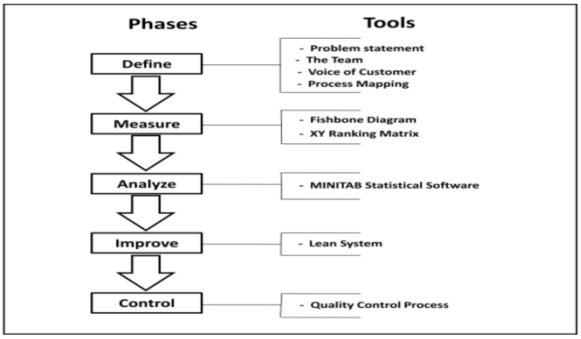


Figure 3. DMAIC phases and tools used in case study. [10]

The methodology start with the identifying all possible causes of a problem those possible causes will then be ranked and evaluated to determine the causes with higher priority. That can be graphically illustrated using the funnel process. The funnel process is a way to make filtering of the unsure causes in each phase before next phase. Figure 6 shows the funnel process.

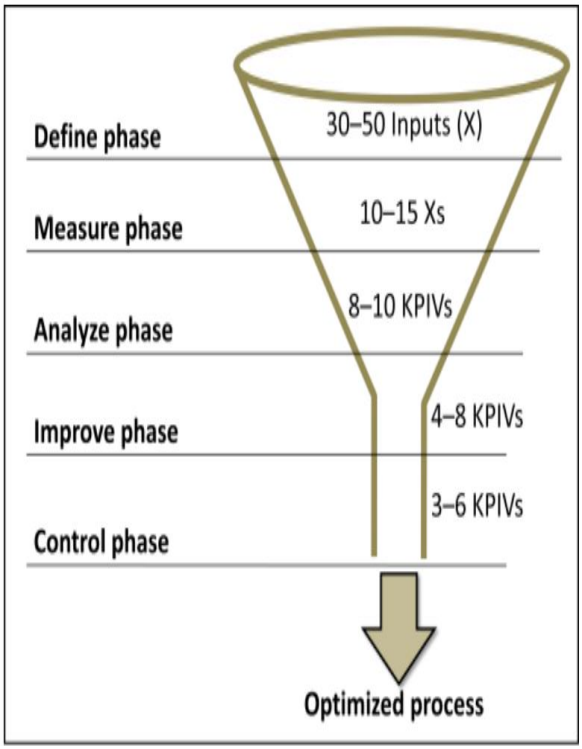


Figure 6. The funnel process. [11]

1- Define Phase

This phase typically involves understanding the problem statement, creating the team and project organization, define the goals and financial benefits which will be getting from project, defining Process mapping. A key part of the define phase is getting organizational support in the form of management commitment and budget for the initiative. The define phase sets the project in motion by ensuring buy-in and support from stakeholders.

1.1 Problem Statement

The number of errors of the billing system at GECOL has been dramatically increased and many customers complaining have been reported. There are many customer complaints from errors in the consumption invoices due to lack of accuracy and validity of reading. This resulted in low income and waste of time for company's staff and customers.

1.2 The Team

In this paper a team of 7 people from different departments and areas at GECOL was created to participate in achieving the paper objectives.

1.3 Voice of Customer

The VOC can be identified in several ways such as direct discussion, interviews and survey. In this case study, a detailed questionnaire is used to capture VOC. Figure 4 presents VOC identified from the questionnaire result.

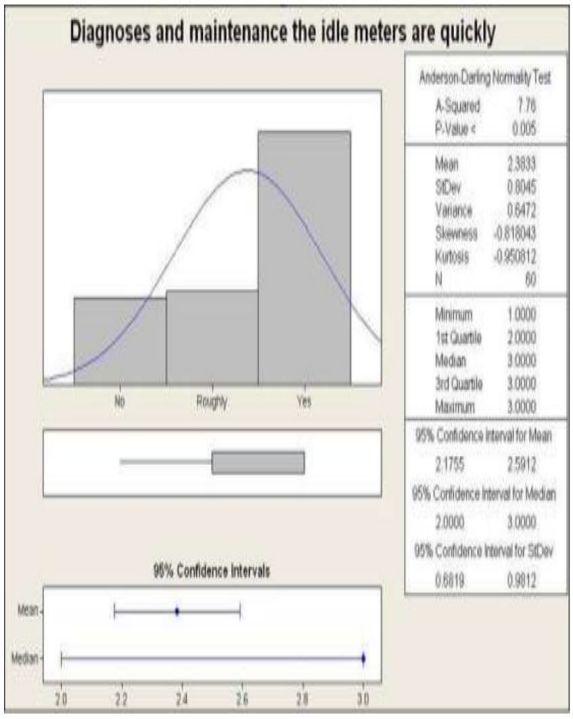


Figure 4: VOC identified from the questionnaire result

1.4 Process Mapping

Process mapping is an approach to analyze a particular process. It involves mapping each individual step, or operation in the problem. The team had conducted many meetings with specialists at GECOL and discussed all processes in the current system to understand the system and prepare the process map. A Microsoft Visio Standard 2002 was used to draw the process map. Figure 5 presents the process mapping for the current billing system.

2- Measure Phase

This phase defines the defect and other matrixes necessary to establish baseline. It focuses on understanding the performance of the process based on current circumstances. Data collection involves looking at process maps in detail to identify areas of potential improvement. Process map 6 analysis should point toward the type of data to be collected. Fishbone diagram and XY matrix tools are used in this phase.

2.1 Fishbone Diagram

Fishbone diagram is an analysis tool to study cause-and-effects of the problem. In this paper it's assist the team to categorizing the many potential causes of problem. A team had many meetings to discuss and

draw the fishbone with causes and effects. Figure 6 presents the general causes

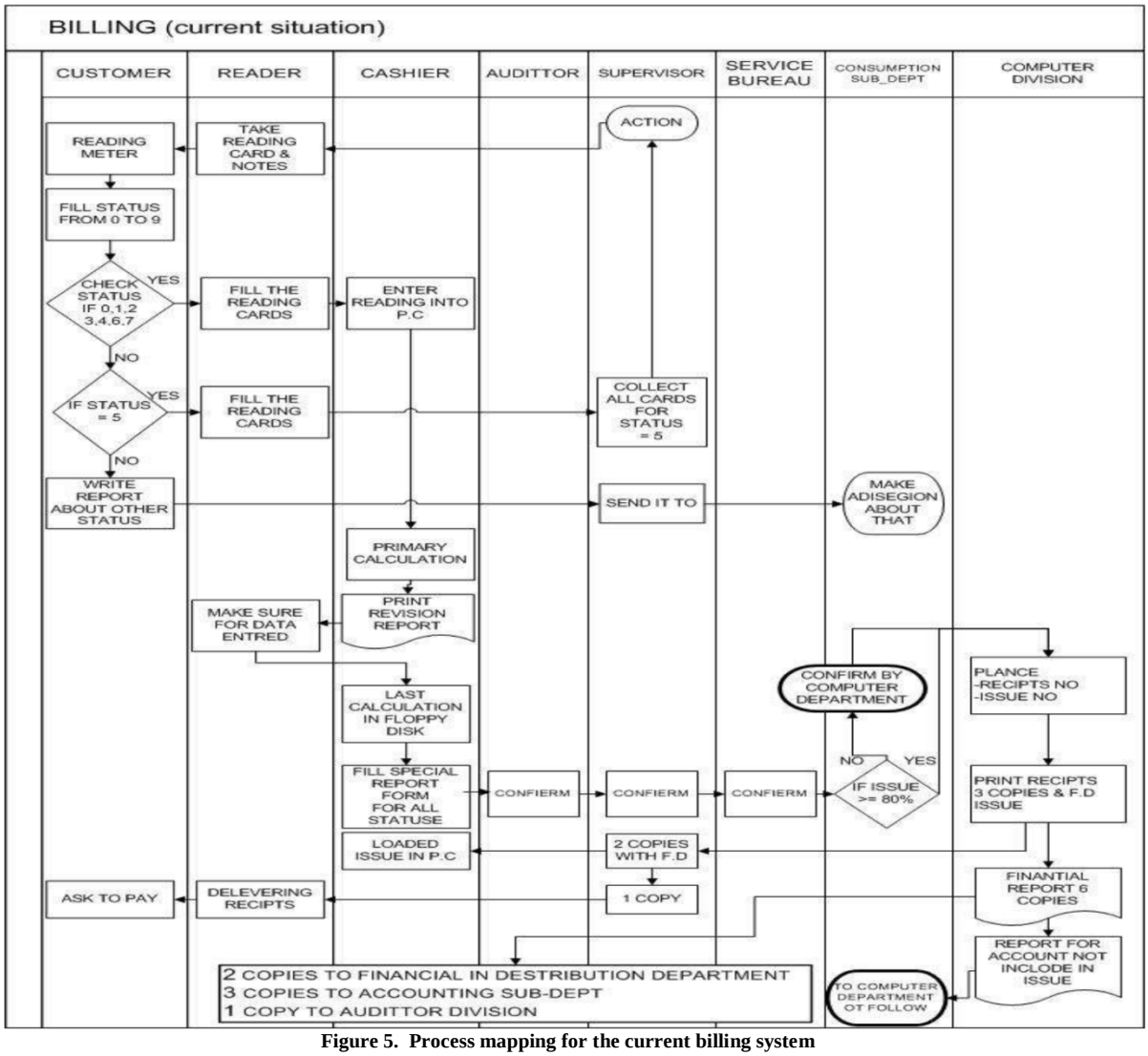


Figure 5. Process mapping for the current billing system

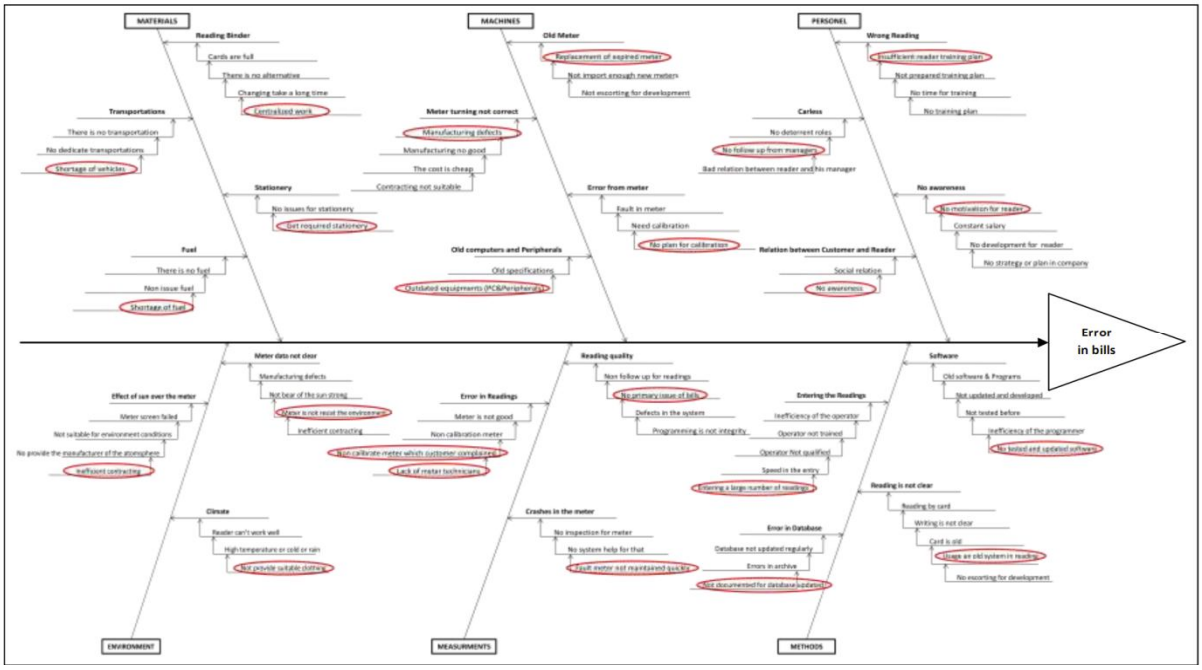


Figure 6. Fishbone diagram

2.2 XY Ranking Matrix

The causes obtained from fishbone diagram are then ranked using the XY ranking matrix Table 2 presents the ranking for all possible causes Microsoft Excel is used to rank all causes graphically as showed in Figure 7.

Table 2. XY ranking matrix for hypotheses.

		Reduce mistakes in readings and in billing invoices	Improve the reading procedures and system	Make good revenues	Reduce the cost	Customer satisfaction	Improve the employee situations	Encourage installments payment	
Outputs Y's / Inputs X's		Y1	Y2	Y3	Y4	Y5	Y6	Y7	Rank
		10	9	9	7	10	8	7	
X1	Insufficient reader training plan	9	6	8	7	9	2	1	378
X2	Reader follow up from managers	8	7	5	2	5	1	0	260
X3	Reader motivation	9	7	9	6	9	9	0	438
X4	Reader awareness	4	3	3	2	5	3	3	203
X5	Replacement of expired Meter	9	6	6	7	8	0	0	327
X6	Manufacturing defects	9	4	8	4	7	0	0	296
X7	Plan for inspection and calibration	6	6	5	1	4	0	0	206
X8	Outdated equipment (PC & Peripherals)	3	8	5	1	3	6	0	232
X9	Centralized work	0	2	2	5	6	9	0	203
X10	Shortage of vehicles	5	7	0	0	5	4	0	195
X11	Getting required stationery	8	3	5	3	3	9	1	282
X12	Shortage of fuel	5	7	0	0	5	4	0	195
X13	Entering large number of readings	8	9	7	2	4	5	0	318
X14	Tested and updated software	3	8	2	1	1	2	7	202
X15	Documented for data updated	5	7	2	4	4	0	0	199
X16	Usage an old style in reading	9	9	8	8	7	8	4	461
X17	No calibrate meter which complained	6	8	2	6	2	2	0	228
X18	Lack of meter technicians	3	3	2	2	7	5	0	199
X19	No primary issue of bills	8	9	7	7	8	6	2	415
X20	Maintain fault meter quickly	5	6	4	2	5	0	0	204
X21	Inefficient contracting for import meters	5	4	2	2	3	6	0	194
X22	Meters not resist the environment	7	7	4	2	3	0	0	213
X23	Not provide suitable reader clothing	7	6	5	0	4	9	0	281

Based on the result obtained from XY ranking matrix the team decided to drop out the last 8 input variables because of their low rank value.

2.3 Case study Data Collection

There are many methods to collect data and requirements such as direct discussion, interviews, survey, questionnaire, Observation, field report, complains of customers. In this case study questionnaire method was used here because it has many advantages as follows:

- Questionnaires can often be answered quickly.
- Respondents can answer questions at their convenience.
- Responses can be easily tabulated and analyzed.

3- Analysis Phase

The analysis phase confirms root causes of problems with data analysis tools and produce the practically important factors and solutions, and describe statistical findings via statistics tests. The Minitab statistical software is used to analyze all possible factors using the data from questionnaires. The confidence level is set to 5% for all questions and acceptance of each cause will be based on the P-value. The Minitab software was used.

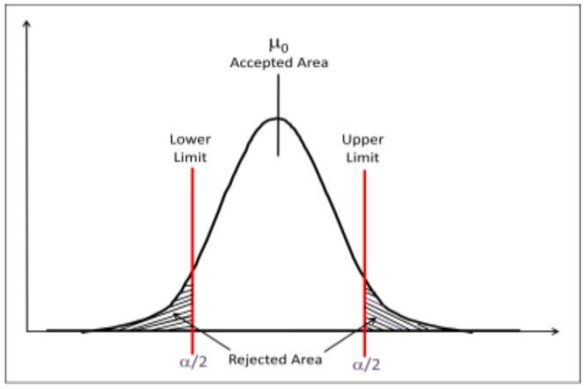


Figure 7. Accept and reject area graph.

4- Improve Phase

This phase involves to developing potential solutions based on the causes. The solutions should be make an impact on the causes and will subsequently have an impact on the paper goals. It includes putting the solutions into action. [12]

5- Control Phase

This phase includes:

- Implementing statistical process control to ensure that results are sustainable.
- Implementing transfer plans and hand-off procedures.
- Verifying results through a cost-benefit analysis and measure customer satisfaction.
- The creation of a control plan to ensure that processes are monitored and action plans are in
  place when there are significant deviations.

CONCLUSIONS

Six Sigma methodology is an improvement quality tool aims to eliminate errors or defects, reduce costs, and achieve customer satisfaction which leads to significant strengthening of both a financial and competitive market position. Many researchers have used six sigma methodology to achieve customer satisfactions. The literature survey did not reveal the implementation of Six Sigma methodology to minimize errors in billing systems.

In this paper, Six Sigma methodology is implemented to a customer service system project to reduce customer service cycle time and improve service quality to achieve customer satisfaction. First, general overview about project management and Six Sigma are presented. Second, literature review on the application of Six Sigma and project management are also presented. The Six Sigma DMAIC methodology (Define, Measure, Analyze, Improve and Control)

methodology are then widely discussed. The Six Sigma DMAIC methodology is implemented to real case study at the General Electricity Company of Libya (GECOL).

The major objectives of the paper are:

- Enhance the customer satisfaction.
- Reduce mistakes in readings and in billing invoices.
- Improve the reading procedures through determining regular itinerary and routes in order to
  be taken in fixed dates.
- Increase revenue, reduce cost and improve efficiency.
- Implement meters outside the properties to facilitate the reading procedures as well as making the regular maintenance and gather information.
- Improve the employee productivity.

RECOMMENDATIONS

After finalized this paper several recommendations have been suggested to improve customer services by decreasing of making mistakes in electricity bills, they are as follows:

1. Apply methodologies and modern technical theories help to improve projects performance.
2. Apply the Six Sigma methodology was led to success in several international projects.
3. GECOL can prevent mistakes in electricity invoices by the following processes:
   - Make sufficient training to readers.
   - Provide necessary stationery to the reader.
   - Make periodic Table of readings.
   - Make periodic Table for inspection and calibration.
   - Installation of appropriate electricity meters and maintenance.
   - Provide the readers with necessary clothing and equipment (HHU).
4. Make studies, seminars and conferences to get experience in project management and Six Sigma to solve the problems and develop the company's services.

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