

# ***Establishing a High Performance on Puerto Rican Government Agencies through the Application of Quality Methodologies***

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**Abstract** — *Government agencies in Puerto Rico must implement quality methodologies to maximize its performance on processes and services. It is well known that government agencies in Puerto Rico suffered a lack on quality methodologies during its processes and services. It is important to develop a design project that can contribute into services and processes improvement. Among the past years, is well known that government agencies in Puerto Rico are not guided by methodologies that contribute on its performance. Since that happened, processes are affected by a negative impact on quality that brings a lot of wastes and affects processes, services, and finances. Through the linking and implementation of Lean, Six Sigma, 5s, and ISO 9001 methodologies. A design project can be developed to improve services and processes, in order maximize Puerto Rican government agencies performance into a higher percentage before 2022. High quality standards are key components on every organization to become successful. It is important to train employees, to understand how important is to practice quality principles by the incorporation of quality methodologies, to make improvements that can maximize government agencies performance and customer satisfaction in Puerto Rico.*

**Key Terms** — *Government Agencies, Improvement Tools, Performance on Processes and Services, Quality Methodologies.*

## **INTRODUCTION**

It is well known that government agencies in Puerto Rico suffered a lack on quality methodologies during its processes and services. It is important to develop a design project that can contribute into services and processes improvement. Among the past years, is well known that government agencies in Puerto Rico are not guided by methodologies that

contribute on its performance. Since that happened, processes are affected by a negative impact on quality that brings a lot of wastes and affects processes, services, and finances. Through the linking and implementation of Lean, Six Sigma, 5s, and ISO 9001 methodologies. A design project can be developed to improve services and processes, in order maximize Puerto Rican government agencies performance into a higher percentage. High quality standards are key components on every organization in order to become successful. It is important to train employees, in order to understand how important is to practice quality principles by the incorporation of quality methodologies, in order to make improvements that can maximize government agencies performance and customer satisfaction in Puerto Rico.

### **Lean Methodology**

Lean is a fact-based, data-driven philosophy of improvement that values defect prevention over defect detection. It drives customer satisfaction and bottom line results by reducing variation, waste, and cycle time, while promoting the use of work standardization and flow, thereby creating a competitive advantage. It applies anywhere variation and waste exist, and every employee should be involved. Lean and Six Sigma have the same general purpose of providing the customer with the best possible quality, cost, delivery, and a newer attribute, nimbleness. There is a great deal of overlap, and disciples of both disagree as to which techniques belong where. The two initiatives approach their common purpose from slightly different angles:

- Lean focuses on waste reduction, whereas Six Sigma emphasizes variation reduction.

- Lean achieves its goals by using less technical tools such as kaizen, workplace organization, and visual controls, whereas Six Sigma tends to use statistical data analysis, design of experiments, and hypothesis tests.

The most successful users of implementations have begun with the lean approach, making the workplace as efficient and effective as possible, reducing waste, and using value stream maps to improve understanding and throughput. Task forces from this team are formed and reshaped depending on the problem at hand. Lean Six Sigma can be used as a tool to lead the way of improving government agencies performance [1].

### 5S Methodology

One lean concept that can easily be implemented at all levels of government is the 5S organization method, a widely accepted lean manufacturing tool. The following tenets of this concept can be applied to individuals, teams, or departments:

- Sort, Store, Shine, Standardize, and Sustain.

By the incorporation of the 5S concept into employees training can ensure to help to build long-term productivity and efficiency into an agency's work culture [2].

### Six Sigma Methodology

Six Sigma is a method that provides organizations tools to improve the capability of their business processes. This increase in performance and decrease in process variation lead to defect reduction and improvement in profits, employee morale, and quality of products or services. Six Sigma quality is a term generally used to indicate a process is well controlled. Six Sigma has been specifically described according to the way that is being used. The main four definitions are based on the following:

- **Philosophy:** The philosophical perspective views all work as processes that can be defined, measured, analyzed, improved and controlled. Processes require inputs to produce outputs.

- **Set of Tools:** The Six Sigma expert uses qualitative and quantitative techniques to drive process improvement. A few such tools include statistical process control (SPC), control charts, failure mode and effects analysis, and process mapping. Six Sigma professionals do not totally agree as to exactly which tools constitute the set.
- **Methodology:** This view of Six Sigma recognizes the underlying and rigorous approach known as DMAIC (define, measure, analyze, improve and control). DMAIC defines the steps a Six Sigma practitioner is expected to follow, starting with identifying the problem and ending with the implementation of long-lasting solutions. While DMAIC is not the only Six Sigma methodology in use, it is certainly the most widely adopted and recognized.
- **Metrics:** Six Sigma quality performance means 3.4 defects per million opportunities [3].

### ISO 9001 Methodology

ISO 9001 is a standard that defines the requirements for a Quality Management System (QMS). It helps businesses and organizations be more efficient and improve customer satisfaction. The primary focus of the ISO 9001 standard is to meet customer requirements and strive to exceed customer expectations. A Quality Management System based on ISO 9001:

- Defines how an organization can meet the requirements of its customers.
- Promotes the idea of continual improvement.
- Requires organizations to define objectives and continually improve their processes in order to reach those [4].

### Quality Application on Government Agencies

Government agencies are often understaffed and overloaded with work. There is often an abundance of paperwork overflowing on the desk of employees, and not enough time to get through all of it. Sending staff members to lean Six Sigma training can show people how they can improve their processes by possibly automating a lot of the time-consuming paperwork. Employees will also find

new ways of utilizing their time to get the most work done in an 8 hour a day. Six Sigma programs offer the best knowledge of how to use resources to maximum capacity in order to save the most money. Government agencies are also limited on space a lot of the time. Lean Six Sigma will show how to make use of the space and eliminate the idea of purchasing more space for employees. This can save thousands of dollars annually and make the best use of taxpayer dollars. Government agencies often are required to work with a tight budget in every department [5]. Lean Six Sigma training can show staff members and management effective ways to save the most money by making the best use of resources, space, and time. Government leaders have increasingly implemented Lean process techniques to make taxpayer-funded operations more efficient, but the use has been limited, a new study shows. The report, conducted jointly by CPS HR Consulting and the American Society for Quality (ASQ) Government Division, found that while Lean process improvement has made government operations more efficient, substantial roadblocks still exist that have kept the process from getting widely implemented. However, those agencies that have incorporated Lean techniques have reported success. Successes reported by the 24 government agencies surveyed included:

- **A 61% reduction in process steps**
- **A 60% reduction in process time**
- **A 19% improvement in error-free work**

Lean process improvement is not a complicated idea, although implementation can prove difficult because it challenges long-held assumptions about how a process should work. Eventually, the idea is to streamline a process to where it's done correctly the first time. The study, conducted in the summer of 2016, included government agencies from 10 U.S. states, the District of Columbia and Canada. In total, 24 agencies responded to the survey. About two-thirds of the government agencies reported that they used Lean primarily to improve timeliness and effectiveness of a process. About 45% targeted processes within an agency that did not directly

impact service to the public, but rather sought to improve internal operations. The government agencies in the survey faced numerous challenges. They included priorities that changed with new political leadership, a lack of staffing support for implementing changes and the fact that a more efficient operation could result in staffing or budget cuts. The study also found that even when implemented, Lean techniques often are used only for a short period of time. The report recommended that agency leaders must assure those who create process improvement. In the same way, federal agencies are working to create lean government operations issued by the Office of Management and Budget in April 2017 to reform the federal government. The overall focus of the reform is to make the government lean, accountable and more efficient, as well as to maximize employee performance. Essentially, the purpose of the memo from the new administration is for agencies to do the same volume of work with fewer resources or deliver more work with the same or current level of resourcing. Although the concept of lean is often associated with the manufacturing sector, many of its rules and guidelines may also be applied in the service sector, including the government [6].

## **MATERIALS AND METHODS**

Through the application of quality methodologies as a tool to develop a design, an analysis of performance on government agencies in Puerto Rico was executed.

### **Lean Methodology**

Lean can be defined as the idea of creating more value for customers with fewer resources. Its core idea is to maximize customer value while minimizing waste. A lean organization understands customer value and focuses its key processes to continuously increase it. The ultimate goal is to provide perfect value to the customer through a perfect value creation process that has zero waste. To accomplish this, lean thinking changes the focus of management from optimizing separate technologies,

assets, and vertical departments to optimizing the flow of products and services through entire value streams that flow horizontally across technologies, assets, and departments to customers. Eliminating waste along entire value streams, instead of at isolated points, creates processes that need less human effort, less space, less capital, and less time to make products and services at far less costs and with much fewer defects, compared with traditional business systems. Companies are able to respond to changing customer desires with high variety, high quality, low cost, and with very fast throughput times. Also, information management becomes much simpler and more accurate. A popular misconception is that lean is suited only for manufacturing. Not true. Lean applies in every business and every process. It is not a tactic or a cost reduction program, but a way of thinking and acting for an entire organization. Businesses in all industries and services, including healthcare and governments, are using lean principles as the way they think and do. The word transformation or lean transformation is often used to characterize a company moving from an old way of thinking to lean thinking. It requires a complete transformation on how a company conducts business. This takes a long-term perspective and perseverance. It is important to think about three fundamental business issues that should guide the transformation of the entire organization:

- **Purpose:** What customer problems will the enterprise solve to achieve its own purpose of prospering?
- **Process:** How will the organization assess each major value stream to make sure each step is valuable, capable, available, adequate, flexible, and that all the steps are linked by flow, pull, and leveling?
- **People:** How can the organization ensure that every important process has someone responsible for continually evaluating that value stream in terms of business purpose and lean process? How can everyone touching the value stream be actively engaged in operating it correctly and continually improving it?

In order to incorporate lean principles on a process, eight wastes must be avoided. The simplest way to describe waste is as “Something that adds no Value.” Customers would not be happy to pay for any action that we take that does not add value to what they actually want, and nor should we be. As an organization, profit is about selling price less costs, no matter how about the selling price. Therefore, the only way to improve profits are to reduce costs; this means removing all elements of waste from processes. In addition to improving profits, wastes have a major impact on customer’s satisfaction with products and services. Customers want on time delivery, perfect quality and at the right price. In order to achieve customers' satisfaction, the following 8 wastes should be avoided:

- **Transport:** Moving people, products and information. Excessive travel or movement of materials is waste. Proper planning and process layout can help reduce or eliminate excess transportation. The use of value stream mapping can help the team visualize exactly how much the material is traveling.
- **Inventory:** Storing parts, pieces, documentation ahead of requirements. This can be a direct result of overproduction or it could be due to poor purchasing practices. Over purchasing supplies because we got a great deal sometimes is no deal at all. Excessive or unneeded inventory can propagate other forms of waste.
- **Motion:** Bending, turning, reaching, and lifting. Any movement or motion performed by the operator that does not add value is waste. During your 5S exercise examine the motions required to perform the task. Organize the workstation so all tools and supplies are easily located and within easy reach. In some cases, re-sequencing certain process steps can reduce excessive and redundant movement or motion by the operator. By reducing or eliminating the waste of excess motion you are also creating a more ergonomic workstation. Always consider safety first.

- **Waiting:** For parts, information, instructions, equipment. Time and resources are wasted when waiting on parts, supplies or information.
- **Over-production:** Making more than is immediately required. Producing more product than required or producing parts faster than the downstream processes can utilize it. Strive to produce the proper amount at the proper time.
- **Over-processing:** Tighter tolerances or higher-grade materials than are necessary. Waste is incurred through use of the wrong tool, performing needless operations or not using the most efficient processes or tools for the job. Beware of the phrase “Because we have always done it this way”. The right process and the correct tools can reduce waste in your process.
- **Defects:** Rework, scrap, incorrect documentation. This form of waste is one of the worst of all. Producing non-conforming parts or assemblies increases scrap, reduces process efficiency, wastes machine, process or assembly time and causes non-value-added tool wear. Defects can also create additional waste in the form of wait time when the downstream operations run out of usable parts.
- **Skills:** Underutilizing capabilities, delegating tasks with inadequate training. Many companies are now realizing that their best asset is their employees. Companies must create an atmosphere where ideas are encouraged. Some of the most successful organizations have created a culture where employee’s ideas are really heard and evaluated [7].

### 5S Methodology

With the ever-changing economic climate, many organizations are periodically adjusting their resources to align with business strategy. This often results in the need to achieve more work with fewer resources. In order to remain successful, businesses must become more efficient, reduce waste and thereby reduce cost. We must find ways to do what we are currently doing in less time and at a lower cost. One way we can accomplish this is through the use of 5S Principles. The 5S Principles are very

effective at identifying and eliminating waste and increasing efficiency. There is a lot of information about 5S and how it came to be. The popular belief is that the Japanese invented the 5S Methodology because the letter “S” stands for five Japanese words, that when translated to roman script, start with the letter “S”. The 5S Method is a standardized process that when properly implemented creates and maintains an organized, safe, clean and efficient workplace. Improved visual controls are implemented as part of 5S to make any process non-conformance obvious and easily detectable. 5S is often one element of a larger Lean initiative and promotes continuous improvement. The 5S list is as follows:

- **Sort:** Separating of the essential from the nonessential items. During sorting the team should go through all items in the work area including any tools, supplies, bulk storage parts, etc. The 5S team leader should review and evaluate every item with the group. This will help to identify which items are essential for getting the job done effectively and efficiently. If the item is essential for everyday operations it should be tagged and cataloged. If the item is not essential, determine how often it is used in the performance of work in that area. If it is a bulk item, decide the proper amount to be kept in the area and move the remaining quantity to storage. Excess inventory is one form of waste and should be eliminated during the 5S activities.
- **Straighten:** Organizing the essential materials where everything has its place. Designate a place for all items that remain in the work area. Put all items in their designated location. An often-referenced quote is “A place for everything and everything in its place”. During the straighten step, look for ways to reduce or eliminate waste. One form of waste in a process is unnecessary operator motion or movement. Therefore, frequently used tools and supplies should be stored in the immediate work area close to the operator. One effective method commonly used to avoid wasted time searching

for the correct tool is constructing shadow boards for all essential tools. Items that are not used as often should be stored based on their frequency of use. All parts bins should be properly labeled. The label should include part number, part description, storage location and the recommended min / max quantities. A properly straightened work area allows the operator to quickly review and verify that they have everything they need to successfully perform their task at hand.

- **Shine:** Cleaning the work area. To be effective we must keep the area and any related equipment clean. Dirty process equipment can actually increase the potential for process variability and lead to equipment failure. Lost time due to equipment failure is considered waste and non-value-added time. A dirty area can also contribute to safety issues that have the potential to cause a worker to be injured. Operators should clean their areas at the end of each shift. By doing this they will likely notice anything out of the ordinary such as oil or lubricant leaks, worn lift cables, burnt out bulbs, dirty sensors, etc. The purpose is to reduce waste and improve operator safety and efficiency.
- **Standardize:** Establishing a system to maintain and make 5S a habit. In this step we must develop the standards for the 5S system. They will be the standards by which the previous 5S steps are measured and maintained. In this step, work instructions, checklists, standard work and other documentation are developed. Without work instructions or standard work, operators tend to gradually just do things their own way instead of what was determined by the team. The use of visual management is very valuable in this phase. Color coding and standard colors for the surroundings are sometimes used. Photos of the area in the standard 5S configuration are often posted for easier identification of non-conformance. The operators are trained to detect non-conforming conditions and correct them immediately. Schedules should also be

developed for regular maintenance activities in each area.

- **Sustain:** Establishing a safe and sanitary work environment (Safety). Sustaining is the continuation of the Sort, Straighten, Shine and Standardize steps. It is the most important step in that it addresses the need to perform 5S on a consistent and systematic basis. During this step a standard audit system is usually developed and implemented. The goal of the sustain step is to ingrain the 5S process into the company culture. The company must strive to make 5S a way of life so the benefits gained through the exercise can be maintained. 5S is not a one-time exercise. Following the 5S Process must become a habit.

The 5S Principles are recognized in many industries as effective tools for improving workplace organization, reducing waste and increasing efficiency. Organizations should be careful to not allow the 5S Principles to become viewed as the whole of the company's improvement efforts. Otherwise it could become the end goal of your company's improvement process instead of a key part of a larger continuous improvement journey. The greatest benefit from using 5S is realized when it is part of a larger initiative and the entire organization has adopted its principles. 5S is more than a system; it is a business philosophy and should be integrated into the organization's culture. There are many benefits to implementing the 5S Methods into a work area on the production line or in the business office. To not only survive but thrive in business today, cost must be controlled, and waste must be avoided or eliminated. The 5S steps, when implemented properly, can identify and reduce many forms of waste in any process or workstation. An organized work area reduces excessive motion and wasted time looking for the right tool. The visual aspect of the 5S Methodology is also very effective. When everything has a place, it is easier to spot something missing or misplaced. A clean work area helps draw attention to possible problems or safety hazards. A clean floor helps spot any leaks or spills could indicate machine maintenance and prevent

slips and falls. Furthermore, encouraging people to watch for and address problems can result in a positive change to an organizations culture. Therefore, the 5S Principles implemented as part of a larger Lean initiative or as a standalone tool can reduce waste, improve quality, promote safety and drive continuous improvement [2].

### Six Sigma Methodology

In the same way, Six Sigma is heralded as one of the foremost methodological practices for improving customer satisfaction and improving business processes. In an effort to bring operations to a Six Sigma level the methodology calls for continuous efforts to get processes to the point where they produce stable and predictable results. Six Sigma defines and evaluates each step of a process, searching for ways to improve efficiencies in a business structure, improve the quality of the process and increase the bottom-line profit. The ultimate goal is to improve every process to a Six Sigma level or better. One of the two major methodologies used within Six Sigma, is DMAIC and it is composed of five sections that are defined as following:

- **DMAIC:** This method is used primarily for improving existing business processes. The letters stand for:
  - Define the problem and the project goals
  - Measure in detail the various aspects of the current process
  - Analyze data to, among other things, find the root defects in a process
  - Improve the process
  - Control how the process is done in the future.

There are also many different management tools used within Six Sigma. While there are too many to list, here are details of the one that is being used in order to develop the design project [8]:

- **Five Whys:** This is a method that uses questions to get to the root cause of a problem. The method is simple: simply state the final problem and then ask the question “why” [9].

Ultimately, all of the tools and methodologies in Six Sigma serve one purpose: to streamline business processes in order to produce the best products and services possible with the smallest number of defects. Its adoption by corporations around the globe is both an indicator of and testament to its remarkable success in today’s business environment. The DMAIC methodology was used across the developing the design project by the following diagrams:

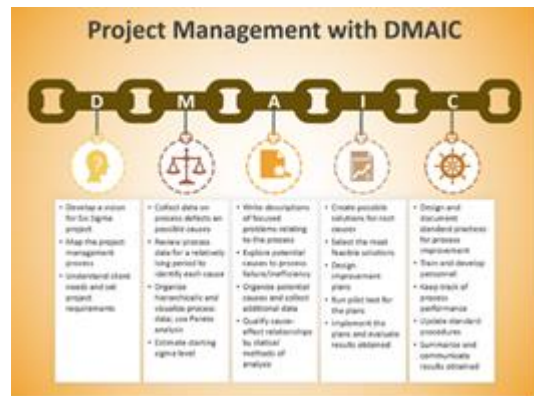


Figure 1  
Project Management with DMAIC

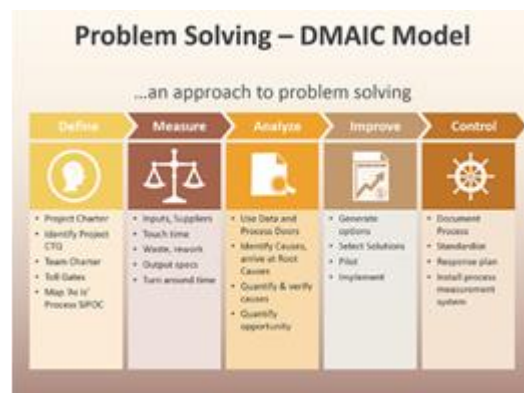


Figure 2  
Problem Solving with DMAIC

### ISO 9001 Methodology

As a way to measure quality, ISO 9001 defines the criteria for a Quality Management System and is the only standard in the family that can be audited against with the goal of voluntary compliance or to become 3rd party registered. All the requirements of ISO 9001 are generic and are intended to be applicable to any organization, regardless of its type or size, or the products and services it provides. The

standard is based on seven Quality Management Principles, including a strong customer focus, the motivation and implication of top management, the process approach and continual improvement. These Quality Management Principles are identified as follows:

- Customer focus
- Leadership
- Engagement of people
- Process approach
- Improvement
- Evidence-based decision making
- Relationship management

Complying with ISO 9001 ensures customers get consistent, good quality products and services, which in turn brings many business benefits. The standards provide guidance and tools for companies and organizations who want to make sure their products and services consistently meet customer's requirements and that quality and customer satisfaction are consistently improved. Compliance with the ISO 9001 requirements are typically achieved when there is a need driven by customers but also when an organization wants to improve its QMS with the goal of improving its products or services and ultimately customer satisfaction. Compliance to the ISO 9001 standard can be done at any time but is typically used when:

- Organizations want to improve their products and customer satisfaction.

Finally, Organizations' deciding to develop and implement any new or improved Quality Management System is a strategic decision. All efforts should be focused on the identification and minimization of risk while meeting and exceeding customer and organizational goal and objective requirements [4].

### Quality Tools

In order to understand and analyze issues that impact the quality on the performance and services on government agencies, a survey was developed. By the developing of the survey, a random sample was selected in order to rate the processes and

services on government agencies. After analyzing the acquired data, wastes on processes and services were identified. The incorporation of the 5s methodology brings support to resolve negative impacts on government agencies performance. Finally, root causes were defined by the utilization of Six Sigma's Five Whys [9]. The following table shows how Six Sigma was utilized as a tool, in order to analyze root causes:

**Table 1**  
**Five Whys Model**

<i>FIVE WHYS</i>	<i>EXPLANATION</i>
Why government agencies have a low performance on processes and services?	In most cases, low performance is caused by wastes during processes and services.
Why wastes on processes and services must be eliminated from government agencies?	Wastes must be eliminated on processes and services in order to maximize its performance.
Why government agencies must have a high performance on processes and services?	A high performance is the key to have a good customer satisfaction.
Why customer satisfaction is so important on government agencies?	A good customer satisfaction is a key component of quality principles.
Why quality principles must be implemented on government agencies?	Quality is fundamental in order to guarantee improve an success on every organization.

## RESULTS AND DISCUSSION

By the incorporation of the previously discussed methodologies, an analysis of wastes, the development of a DMAIC system, the incorporation of 5S, and a survey were developed as a tools in order to have guidelines and obtain data that should sustained the development and implementation of the project design. Those tools were key components in order to achieve objectives and solve the problem statement. By the provided data, an analysis of wastes on services and processes was performed and the application of the DMAIC cycle was implemented to resolved issues on its performance. Also, lean applications as 5s were combined to bring support to the project design objective, in order to fulfill the stated contributions. After finishing a random sampling survey, the acquired data shows that people are not satisfied with government agencies performance on processes and services. The results shows that governed agencies suffer from wastes on its processes and services that cause

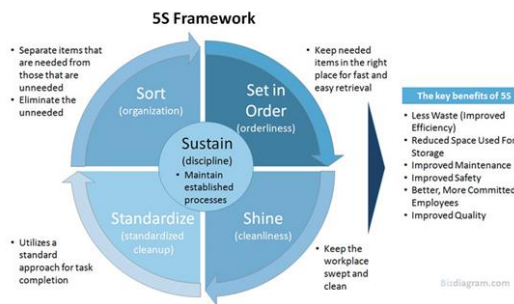


a negative impact on its quality. In order to counteract that negative impact, solutions for issues involving quality will be provided as guidelines. The following table states the found wastes with their solutions:

**Table 2**  
**8 Wastes and Solutions**

WASTE TYPE	EXAMPLE	SOLUTION
Transportation	Leg work created by improper dt requests	Properly scope necessary data points, along with
	Large file requiring long transmission times	appropriate data ranges
Inventory	Large files increasing the complexity of analysis	Understanding how deliverables will be created, and what data is required
	Unnecessary outputs in tools	Simple and elegant outputs
Motion	Difficulty in maneuvering around the tool to find information	Make important information readily available to the customer
Waiting	Improper data requests	Understand what inputs will drive the outputs
Over-production	Adding extras into the tools which are outside the scope	Specific deliverables
Over-processing	Reinventing processes	Take time to follow previously logic structures, forms, and formatting.
Defects	Broken tools	Test tools as many times as possible
Skills	Employees are not utilizing	Engage correct people and

In the same way, as a tool to counteract wastes and maximize performance on government agencies, 5S methodology must be implemented as. The following diagrams shows the utilization of 5s methodology in order to struggle wastes and be aware about its key benefits.



**Figure 3**  
**5S Solutions**

Finally, Six Sigma methodology was utilized as a tool to manage gaps through processes and services, in order to find critical quality components, root causes of issues, and maximize customer

satisfaction with the application high quality standards on government agencies.



**Figure 4**  
**DMAIC Framework**

## ACKNOWLEDGMENTS

The problem stated expects to be solved: by the implementation of quality methodologies as Lean, 5s, Six Sigma, and ISO 9001. With the incorporation of the previously mentioned methodologies, a research and a project design were developed in order to utilize tools that can be useful to maximize performance on processes and services on government agencies in Puerto Rico. Limitations through the project design was based on the availability of information based on processes and services on government agencies in Puerto Rico. Findings through articles established that government agencies in other countries utilizes quality methodologies to maximize performance. By the completion of the design project, the following contributions were developed in order to make improvements that can maximize government agencies performance and customer satisfaction in Puerto Rico:

- Finding wastes on processes and services that minimize performance on government agencies.
- Incorporation of 5s methodology to minimize wastes and maximize performance on government agencies.
- Execution of DMAIC improvement cycle to develop a project design that should be implemented on government agencies to maximize its performance.

- Incorporation of a Quality Management System capable or maximize performance on government agencies.

Future Research must be developed in order to counteract found limitations. The success and final outcome of this project required a lot of guidance and assistance from many people and I am extremely privileged to have got this all along the completion of my project. All that I have done is only due to such supervision and assistance and I would not forget to thank them. I respect and thank Mr. Rafael Nieves Castro, Ph D. for providing me an opportunity to develop the design project and giving all his support and guidance, which made me complete the project.

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