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Efficacité de la Méthodologie Six Sigma dans la Gestion de la Chaine Logistique

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Abstract Lean Six Sigma Supply Chain Management and have share commonalities in terms of process and focus on solving customer problems to achieve customer satisfaction. They also complement each other and can be integrated together. This work has extended previous work on the proposed approaches and the implementation of the Lean Six Sigma DMAIC to improve Supply Chain Management using tools. Lean Six Sigma Tools efficient movement through the Supply Chain Management, including inventories, schedules, quantities of demand, etc. Supply Chain Management can use Lean Six Sigma principles, such as focusing on added value for customers, reducing waste and deficient, streamlining the value stream, and improved delivery times. The relevance of these tools and methods generally depends on the understanding of the methods and application environment. Improving the implementation, management and performance of a supply chain are not easy tasks. However, Supply Chain Management can use the concepts and tools of Lean Six Sigma to achieve high levels of customer satisfaction in terms of cost, quality and delivery. The case study provides an example implementation of Lean Six Sigma to improve a Supply Chain. It validated the implementation and provided a description of all phases of DMAIC.

Keywords: *six sigma, supply chain management, DMAIC, lean six sigma*

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1. Introduction

Globalization announced some years ago, is a phenomenon that has affected all markets worldwide. It has resulted in the gradual disappearance of national markets and the creation of regional blocs. The other face of globalization is the intensification of competition became increasingly cruel.

The latter has led to a multiplication of the number of products and services offered, and naked reduction of the duration of life cycles. In addition, given the multiple mutations that characterize globalization, companies have found themselves in search of strategies to gain an advantage consolidated. These strategies are responses to the requirements imposed by the new data from the environment, such as; customer satisfaction in time reduced the production of various products in small quantities and highly personalized. Indeed, we can say that we are in a time when the problem is happening. The means of production déspécialisent, and become flexible, that is to say suitable for a wide variety of products.

A question arises, how can companies cope with these environmental constraints? A possible answer to this is to adopt a mode of industrial organization, such as logistics, Just in Time, Kanban, 5S, TQM. .. etc. These managerial approaches have proven in many European and American companies in terms of performance. Face the new competitive environment, companies are called Tunisian improve productivity through the adoption of modern management methods, more flexible and more efficient in order to meet the challenge of competitiveness.

As logistics management approach, in our opinion could be an answer since it is a clue to any industrial undertaking to increase its flexibility and productivity. Starting from the fact that the outcome of logistics based on a set of dimensions. Six Sigma thinking offers the potential to refine the current approach to improving supply chain. It probably offers advantages in the delivery of reduced variation over the elimination of superfluous activity and not to value-added delivered in existing approaches.

While Six Sigma as a change and improvement strategies deliver significant business benefit to practitioner organizations that have not been successfully adapted to deliver similar benefits across supply chains. It manifests in the literature regarding the applications published most of Six Sigma in supply chains are closer to the traditional internal Six request. Swart Wood (2001) argues that the SCOR model provides the basis for analyzing the performance of supply chain, indicating which problems largely lie and their potential impact on operations. It advocates the combination of SCOR with

Six Sigma as they have complementary capabilities, with SCOR providing the basic understanding of supply chain issues, while Six Sigma can be deployed to implement improvement projects. As part of achieving our End Of Memory Studies we try to increase our theoretical studies through a practical study within the company Refrigeration and Brasserie de Tunis. At this level, our project "Effectiveness of Six Sigma methodology in managing the supply chain" in the company SFBT essentially seeks to resolve the following problem "The main focus of this activity was reduced and the reduction of unnecessary variation ". However, we can show the variation in supply chains have a significant effect on performance.

2. Six Sigma Presentation

Six Sigma is a philosophy of quality turned towards the customer satisfaction. First of all, one includes/understands well that a greater customer's satisfaction will at the same time allow all to preserve our customers and to conquer the new ones. This increase in the losses of market will be concretized by an improvement of profitability. Six Sigma can reduce variability which is the enemy of quality (Dewhurst et al., 1999; Finster, 2001; De Mast et al., 2006). When an engineer has just manufactured a product which gives whole satisfaction, its dream would be of being able the cloner to identical so that each product preserves same qualities. But it is not unfortunately possible, there will be always a small respect centre the products considered identical, and these are the small respect which lead to non-quality. For more details see Figure 1.

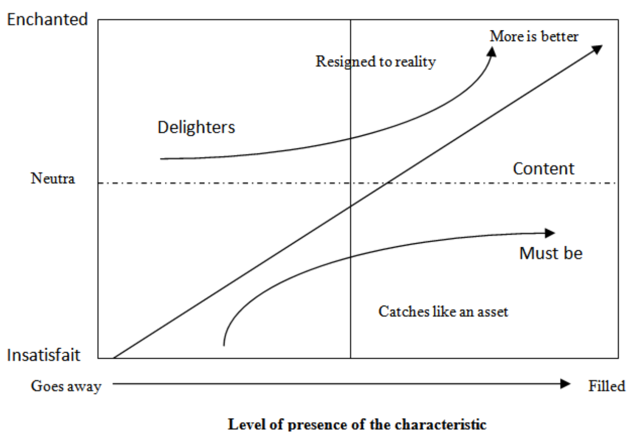


Figure 1. Level of presence of the characteristic

3. What is a Six Sigma Performance

A process occurring at a Six Sigma level is such that it does not produce more than 3, 4 defects per million opportunities.

process performance	DPMO	Sigma process
30,9%	691,462	1,0
69,1%	308,538	2,0
93,3%	66,807	3,0
99,38%	6,210	4,0
99,977%	233	5,0
99,99966%	3,4	6,0

The increased level of sigma Requier exponential reduction of default;

♣ Reduced defects generated a higher level of sigma process;

♣ It is not appropriate to automatically set a goal for all Six Sigma processes;

♣ It is not sensible to seek a Six Sigma performance for all processes;

♣ The effort to achieve Six Sigma must be evaluated: the cost \ benefit;

♣ For example, if the sigma is greater than 3, a target of 50% reduction of defects is fixed (ex: 1000 500 DPMO DPMO). If sigma is less than 3, the goal of reducing defects by a factor of 10 is fixed (ex: 1000 100 DPMO DPMO);

♣ Sigma level process measures how the process varies with respect to client specifications. ...... interval performance tolerated by the client;

♣ The term Six Sigma redoes a statistical measure of the variation of a methodology and power.

The application of Six Sigma has the ability to reduce the variation of the characteristics of the product or service from the target by using either continuous improvement or a design/redesign approach. The first approach follows the phases: define measure, analyze, improve and control. This approach is known as DMAIC methodology. The second approach progresses through the phases: define measure, analyses, design and verify. This is known as the DMADV methodology (Banuelas and Antony, 2003).

DMAIC is used for improving an existing process, whereas DMADV is employed for the design of products (Snee, 2004; Banuelas and Antony, 2003).

Each phase of the DMAIC process plays a different role and essential in the overall process of management improvement.

- Define. The Define phase focuses on defining the objectives and limits of the project and identify issues necessary to achieve the level of sigma highest possible.
- Measure. The objective of Phase Measure Six Sigma strategy is to gather available information about the current situation, to obtain baseline data on the current performance of the process and identify problem areas.
- Analyze. The objective of Phase Analysis in Six Sigma quality effort is to identify the most likely causes of quality problems, causes and confirm these with appropriate analytical tools.
- Improve. The objective is to improve the phase implement solutions to solve problems (most likely causes) identified during the previous phase (Analyze).
- Check. The objective of Phase Control is to assess and monitor the results of the previous phase (Improve).

For designing the framework of the WSS model, the DMAIC methodology is chosen.

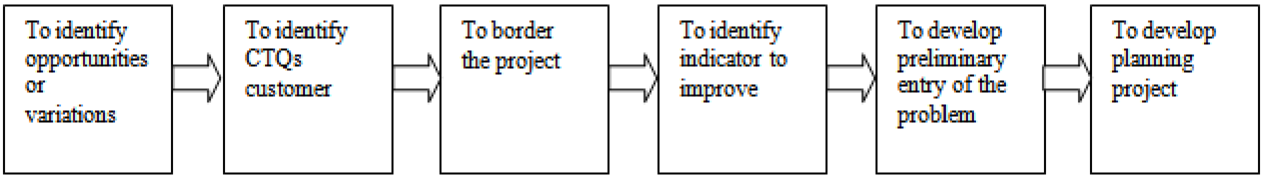
The conventional DMAIC concept is explained in a few words below.

3.1. Define Phase

Through this phase, Six Sigma project is drafted and the process to be improved is identified. After identifying the process by using suitable techniques, the process is documented. One such technique that is often used is the flow-charting technique.

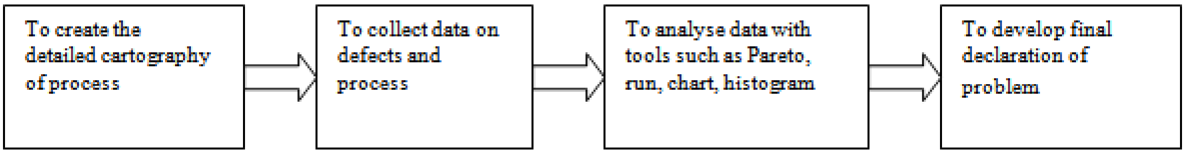
Finally, the customer's requirements are identified, analyzed and prioritized. This phase

Can be presented as below.



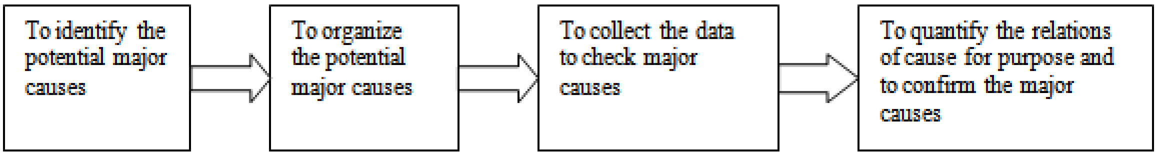
3.2. Measure Phase

During this phase, data are collected to evaluate the level performance of the process and provide information for the subsequent phases. The Six Sigma team decides the characteristics to be measured, the person doing the measurement, the measuring instruments, target performance and sampling frequency. Finally, the process capability is calculated. This measure phase can be resumed as below.



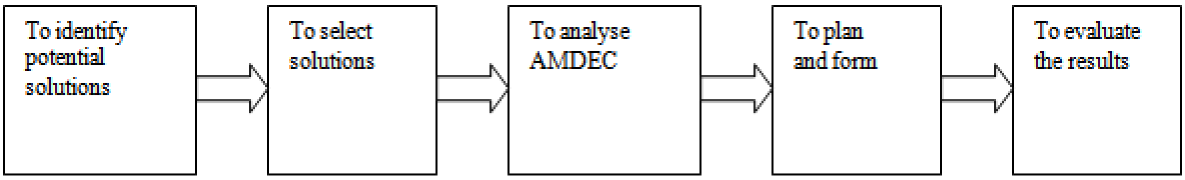
3.3. Analyze Phase

In this phase, Six Sigma team analyses the data collected to find the key variables which cause process variation, and discovers the causes for defects. Alternative ways of improving the process are also evaluated during this phase. The various tools used in this phase are root cause analysis, cause and effect diagram, Pareto charts, failure mode and effects analysis and design of experiments. We can represent this phase by diagram below.



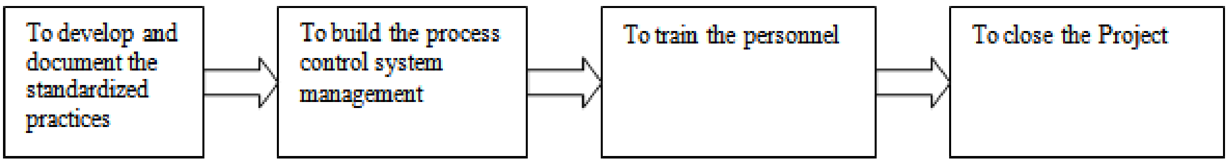
3.4. Improve Phase

Here, the Six Sigma team modifies the process to stay within the maximum permissible range of the performance of the key variables. The process performance has to be monitored and measured. If it is satisfactory, it can be institutionalized. Solutions for process improvement are obtained through process simplification, parallel processing and bottleneck elimination. To improve is a very important phase which can be presented as it is indicated in diagram.



3.5. Control Phase

This phase has the purpose of sustain the improvements established through the previous phases. By using control charts, the critical variables related to the performance are controlled in order to keep an eye on the process performance after improvement. It can be represented as below.



4. Lean Six Sigma Logic

The work is a proposal for a theoretical observation angle in which the first chapters expose it to the literature on Six Sigma and the main features of this approach and outline its history and earnings. In the second chapter describes the Basic Concepts and Foundation logistics particular emphasis on Supply Chain Management in the major implementation of Six Sigma within an organization. The third chapter is focused on the study of the Reference Model of the supply chain and Lean Six Sigma Logic.

The research work focuses on the implementation of a global supply chain that results first by integrating internal business processes to implement a new organization and planning, which is relatively easy if the project legitimized by senior management. Then, by the mastery of new technologies of information flow, which is much more difficult. Finally processes integration of with different partners, which is not easy at all.

Lean Logistics offers today a range of methods and tools that allow significantly improving the efficiency and performance streams upstream and downstream production. Six Sigma Lean comes in supplement to support continuous improvement actions and sustain results. Companies moving in this direction, however, must realize that a break in the thinking and operation must exist to eliminate tirelessly waste, reduce inventory levels and understand how logistics costs overall.

Six Sigma Lean complements to support continuous improvement actions and sustain results. The company wish to develop the concepts of Lean Sigma Chain extent must create adequate infrastructure which will make time shorter cycles, visibility and instant synchronization, flexibility and responsiveness, better cost for all of its networks, in short, a better competitiveness shared.

5. Management of the Supply Chain

5.1. Definition

SCM carries its definition from its basic components namely the organization, processes and flows, its orientation towards customer satisfaction, coordination of all stakeholders to achieve the expected level of performance at the lowest overall cost which performance is constantly measured.

In the literature, several definitions of SCM cohabited and complementary exist. MÜLLER (2003) is considered a "concept developed by companies to provide a response to a client request customized quality and service."

Thus, the SCM's primary goal of removing barriers that limit communication and cooperation among the various members of a supply chain [MÜLLER, 2003]. Taking this principle to better coordinate the various entities in the chain to provide a better response to customer needs, Stadtler et al. (2000) define it SCM as "the task of integrating organizational units throughout the supply chain and coordinate the flow of materials, information and financial in order to satisfy customer demand and improving the competitiveness of the supply chain ".

5.2. Management of the Supply Chain

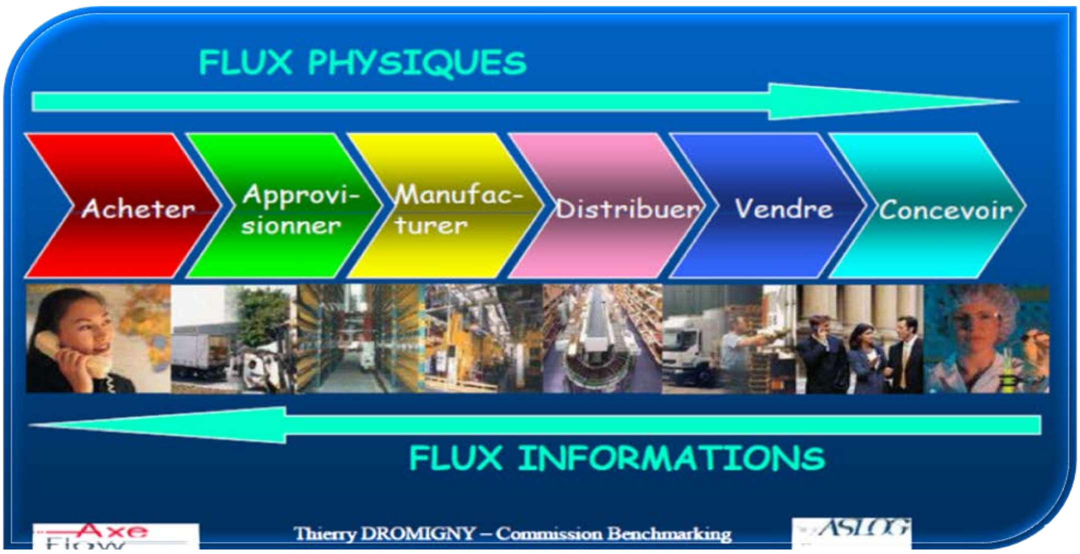
The global supply chains are indeed very complex networks. They are more vulnerable to disturbances that may have a significant impact on profitability and shareholder value. Recent research at Cranfield School of Management has identified where risk sources in the supply chains can lie and how this risk could be mitigated and managed through the application of "Six Sigma" philosophies and procedures.

Lean Six Sigma for the management of the supply chain process improvement offers unique steps to identify and resolve the root causes of supply chain in daily operations.

Lean Six Sigma for the management of the supply chain contains specific information for developing inventory models, measures for the harmonization of objectives with strategic goals, a concise overview of supply chain concepts, and models illustrating how to advance the level of investment of time and customer service demand and impact of the inventory.

Designed to help Six Sigma professionals and frontline managers achieve higher levels of competitiveness, Lean Six Sigma for the management of the supply chain provides the guidelines, tools and techniques necessary to eliminate problems supply chain and improve business performance.

6. Logistics: Strategic Function Cross-company



Globalization, increased competition, mergers, markets and the versatility of the lack of visibility of their end to end supply chain lead firms to reconfigure their organizations to deliver customer service and optimize the resources involved. The ability for the company and its network to be responsive, flexible, effective and efficient to win a competitive advantage requires the adoption of reference models supply chain processes. The SCOR model is a model adopted by the most successful companies.

6.1. Le Modèle SCOR, Vecteur d'excellence de la Supply Chain

6.1.1. Various Business Expectations

In our experience, companies opt to use the model primarily to:

- Support strategic decisions: the SCOR model is an excellent vehicle for implementation of decisions from the corporate strategic planning,
- Provide a consistent framework for measuring their performance: the model helps companies deal with the complexity of organizational structures that generate communication failures and inconsistencies in the construction and use of key performance indicators,
- Contribute to the operations of internal and external integration: the model helps develop cross-flow structures allowing companies to create real pipelines from order entry until payment. It facilitates and initiates Furthermore, the integration of different actors in the chain. The model achieves both vertical integration (from strategy to transaction) and horizontal (end to end) of the string.

6.1.2. The Heart of SCOR

SCOR is a modeling tool. It defines a procedure, process indicators and best practices from time to represent, assess and diagnose the Supply Chain. This methodology is based on the client generic, rigorous, comprehensive and structuring. It is primarily available to the actors of the supply chain and standardized a common language (alphabet, process indicators) that responds to a need for a single definition, in order to accelerate the integration of internal and external companies. The internationalization emphasizes the need and the model helps to make an alignment of subsidiaries, most of the time, culturally very different. In addition, the current proliferation of collaborative projects (forecasting...) reinforces this need for a common definition and standard.

The model allows passing a vision of operations by function, evidenced by the Value Chain Michael Porter, a vision operations per process, which only responds to new economic and financial challenges. The model has an approach called Top Down which establishes the link between business strategy and management of individual orders.

The SCOR model is organized around the needs of the customer (orders, claims, and requests for information. ..) and covers the processes involved in:

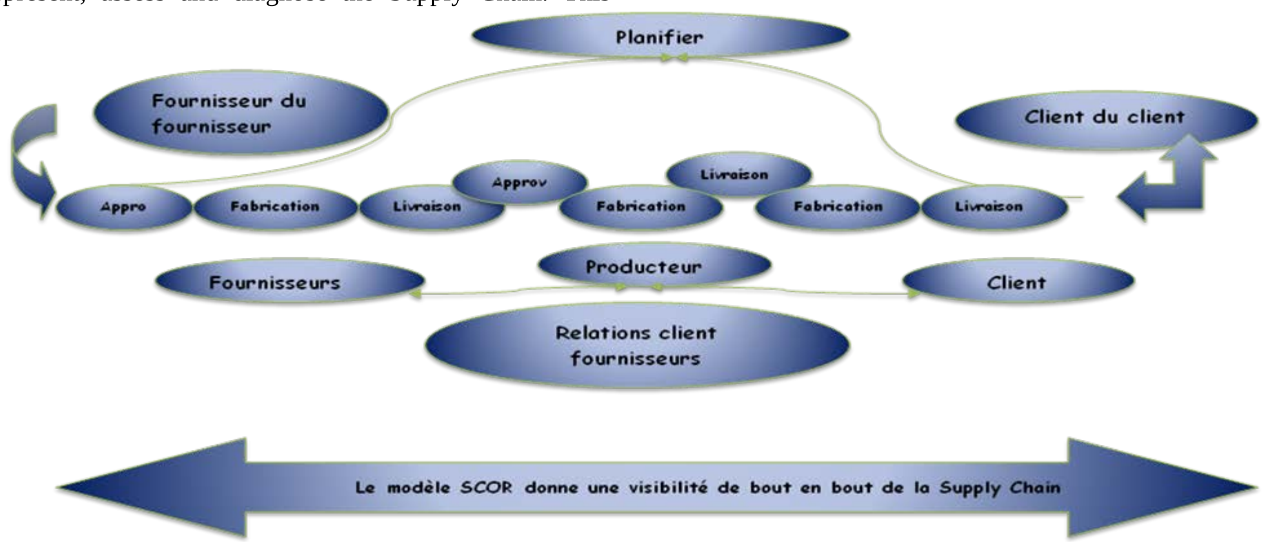
◆ Interaction with the client from the receipt of the order until payment of the invoice,

◆ Exchanges from the customer's customer to the supplier's supplier,

◆ Interactions related to the application since its analysis to the execution of each command.

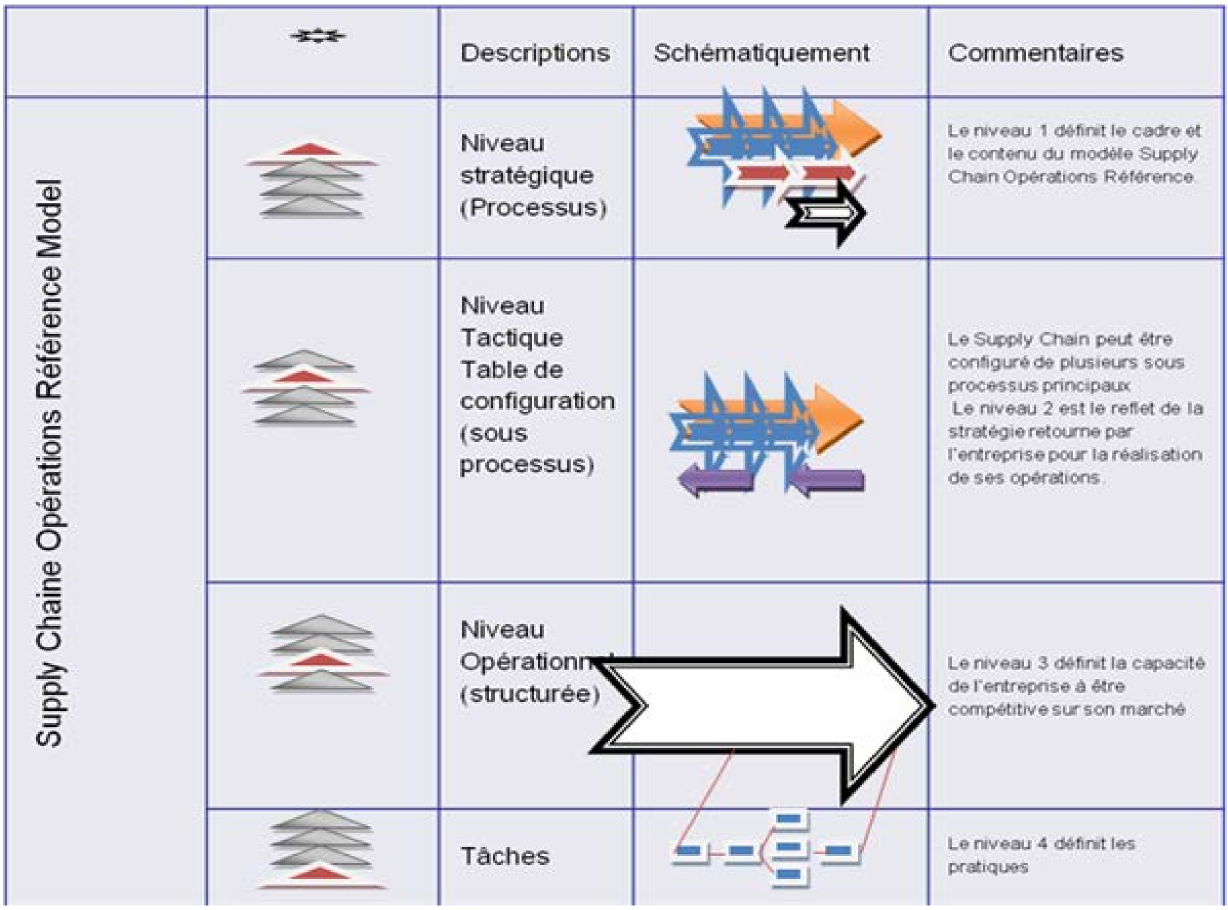
6.2. The SCOR Model

The SCOR model provides the basis for analyzing the performance of supply chain, indicating which problems largely lie and their potential impact on operations. It advocates the combination of SCOR with Six Sigma as they have complementary capabilities, with SCOR providing the basic understanding of supply chain issues, while Six Sigma can be deployed to implement improvement projects.



SCOR defined and codified processes of the supply chain on 3 levels:

- Level 1, and modeling a global supply chain. This level includes six main-processes: Plan (plan), source (supply) Make (produce), Deliver (distribute), Return (return), Enable (bear).
- Level 2, process to subdivide the main processes according to their use.
- Level 3, process element that subdivides the process activities.



7. Project Context

7.1. The Background of the Company

We present in this part our practical study in the company Coca Cola (the filial SFBT in Tunisia), our study is based on the optimization and reduction of water consumption, by applying the tools of the method Six Sigma like Pareto, the histograms, diagram causes effect (Ishikawa), control charts and AMDEC.

SFBT: refrigerating company and brewery of Tunisia: its registered office is located at Bab Sadoon and it installed another sites of production and sale in various areas.

- SFBT Sfax
- SFBT Mahdia
- SFBT Charguia.

7.2. The factory of SFBT is made of three lines of production

- A line for the family production (1 L) with a capacity of 60,000 bottles per hour (HK)
- A line for the standard production (small size) with capacity surroundings 24,000 bottles per hour (SIG).
- A line for the production of bottles out of with a capacity of 70,000 bottles per hour (PET).

The management, therefore, sought a systematic approach to achieve this improvement goal. This study proposes a model to implement the DMAIC Six Sigma approach and demonstrates that not only can the customer benefit, but the organization may also improve its business processes by making a performance commitment to Six Sigma quality.

A review of the customer complaints records determines that too much time has been spent taking the development of the design deliverables out of engineering. Four problem areas have been recognized in which the DMAIC Six Sigma approach could affect improvements if applied to engineering design. The four problems are defined in the following subsection. A description of the production phases can be indicated by the next figure.

Water overall consumption in Tunisia (2006) is 337.1 mm^3.

And the use in food activity: 9.5 mm^3.

As well as the quantity of water used in group SFBT (2004) is: 1,956 mm^3 = 20.6 % of the food activity = 6.11 % of the industrial use.

At the beginning of 2011, the fixed objective of SFBT Sfax is the reduction of the water consumption by the elimination of the losses, the recovery and the recycling of the water of the various points of consumption. In 2011, the SFBT reached a ratio of 3.75 L\LPF, which is still high. The Six Sigma integration in 2012 can reduce the total ratio of water consumption lower than 3 L\LPF.

The process of water production treatment can be resumed as:

- Entered element: water
- Exit element: production water.

The city water will not be directly used, it will undergo treatments. After this treatment, one obtains the water of softened production and water. In Figure 3 and Figure 4, we indicated both process of water treatment and the water company circuit.

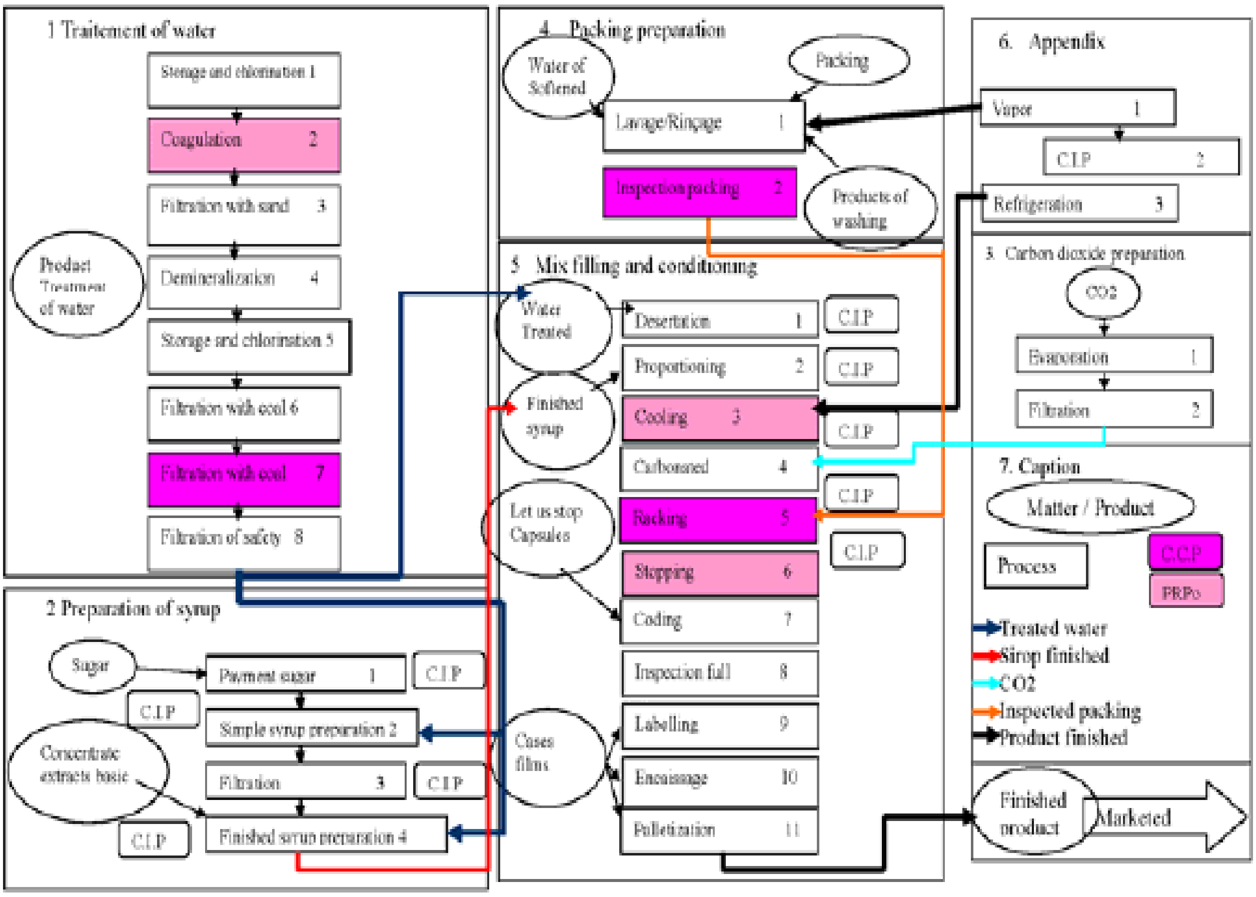


Figure 2. Production phases of Coca Cola (see online version for colors)

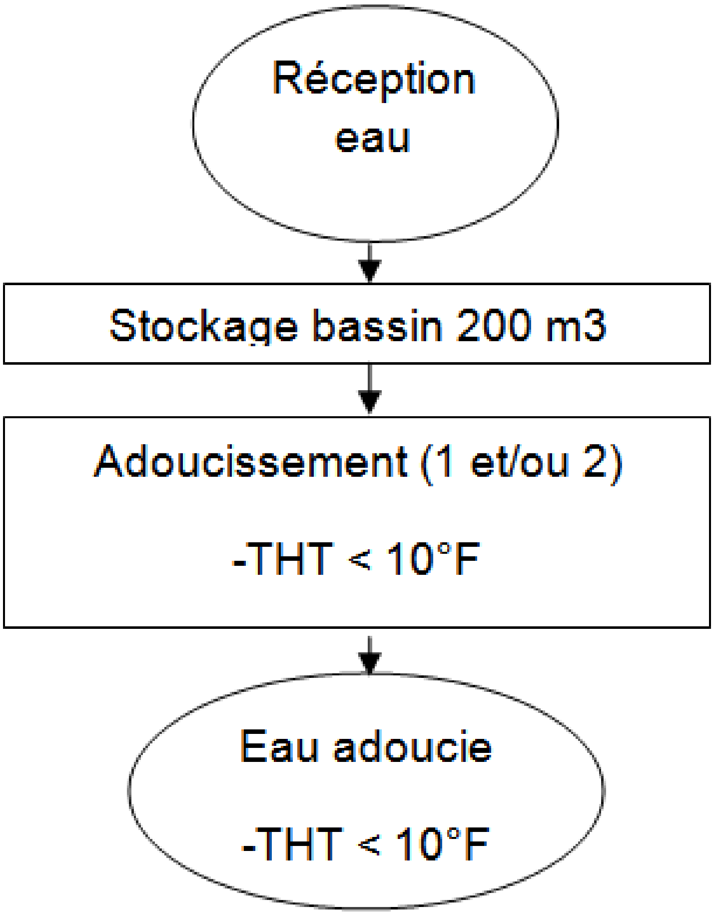


Figure 3. Water process treatments

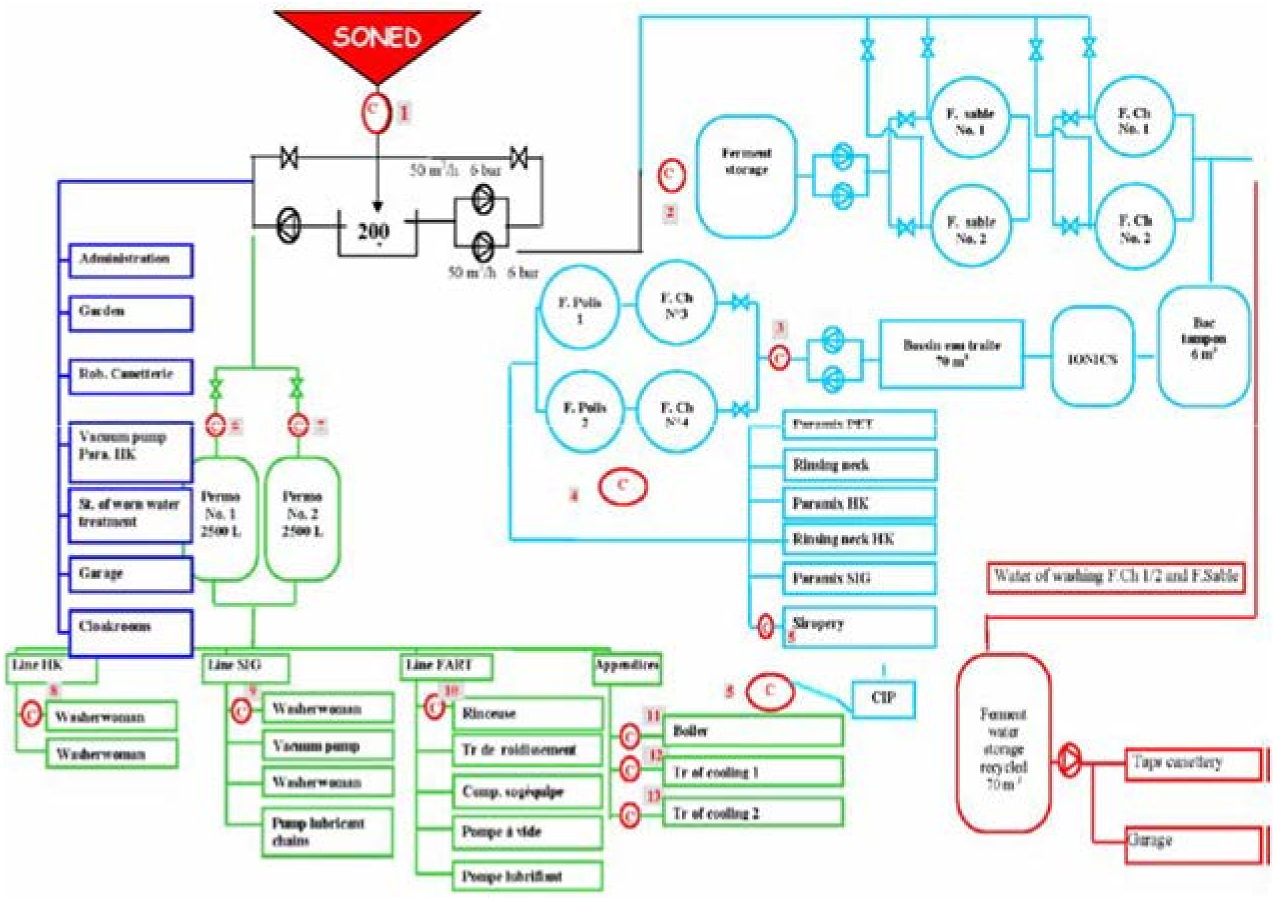
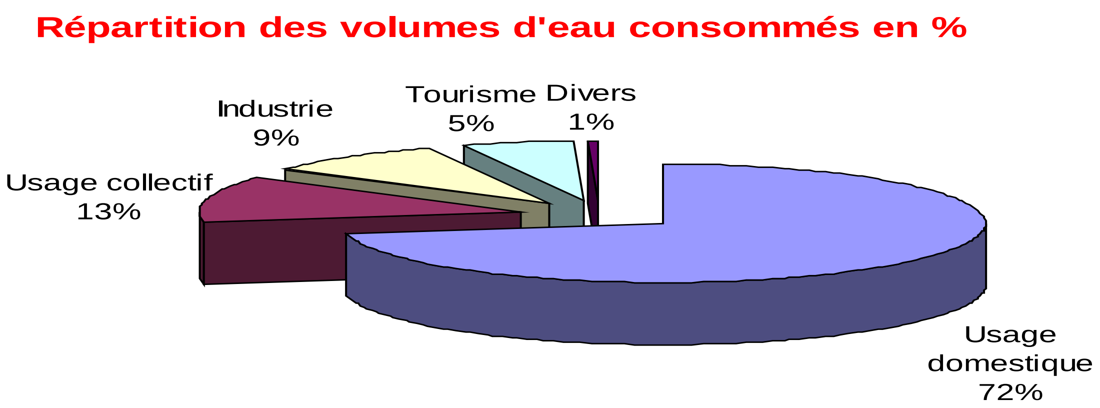


Figure 4. The company water circuit (see online version for colors)

7.3. Total Water Consumption in Tunisia (2011) was 337.1 Million m³

- Use in the food business: 9.5 Mm³
- Use SFBT: 1,956 million m³ = 20.6% of the feeding activity = 6.11% for industrial use

a). Changes in the Ratio of Water Consumption between 2009 and 2012

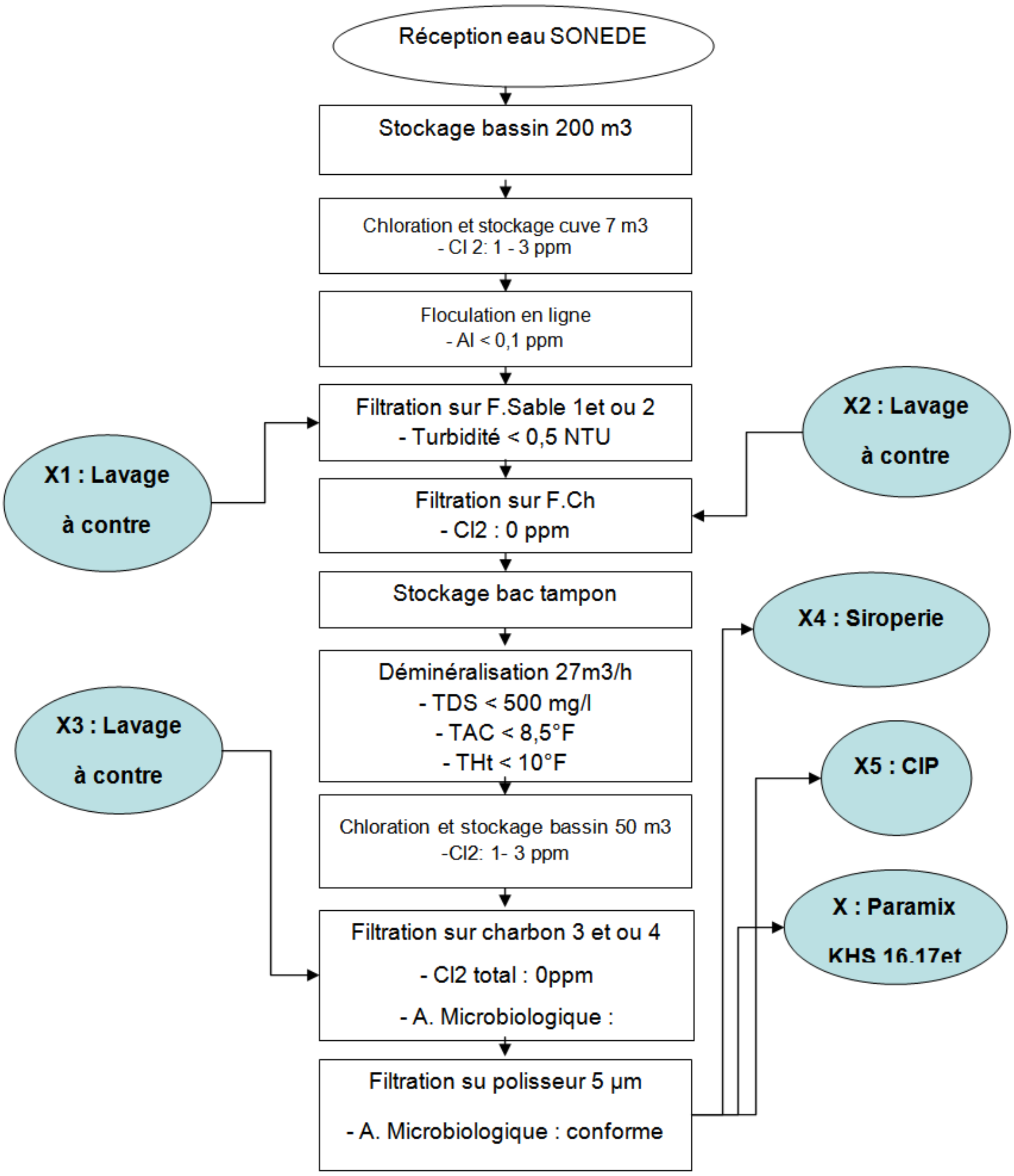


b). Evolution of tea water consumption ratio between 2005 and 2007 (see online version for colors)

CTQ Client

Client	CTQ	Validation CTQ	Spécification
Production Direction	Quantity: Quality water production Quality water processus Ratio minimal	Pression Débit TDS, TH, TAC, Chlore, Turbidité, THT Benchmark (Usines groupe SFBT)	6 bar TDS < 500 mg/l, TH<10 °F, chlore=0 ppm, Tur < 0.5 NTU, TAC< 8.5° F THT < 10°F, 2,5 < R < 7,5

a. Points of consumation identification



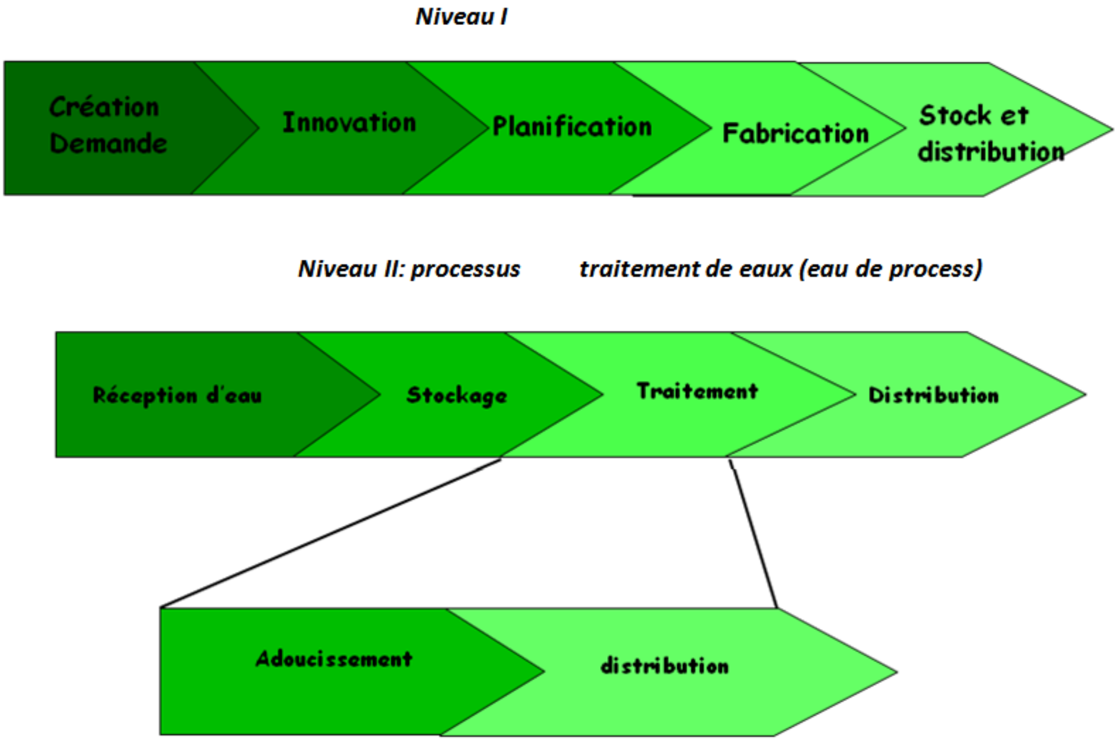
b. Identifying points? Consumer to follow

Xi	Points de consommation
X1	Lavage filtre a sable
X2	Lavage filtre a charbon N°1
X3	Lavage filtre a charbon N°2
X4	Siroperie
X5	CIP
X6	Régénération des adoucisseurs
X8	Laveuse HK
X9	Laveuse SIG
X10	Rinceuse PET
X11	Chaufferie
X12	Tours de refroidissement

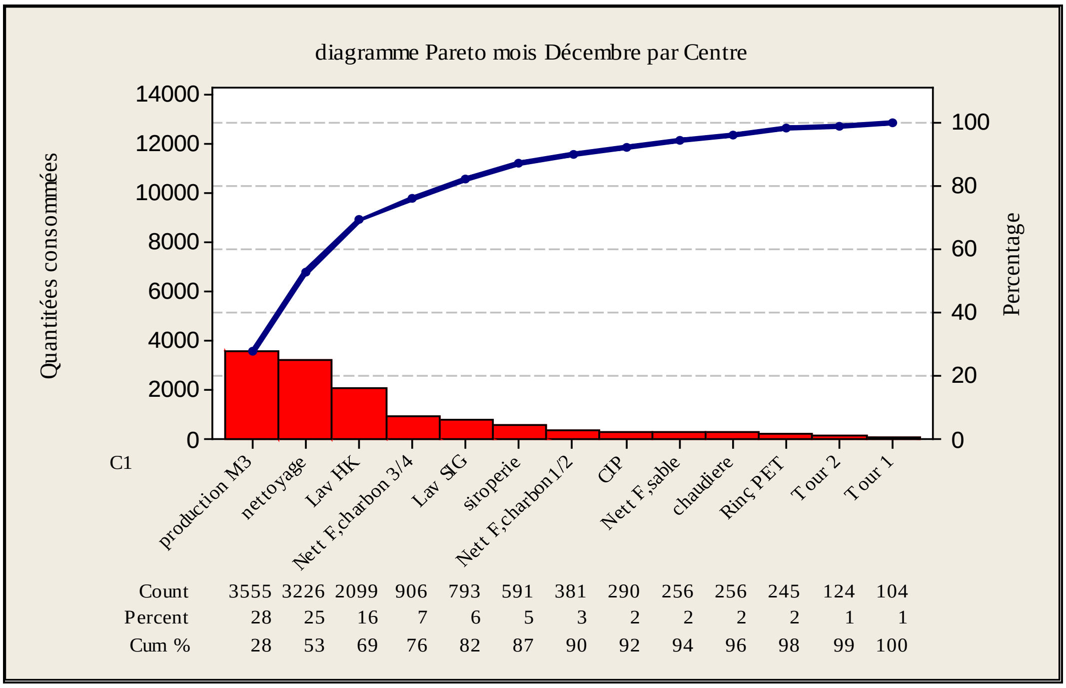
c. Map data collection

Quoi?	Où?	Comment?	Qui?	Quand?
X1	Trait d'eau	Compteur 2	Op trait eau	Chaque lavage
X2	Trait d'eau	Compteur2	Op trait eau	Chaque lavage
X3	Trait d'eau	Compteur3	Op trait eau	Chaque lavage
X4	Siroperie	Compteur4	Siropier	Chaque jour
X5	Salle CIP	Compteur5	Siropier	Chaque jour
X6	Trait d'eau	Compteur6/7	Op trait eau	Chaque régénération
X8	Ligne HK	Compteur8	Graisseur	Chaque jour
X9	Ligne SIG	Compteur9	Graisseur	Chaque jour
X10	Ligne PET	Compteur10	Graisseur	Chaque jour
X11	Chaufferie	Compteur11	Op chaufferie	Chaque jour
X12	Prés salle machines	Compteur12/13	Op SM	Chaque jour

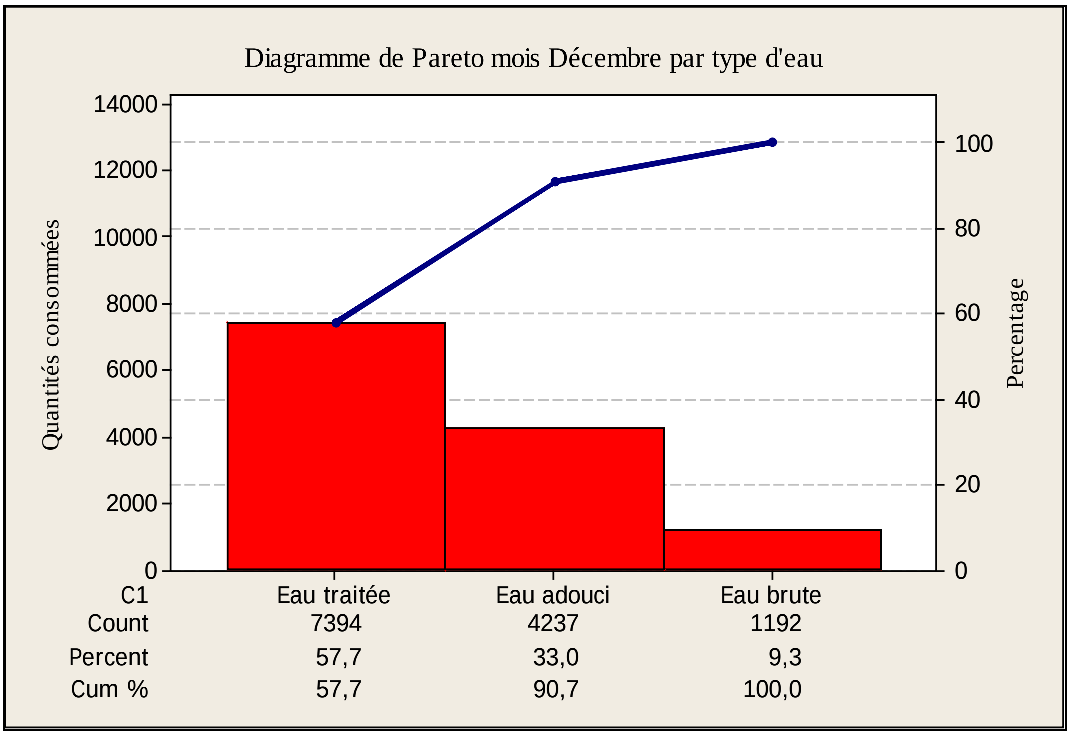
c). Process diagram snake



d. Pareto diagram month December 2011? Consumption by center



e. Pareto diagram month December 2011? Water consumption by type



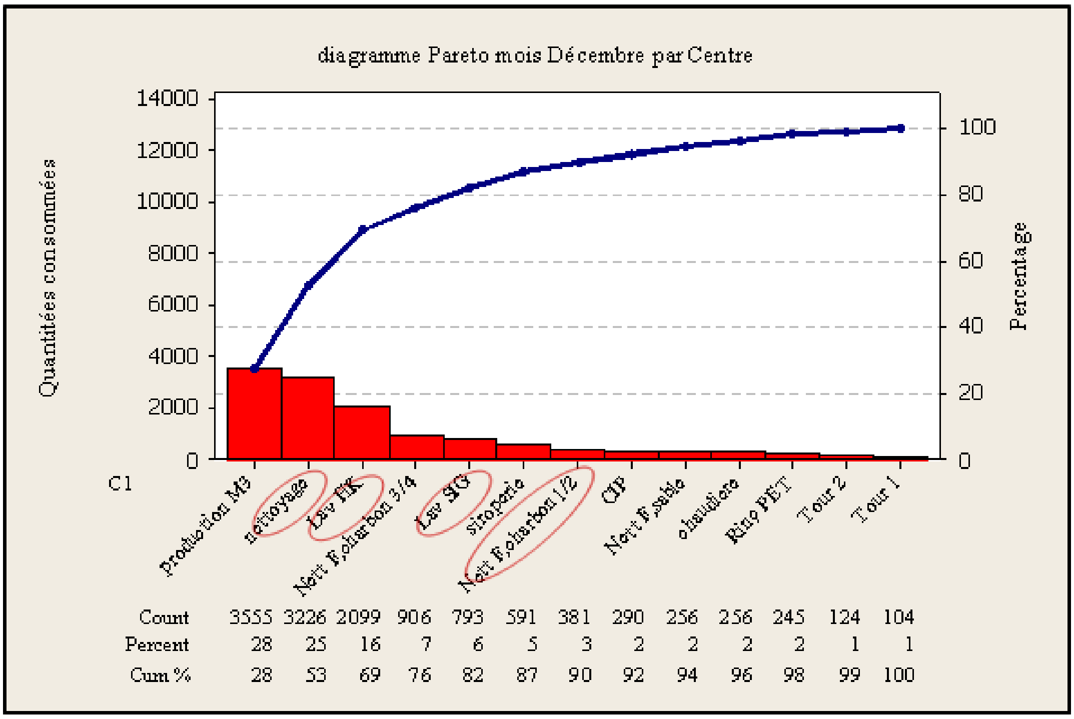
f. Action Plan

- Purchase and installation of meters at missing the syrup room, dining CIP, cooling towers 1 and 2.
- Changing the counter washer HK
- Creation of tracking forms for each service counters
- Monitoring of water consumption parameters washers (pressure, flow)
- Monitoring of operating cycle carbon filters 1 and 2 of the sand filter and measuring parameters of water quality at their outputs.
- Measurement and verification of the results of water quality parameters (laboratory analyzes verified by Bureau Veritas).

g. Improvements made

- Installation and commissioning of water-saving washer at HK (stop water way back in the final rinse nozzles) (29.01.2012 + weeks followed).
- Connect the input of the washer boxes GIS with prewash bath of washer bottles (08/02/2012).
- Reduced pressure-rinse bottle washer at SIG (1 bar to 0.8 bar). From 08/02/2012
- Change the frequency of cleaning carbon filters and filter sand daily to weekly (depending on Δ P <0.5 bar). Month in January 2012.

h. Pareto diagram month December 2011

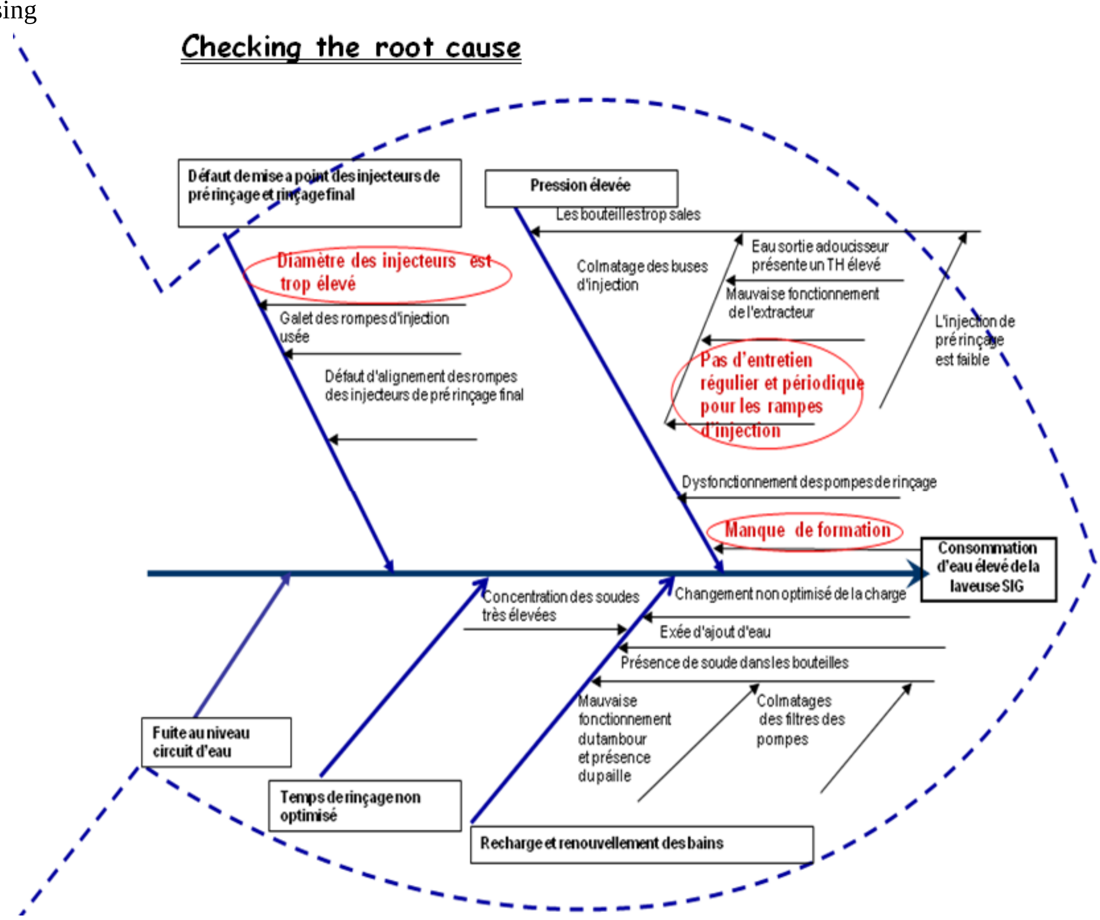


i. Checking the root cause

To apply the brainstorming method, one used the method by turn which best characterizes by an idea which advances by turn until everyone passes. And the end of the meeting there is noted these differentials problems which can beings the causes of the problems for the two Washerwomen (SIG and HK):

- The tubes are clogged
- Diameter of the injectors is widened too much
- Washerwoman in stop and rinsing functional finale
- High water pressure
- Reload baths and renewal
- Pump pre-washing or pre-weak rinsing
- Water leakage on the level of closings of the baths
- Escape on the level circuit of water
- Soda concentration is high
- The alveolus which passes without bottle
- Diameter of the tubes not optimized
- Misalignment of break final rinsing and pre final rinsing
- Operating time of the tubes of final rinsing not optimized. For treated water:
- Badly functioned frequency
- High water pressure
- Time contacts of the high filters and signal
- Cycle washing not optimized
- Dysfunction of the gauges level of vat tampon and ferments storage
- Water leakage on the level of the valves (led)
- resin damages on the level of the softener
- cip not optimized
- Water loss on the level of pile
- Calibrations of the flow meters
- Too low TDS on the level of adjustment left the Ionics
- Escape on the level circuit/water valves.

j. Checking the root cause



k. FMEA

Checking causes effect allows us to identify the underlying causes that can beings as factors for possible solutions to our problem, applying FMEA in the next phase.

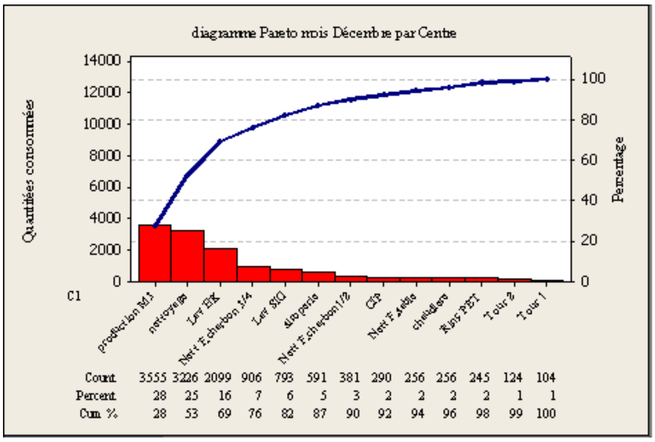
Non Detection	
Note D	Critères
1	Détection immédiate par un compteur suivie par heur/jour
2	Détection difficile (utilisation des compteurs non suivie par heur/jour)
3	Absence de contrôle ou détection
Gravity	
Note G	Effets
1	consommation d'eau est < à 160 m
2	160 m <consommation d'eau < 383m
3	consommation d'eau est > à 383m

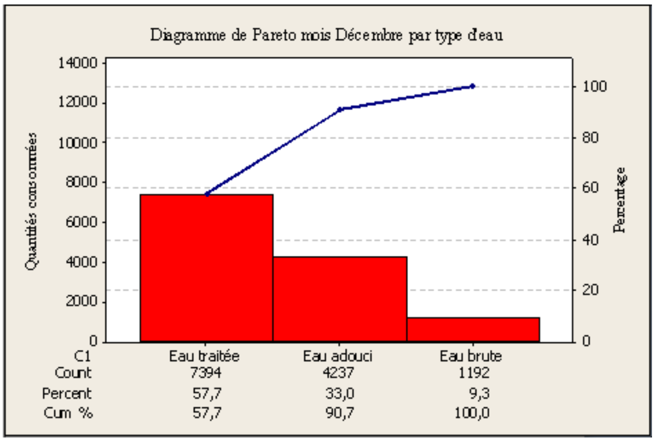
Etape de processus	Mode de défaillance potentiel	Effet potentiel de la défaillance	Gravité	Cause (s) potentielle	Occurrence	Contrôle actuel	Détection	Criticité	Action proposée	Action prise	Gravité	Occurrence	Détection	Criticité
Réduction de la consommation d'eau de laveuse HK	Pression et quantité d'eau consommée très élevées	Perte d'eau et gaspillage		Pas d'entretien régulier et périodique pour les rompes d'injection		Inspection visuelle	3	9	Vérification régulier de rompes d'injection et planning de maintenance	Les rompes d'injection ont été vérifiés	2		1	2
				Défaut de l'opérateur		Inspection visuelle	2	6	Former la personne	Tous ont été formés	2		1	2
				Fuite d'eau		Inspection visuelle	3	9	Vérification régulier de circuit d'eau et planning de maintenance	La vérification régulier de circuit d'eau et planning de maintenance a été effectué	2		1	2
			3	Pas d'automatisation du rinçage finale		Aucun	3	9	Automatisation du rinçage finale	Automatisation et diminution de la pression du rinçage finale	2		1	2
Réduction de la consommation d'eau de laveuse SIG	Pression et quantité d'eau consommée très élevées	Perte d'eau et gaspillage		Diamètre des injecteurs est trop élevé		Aucun	3	9	Diminution des diamètres des injecteurs et de la pression du rinçage finale	Les diamètres des injecteurs et la pression ont été diminués	1		1	1
				Fuite d'eau		Inspection visuelle	3	9	Vérification régulier de circuit d'eau et planning de maintenance	La vérification régulier de circuit d'eau et planning de maintenance a été effectué	2		1	2
				Défaut de l'opérateur		Inspection visuelle	2	6	Former la personne	Tous ont été formés	2		1	2
			3	Pas d'entretien régulier et périodique pour les rompes d'injection		Inspection visuelle	3	9	Vérification régulier de rompes d'injection et planning de maintenance	Les rompes d'injection ont été vérifiés	2		1	2
Réduction de la consommation d'eau de la salle de traitement d'eau	Quantité d'eau consommée est très élevé	Perte d'eau et gaspillage	3	Pas de recyclage		Aucun	2	6	Installation de récupération de l'eau de rejet de l'IONICS	La récupération a été effectuée	2		1	2
				Fuite d'eau		Inspection visuelle	3	9	Vérification régulier de rompes d'injection et planning de maintenance	Les rompes d'injection ont été vérifiés	2		1	2
				Fréquence de lavage élevé		Contrôle effectuer au laboratoire	3	9	Diminution de la fréquence de lavage des filtres	La fréquence de lavage des filtres a été diminué (une fois par semaine)	1		1	1
				Sur dimensionnel de temps de lavage		Inspection visuelle	3	9	Former la personne	Tous ont été formés	2		1	2

l. Estimation of directs gains

- Objective: Reduce the ratio of water to 3 L / LPF Meet production quantity and quality.
- Financial gains: 2011 Ratio: 3.75 L / LPF
- Economy projected: G = 0.75 L / LPF
- Production drink in 2011 = 49,833 m3
- Gain = 49 833 * 0.75 = 37 375 m3 in dinars: Gain ≈ 62 000 DT

m. first results





n. economic performance

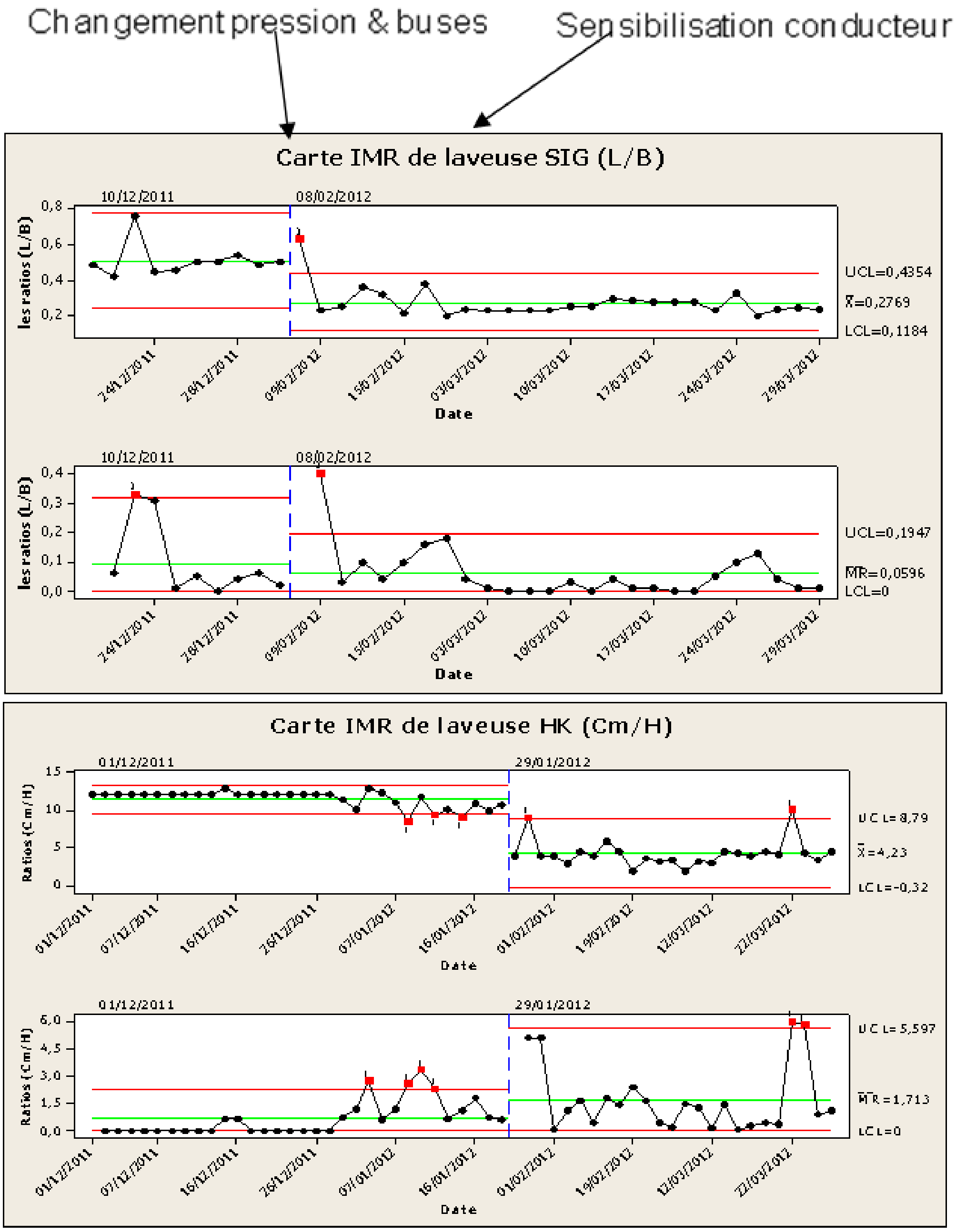
The first calculations of the economic project in the first four months of 2012 are 30.613 DT.

Mois	production 2012	Ratio 2011	Ratio 2012	R1 - R2	(R1 - R2)*P	PU (DT)	Total gains
Janvier	3330,60	3,72	2,84	0,88	2930,93	1,656	4853,62
Février	565,40	5,68	2,94	2,74	1549,20	1,656	2565,47
Mars	2696,74	5,74	3,00	2,74	7389,07	1,656	12236,30
Avril	4659,92	4,12	2,70	1,42	6617,08	1,656	10957,88

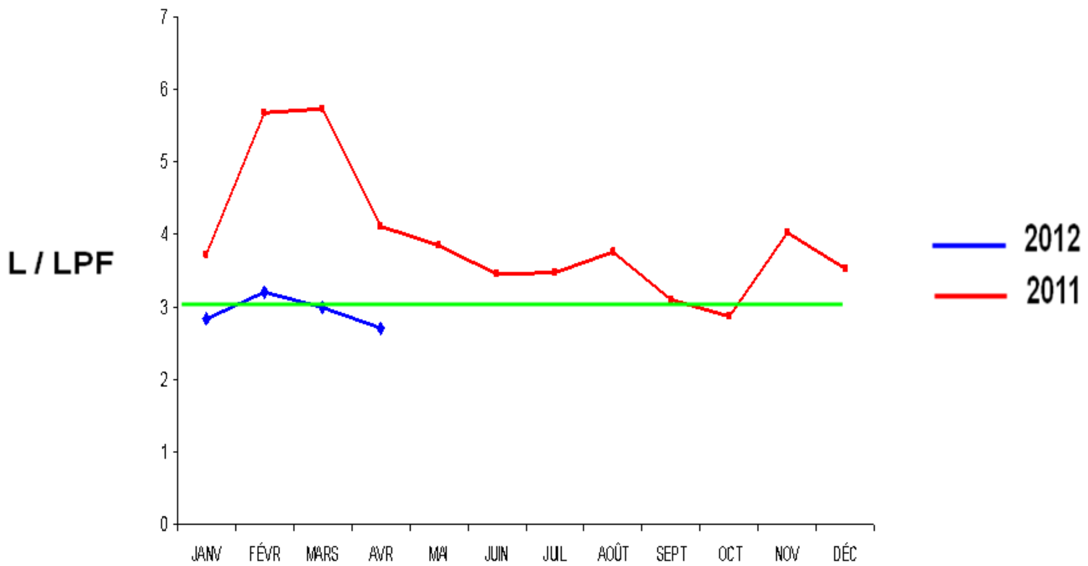
o. Verifying the results of improvement? Your washer

$$C_M = \frac{Q\_consomme\_par\_jour}{H\_de\_production}$$

$$R_L(HK) = \frac{consommation\ \ journaliere\ de\ laveuse\ SIG}{Nombre\ de\ bouteille}$$



p. The evolution of the ratio of water consumption after upgrading



8. Conclusion

The Six Sigma project has enabled the company to achieve the previously determined and focused on reducing water consumption at a ratio of 2.7 L / LPF.

Six Sigma thinking offers the potential to refine the current approach to improving supply chain. The Six Sigma complements the SCM to support continuous improvement actions and sustain results. The results of this project satisfactorily applied to the reduction of water consumption led SFBT SFAX Six Sigma to replicate on other projects such as reducing energy consumption, improving yields lines production and decrease waste of raw materials.

After these presentations of the basic principles, it is by experiment, that the whole of the processes varies from one day to another and never repeat same manner. What one notes in the everyday life is true also for the industrial and administrative processes. Until now, the methods of analysis and the traditional tools used make it possible to reach only results, in term of availability, quality, about 95% to 98% according to mediums'. To arrive at a level of result measured in percent, can satisfy some but to progress of a point does not represent the whole of the efforts to make to arrive at the desired results.

It becomes essential to change vision in order to be interested in the variability of the processes and their control in order to progress in a notable way towards excellence. The power of Six Sigma lies in its 'empirical' approach, controlled by the data (and the use of quantitative measurements to check the manner whose system behaves) to achieve the objective of improvement of the process and the reduction of dispersion. This takes place by the application of projects known as 'of improvement Six Sigma' which, in their turn follow the series of stages 'DMAIC of Six Sigma', to define (which is the defect, to identify the projects according to the key characteristic), to measure (to determine which measurement associated with the defect observed), to define an action plan which helps to identify the sources and the potential causes of the defects, to analyze (to determine which are the potential causes of the problem which affect the key characteristics), to improve (to improve the process or the product, to eliminate or control the sources of variation which affect the key characteristic) and to control (to control the process the stability and of capability).

These indices enable us to obtain good interpretation and to make the adequate decisions in the companies and specifically within the company SFBT Sfax, of which the goal to improve the process by reducing the quantity of water consumption and to minimize the wasting and the loss of water. This improvement is effective since the same quality of water was kept and to achieve the goal. To apply this step and to check the results obtained, we used the tools of quality like Pareto, the histogram, the curves and the control charts using the software like Sigma XL, Minitab 14 and AMDEC. The excellent results of this project applied to the reduction of the water consumption led Coca Cola to apply Six Sigma to other projects such as the reduction of the consumption of electricity, the improvement of the outputs the lines of production and the reduction in the raw material losses.

The application of Six Sigma proves the industry is a small step towards an energy economy. Once Six Sigma finds its rightful place in the energy-intensive process industry, enormous gains can always be expected from its application. It is found that the Six Sigma methodology is highly beneficial to improve the performance of any thermal power plant. A higher consumption of DM water is found to be a big problem in a thermal power plant. The causes for more DM water consumption are SWAS, problem of valve passing, vacuum pump overflow, etc. SWAS makes a big impact, having a 33% contribution to DM water consumption. The mean make-up DM water is expected to go down below 0.5%, which is substantial for any thermal power plant. It is revealed that the application of the Six Sigma project recommendations brought up the sigma level to 1.63.

The estimated savings from the project after the implementation of all recommendations are expected to be around 0.8 million dollars per annum. The DM water make-up consumption is an isolated example of energy conservation measures in a process industry.

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