

Abstract

Purpose: This research aims to expand the knowledge about Six Sigma implementation in the public sector, By analyzing an improvement initiative in a ras el oued municipality, The initiative is reflected in A comparison with literature regarding the production and service sectors unfolds similarities and differences, On the other hand, a practical way of implementing Six Sigma will be proposed in the municipality;

Design/methodology/approach: The paper applies the action research method. Especially for the broad field of project management, In the beginning, the theoretical framework of the article will be presented to the presentation of the practical way of implementing Six Sigma through the dmaic methodology and here the focus will be only on The first stage;

Originality/value: The six sigma application in this article provides insights into practical implementation experience in a municipality as well as lessons learned. This paper represents academic report of a six sigma program in a ras el oued municipality and underlines the need for scientific support of those initiatives in further municipalities worldwide;

Keywords: Six Sigma, Municipality, Case Study.

Résumé

Objectif: Cette recherche vise à approfondir les connaissances sur la mise en œuvre de Six Sigma dans le secteur public. En analysant une initiative d'amélioration dans une municipalité de Ras el oued, l'initiative est reflétée dans Une comparaison avec la littérature sur les secteurs de la production et des services révèle de nombreuses similitudes et différences, Sur la D'autre part, un moyen pratique de mettre en œuvre Six Sigma sera proposé dans la municipalité;

Conception / méthodologie / approche: Le document applique la méthode de recherche-action. Particulièrement pour le vaste domaine de la gestion de projet, le cadre théorique de l'article sera

présenté à la présentation de la manière pratique de mettre en œuvre Six Sigma à travers la méthodologie dmaique et l'accent ne sera mis ici que sur La première étape;

Originalité / valeur: L'application six sigma de cet article fournit des informations sur l'expérience pratique de la mise en œuvre dans une municipalité ainsi que sur les enseignements tirés. Ce document représente le rapport académique d'un programme Six sigma dans une municipalité de Ras elOued et souligne la nécessité d'un soutien scientifique à ces initiatives dans d'autres municipalités à travers le monde;

Mots-clés: Six Sigma, municipalité, étude de cas

Introduction

During the last few decades, many quality improvement methodologies have been used extensively by organizations to improve products and services. Techniques like continuous quality improvement (CQI) and total quality management (TQM) have been used to provide modest, incremental improvements, whereas techniques like reengineering and Six Sigma have been used for making drastic changes to existing processes;

Six Sigma is a disciplined approach to improving product, process and service quality, define Six Sigma as an organized and systematic method for strategic process improvement and new product and service development that relies on statistical methods and the scientific method to make dramatic reductions in customer defined defect rates. Six Sigma has evolved significantly and continues to expand to improve process performance, enhance business profitability and increase customer satisfaction. Quality management has been an extremely important management strategy for achieving competitive advantages and improvements. Traditional quality concepts like Statistical Quality Control¹, Statistical Process Control, Zero Defects and Total Quality Management, have been major key players for many years;

While Six Sigma is a more recent initiative quality improvement to gain popularity and acceptance in many industries as well as service industries across the world. The basic elements of Six Sigma like Statistical Process Control, Failure Mode Effect Analysis, Gage Repeatability and Reproducibility and there are other tools that have been on reduction of rejects and enhancing the quality. Six Sigma provides a basic framework in which all these tools can be performed with management supportⁱ ;

The question is how to use this methodology in the municipality and specifically in the biometric interest as a step towards using the Six Sigma methodology.

This main question is divided into a first sub-question about what, General operations, major operations and completion processes within the neighborhood health organization;

and another sub-question about what Six Sigma is?

What is the method of improving DMAIC?

What is the map of operations in the municipality of Ras el-oued?

Finally, what are the important characteristics in the evaluation of the quality of service in the municipality?;

In order to answer these questions, what we have done in this study is to draw up a map of operations within the municipality and specifically to benefit biometric documents by using interviews with officials and then defining the critical determinants of the general quality (CTQ's) based on a discussion group with customers who have received this service before, Operations;

The aim of this experiment is to explore practical steps towards the Six Sigma application. The paper is divided as follows: First, we briefly present the theoretical framework of the study, which includes basic concepts about Six Sigma. Then we discuss the implementation of the Six Sigma part of the municipality. Finally we present the results of the field study and discuss the results achieved.

Six Sigma Strategy is a way to activate the modernization of service operations

Below we present the theoretical framework of the study and its six Sigma concepts and methodology

1. Defining six sigma

Six Sigma as a methodology for process improvement involves a vast library of tools and knowledge, which will be covered throughout this article. In this section, we'll begin to define the statistical concept represented by 6. At the most basic definition, 6. is a statistical representation for what many experts call a "perfect" process. Technically, in a Six Sigma process, there are only 3.4 defects per million opportunities. In percentages, that means 99.99966 percent of the products from a Six Sigma process are without defect. At just one sigma level below 5, or 99.97 percent accuracy processes experience 233 errors per million opportunities. In simpler terms, there are going to be many more unsatisfied customersⁱⁱ.

2. Merits of Six Sigma

With the abundance of descriptions of Six Sigma - see Harry and Schroeder (1999) and Brady and Allen (2006) for example – it is not necessary to describe the details of the mechanics here. As pointed out in Goh (2010), the effectiveness of Six Sigma has in no small part been dependent on the following major attributesⁱⁱⁱ:

Use of a tangible metric for comparison of performance across different processes or even industries, and for marking progress in improvement projects; in particular, a chosen metric (commonly known as CTQ, or critical-to-quality) is more often than not defined with respect to customer requirements than an organization's internal needs;

Clear assignment of roles and responsibilities of problem-solving and improvement personnel, in particular the common designation of roles via the Champions-Master Black Belt- Black Belt-Green Belt hierarchy;

Logical alignment and integration of statistical tools – this is the answer to the perception of academics that there's "nothing new" in Six Sigma; in other words Six Sigma offers a good illustration that "the whole is larger than the sum of the parts";

Integration of analysis and synthesis techniques with modern information technology both in software (user-friendly statistical software packages) and hardware (personal computers, notebook computers and various convenient devices) Thus the burden of number-crunching and understanding of theories are no longer obstacles to decision making on the basis of results of data analysis, fact-based procedures.

Another interesting feature of Six Sigma is that, unlike many other improvement ideas, it is not the product "of academia, by academia, for academia". Six Sigma was the outgrowth of the need to improve product quality in order to maintain business competitiveness. It is therefore not unusual to hear, for example people from some university's Statistics Department that there is "nothing new" in it. From an academic point of view, there indeed is "nothing new" in the individual techniques in the so-called "body of knowledge" required of Six Sigma professionals, namely the Black Belts. However, the attractiveness of Six Sigma does not lie in the application of statistical tools;

3. Dmaic methodology

Below are the practical steps to apply dmaic optimization methodology:

Define: The Define Phase is the first phase of the Lean Six Sigma improvement process. 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 your teams define the outline of their efforts for themselves and the leadership (executives) of your organization;

Table 1: Phases and Tools in Define

DMAIC Phase Steps	Tools Used
Define Phase: Define the project goals and customer (internal and external) deliverables.	
Define Customers and Requirements (CTQs)	Project Charter
Develop Problem Statement, Goals and Benefits	Process Flowchart
Identify Champion, Process Owner and Team	SIPOC Diagram
Define Resources	Stakeholder Analysis
Evaluate Key Organizational Support	DMAIC Work Breakdown Structure
Develop Project Plan and Milestones	CTQ Definitions
Develop High Level Process Map	Voice of the Customer Gathering

Source: Available on: Jeffrey Alan Fletcher, Lean Six Sigma & Local Government, Teaching Public Administration, <http://mc.manuscriptcentral.com/TPA>, February 2016, Pp12-13.

Measurement: Measurement 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's good to consider both at the start of the project ;

Table 2: Phases and Tools in Measure

DMAIC Phase Steps	Tools Used
Measure Phase: Measure the process to determine current performance; quantify the problem.	
Define Defect, Opportunity, Unit and Metrics	Process Flowchart
Detailed Process Map of Appropriate Areas	Data Collection Plan/Example
Develop Data Collection Plan	Benchmarking
Validate the Measurement System	Measurement System Analysis/Gage R&R
Collect the Data	Voice of the Customer Gathering
Begin Developing $Y=f(x)$ Relationship	Process Sigma Calculation
Determine Process Capability and Sigma Baseline	

Source: Jeffrey Alan Fletcher, op cit, Pp12-13.

Analyze: This phase is often intertwined with the Measure Phase. As data is collected, the 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 in an effort to narrow down and verify the root causes of waste and defects ;

Table 3: Phases and Tools in Analyse

DMAIC Phase Steps	Tools Used
Analyze Phase: Analyze and determine the root cause(s) of the defects.	
Define Performance Objectives	Histogram
Identify Value/Non-Value Added Process Steps	Pareto Chart
Identify Sources of Variation	Time Series/Run Chart
Determine Root Cause(s)	Scatter Plot
Determine Vital Few x's, $Y=f(x)$ Relationship	Regression Analysis
	Cause and Effect/Fishbone Diagram
	5 Whys
	Process Map Review and Analysis
	Statistical Analysis
	Hypothesis Testing (Continuous and Discrete)
	Non-Normal Data Analysis

Source: Jeffrey Alan Fletcher, op cit, Pp12-13.

Improvement: once the project teams are satisfied with their data and determined that additional analysis will not add to their understanding of the problem, it's 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 ;

Table 4: Phases and Tools in Improve

DMAIC Phase Steps	Tools Used
Improve Phase: Improve the process by eliminating defects.	
Perform Design of Experiments	Brainstorming
Develop Potential Solutions	Mistake Proofing
Define Operating Tolerances of Potential System	Design of Experiments
Assess Failure Modes of Potential Solutions	Pugh Matrix
Validate Potential Improvement by Pilot Studies	QFD/House of Quality
Correct/Re-Evaluate Potential Solution	Failure Modes and Effects Analysis (FMEA)
	Simulation Software

Source: Jeffrey Alan Fletcher, op cit, Pp12-13.

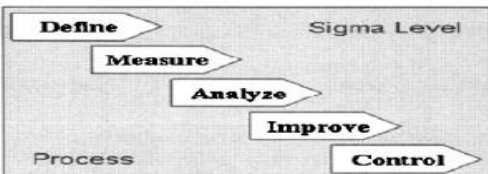
Control: This phase is a mini version of process management. The team has been building a form of infrastructure throughout the life of the project, and during the Control Phase they begin to document exactly how they want to pass that structure on to the employees who work within the process^{iv};

Table 5: Phases and Tools in Improve

DMAIC Phase Steps	Tools Used
Control Phase: Control future process performance.	
Define and Validate Monitoring and Control System Develop Standards and Procedures Implement Statistical Process Control Determine Process Capability Develop Transfer Plan, Handoff to Process Owner Verify Benefits, Cost Savings/Avoidance, Profit Growth ,Close Project, Finalize Documentation Communicate to Business, Celebrate	Process Sigma Calculation Control Charts (Variable and Attribute) Cost Savings Calculations Control Plan

Source: Jeffrey Alan Fletcher, op cit, Pp12-13.

in the last, The DMAIC tool encourages creative thinking about problems within an organization's business processes. For example, when a process is operating so poorly that it necessitates abandoning the original process and starting over, then the 'improve step' of DMAIC actually becomes a process planning or replanning step. The use of the DMAIC approach within Lean Six Sigma projects helps participants discover and even rediscover problems in their businesses processes. In fact, as Madder writes, "Most organizations have instituted management reviews called checkpoints or tollgates throughout these design phases to allow the organization to assess risks, monitor progress and ensure transitions from each phase to the succeeding phase". The steps of applying Six Sigma methodology can be summarized in the following figure:

Performance Indicators (input, CTQ)	Six sigma application procedure (DMAIC)	Indices of performance improvement (output)
Variations in cycle time Idle/waiting time of labor Idle/waiting time equipment Excess or shortage of inventory (Buffer size) Material quality Safety measures Percent of earned value achieved	 Improvement achieved through minimizing waste and variability and establishing quantitative targets based on the six sigma application strategy	Cycle time reduction Efficiency improvement Productivity improvement Increased throughput yield Buffer size optimization

the shape1: Basic framework for six sigma application to construction projects

Source: Available on: Seung Heon Han et al, **Six Sigma-Based Approach to Improve Performance in Construction Operations**, JOURNAL OF MANAGEMENT IN ENGINEERING, <http://www.ascelibrary.org>, JANUARY 2008.

Case Study

In view of the nature of the study and its objective, the focus was on the interest of the users of the Municipality of Ras el-oued Bordj Bou Arreridj for the extraction of major operations and completion operations. The organizational structure and the targeted municipal data are as follows:

1. Definition of the institution

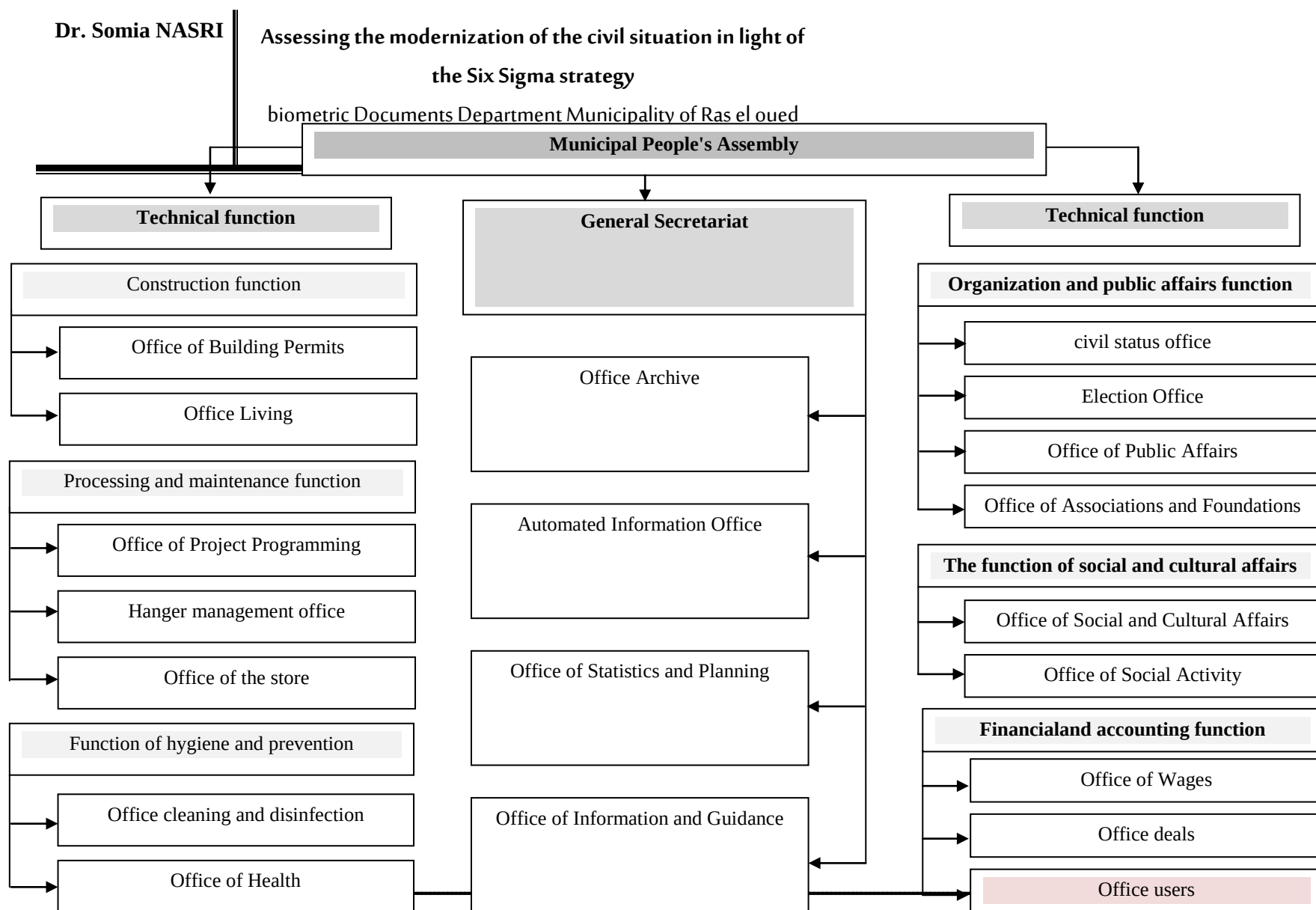
First, before modeling Civil Status processes, The institution in question will be identified:

Table 6: Ways of communication

Code	municipality	Title	Telephone / fax	E-mail
3417	Awlad braham	neighborhood of Awez Mohammed	035 84 21 36 035 84 21 15	apcouledbraham@hotmail.fr
3402	Ras el-oued	Street, 1 November 1954	035 84 02 07 035 84 16 61	apcreo@gmail.com
3430	Ain tessera	Street, Boudiaf Abd el Lafi	035 63 51 98 035 63 51 83	apctassera@gmail.com

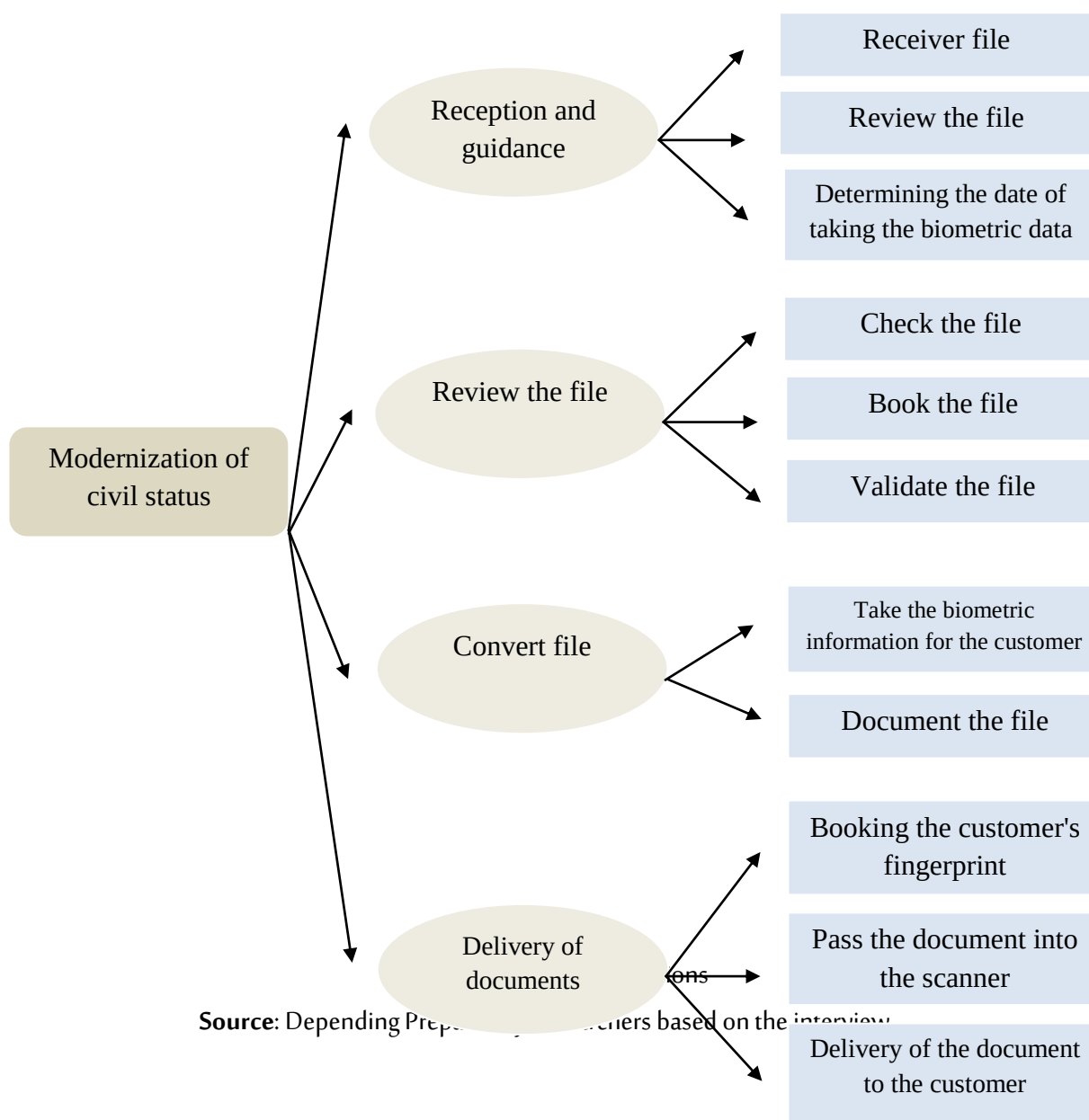
Source: Available

on: <http://www.interieur.gov.dz/index.php/ar/%D8%A7%D9%84%D8%AC%D9%85%D8%A7%D8%B9%D8%A7%D8%AA%D8%A7%D9%84%D8%A5%D9%82%D9%84%D9%8A%D9%85%D9%8A%D8%A9/%D8%AA%D9%86%D8%8%D9%8A%D9%85%D8%A7%D9%84%D8%AC%D9%85%D8%A7%D8%B9%D8%A7%D8%AA%D8%A7%D9%84%D8%A5%D9%82%D9%84%D9%8A%D9%85%D9%8A%D8%A9.html>



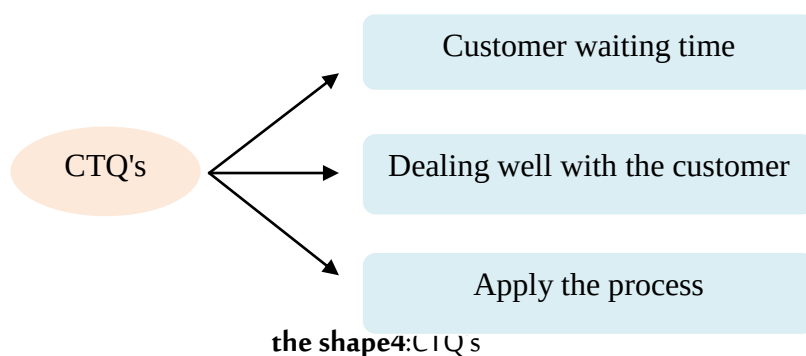
2. Define the problem

The users' interest within the municipality of Ras el-oued in Bordj Bou Arreridj was closely related to the procedures for the extraction of biometric documents. The results of the interview with the official showed the existence of 4 main operations that branch out to completion operations as follows:



After the interview with the users' interest and touring the civil status modernization department, the map of the previous operations was formed with the actual launch of a discussion group in order to identify the critical characteristics of the operations performed in blue ;

A discussion group was formed with 6 customers who dealt with the municipality to extract the biometric documents. Based on the completion processes, the following questions were asked: What are the most important features you would like to provide in the biometric documentation extraction department? Here most customers stressed the need to implement the processes as they came and complete the time in their application and good dealing with the customers of the municipality. Based on the results of the discussion groups, the following figure was drawn:



the shape4:CTQ's

Source: Prepared by researchers based on discussion groups

Limitations and Further Research

This study is experimental and analytical, combining data collection using the interview and the discussion group. Below we present a summary of the results of this work and outline its limits and show some Suggestions for subsequent studies, but we start by answering the research questions.

1. Answer questions

The first question posed by the study was: what Six Sigma is? Technically, in a Six Sigma process, there are only 3.4 defects per million opportunities. In simpler terms, there are going to be many more satisfied customers;

The second question was about the steps taken to improve quality using the Six Sigma strategy, and it turned out to follow five steps, most notably the definition stage, which was focused on extracting the map of operations and the critical characteristics of quality ;

What is the map of operations in the municipality of Ras el-oued? Here we relied on the interview to extract the main processes and the completion of the process in the extraction of biometric documents, and we have formed four major operations, which are also divided into 11 completion processes;

Finally, what are the important characteristics in the evaluation of the quality of service in the municipality?; we used a discussion group to extract them. They relate to multiple and different aspects, depending on the completion process and sometimes relate to the critical characteristics of time. Sometimes by treatment and sometimes by the aspect associated with the application of the process, and so on.

2. Scientific applications of the study

Our findings give practitioners in the sector a view from a different angle of the municipality, the angle of operations. This approach to operations and defining their critical characteristics from a customer's point of view gives the path an overview of the strengths and weaknesses in the performance of operations within the organization.

3. Scientific applications of the study

The scientific value of this work is highlighted in the experimental methodology used. Where we traced a path. The customer within the organization and extracted the processes required by his service, and the most important indicator in assessing the quality of each completion. One of the most striking scientific results of this experiment is the large number of operations that are difficult to find a standard to evaluate from the point of view of the customer. Most customers emphasized that the standard of application of the process may be the solution .

4. Limits and prospects of study

This research dealt with one institution. Therefore, the results of the quality level can not be disseminated to institutions of the target type. The study also addressed a specific type of civil status, which is the modernization of the civil situation. The results related to the operation plan and the critical characteristics of quality cannot be generalized to the other types of the municipality, the ordinary civil situation ;

In our research, we did not refer to the priority in operations, which is an initial step and here it is useful to conduct a study in this aspect. It is important to find a reliable and accurate way to measure the importance of each process in order to prioritize improvement ;

The steps we have tested are a small part of Six Sigma's steps, which can be the subject of subsequent studies that test, for example, the five steps (DMAIC) to activate improvement projects in the municipality's interests;

Studies can also be conducted on the availability of six Sigma success conditions in health institutions in Algeria, and difficulties which could object to their use.

Reference

ⁱ Muhammad Imran Qureshi et al, Customer Satisfaction Measurement and Analysis Using Six Sigma in Telecom Sector of Pakistan, EUROPEAN JOURNAL OF SUSTAINABLE DEVELOPMENT, Volume 1, No. 1, 2012, p54.

ⁱⁱ The Council for Six Sigma Certification, six sigma yellow belt certification, www.sixsigmacouncil.org, p07.

ⁱⁱⁱ T N Goh, SIX SIGMA AT A CROSSROADS, Proceedings of the 41st International Conference on Computers & Industrial Engineering, 2018, p308.

^{iv} RADHA KRISHNAN & K. ARUN PRASATH, SIX SIGMA CONCEPT AND DMAIC IMPLEMENTATION, International Journal of Business, Management & Research (IJBM), Vol. 3, Issue 2, Jun 2013, pp 112-114.

^v Jeffrey Alan Fletcher, Lean SixSigma & Local Government, Teaching Public Administration, <http://mc.manuscriptcentral.com/TPA>, February 2016, Pp12-13.