Vol.3 Iss.2 pp.80-96 **Journal of Operational Management & Marketing Strategies (OMMS)**

Implementation of the DMAIC-Lean Six Sigma approach to reduce the waste rate

Sahbi dkhili[#]1, Ameni Ben Dkhil[#]2

[#]*Department of Economics and Management, ISET Kairouan*
University Campus 3199 Raccada – Kairouan, Tunisia

[1]dkhilisahbi@yahoo.fr
[2]bendkhil1998@gmail.com

***Abstract*— our research objective in this article is to contribute to the implementation of a project to improve production, by reducing the rate of waste, within the Tunisian Cardboard Company (TCC), at through the application of the DMAIC approach of Lean six sigma**

To achieve this objective, we will use a methodological approach, in which the first part of this article will be reserved for the literature review of Lean six sigma concepts and its tools. The second part will present the results recorded from the implementation of a Lean six sigma- DMAIC approach for reducing the waste rate in the TCC Slitter workshop.

Keywords— Lean six sigma, DMAIC, waste, control chart, capability, 6S.

I. Introduction

Nowadays, faced with an increasingly competitive industrial sector, and a clientele which is becoming very demanding for high quality products, the Tunisian company, in general, and in particular the case of our company TCC, must concentrate its efforts on the research of methods and means appropriate to obtain the targeted quality and competitiveness while minimizing its various costs and charges.

As a result, and with this objective of improving quality in its production workshop, this work attempts to answer the following problem: how does the implementation of a DMAIC Lean Six Sigma approach allow reducing the waste rate, and thus improving production within the Tunisian Cardboard Company.

II. Theoretical framework of the Lean six sigma method

A. Presentation of the Lean Six Sigma method [1]

Lean Six Sigma is the combined application of two concepts: Lean and Six Sigma.

1) Lean: aims to eliminate tasks without added value, to simplify processes by increasing fluidity, flexibility, agility, in order to increase the value defined by the customer and thus contribute to improving the company's performance.

2) Six Sigma: aims to reduce the variability of processes in order to make them more reliable, stable and predictable, and to ensure "perfect" reproducibility of the process to move towards zero defects and customer satisfaction. The name Six Sigma refers to the statistical concept of standard deviation. On a distribution curve following the normal law (figure 1), the Six Sigma approach uses the probability of obtaining each time a result within 6 times the standard deviation. This means that we aim to have 99.9999998% of the results within a lower and upper limit corresponding to the calculation of 6 times the standard deviation.

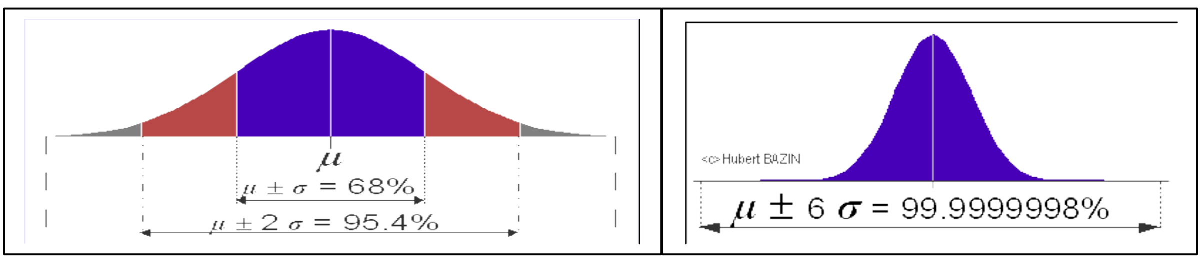

Fig. 1: Six Sigma on a normal distribution.

ISSN: 2961-662X

3) Lean Six Sigma is the alliance of the two concepts which link the notions of productivity (Lean) and quality (Six Sigma).

In summary, the application of the Lean Six-Sigma method allows the increase in the company's turnover by:

- Reducing non-quality costs by reducing the number of rejects and reprocessing,
- Optimizing the availability of machines in production,
- Increasing market share through customer satisfaction

B. Lean Six Sigma and problem resolution tools

1) DMAIC: DMAIC is a continuous improvement approach used to manage projects in a structured manner.

Fig. 2 DMAIC approach [2]

Each of these phases is clearly defined and the implementation can easily combine tools that come from Lean Six Sigma and diagnostic and problem solving tools are associated with each of the phases of DMAIC (for example; 6S, QQOQCCP, Brainstorming, Ishikawa diagram, Pareto diagram, control chart, capability, etc.). [3]

Fig. 3 Tools and methods used in the DMAIC approach [4]

ISSN: 2961-662X

2) WWWWWHW: also called the questioning method, is a problem-solving tool comprising an almost exhaustive list of information on the situation. [3]

TABLE 1:
THE 5W AND W

Letter	Question	Sub-question	Examples
W	What?	What's the problem?	Periodicity, deadline, date, duration, etc.
W	Who?	From whom? On whose behalf?	Person, manager, department, chain,
W	Where?	Where is the problem located?	Place, stage, stadium, etc.
W	When?	From when? Until when?	Periodicity, deadline, date, duration, etc.
H	How?	How did it happen?	Procedure, means, manner, methods, technique
W	Why?	Why do it?	Cause, reason for being, objective, …

3) Brainstorming [3]: is a creativity tool, which is practiced within the framework of a working group; and on a given theme to produce a maximum of ideas in a minimum of time, in pleasant conditions and takes place in accordance with the rules:

- Say it all (variety, diversity);
- Say as much as possible (quantity takes precedence over quality);
- Plunder the ideas of others (analogies, variants, oppositions, opposites, etc.);
- Do not comment, do not censor, do not criticize the ideas expressed;
- Participate in a good mood.

4) Weighted voting: Weighted voting is practiced in a working group, the objective of which is to determine the relative importance of criteria in descending order of importance. [3]

When the factual evaluation of the criteria of a list is not possible or difficult, weighted voting is based on the life and experience of the participants in the working group in order to identify which ones seem to be the most important.

5) Ishikawa diagram) [3]: (also called fishbone diagram) is practiced in a working group.
It consists of classifying by family the causes likely to have an effect into five or six categories (5M/6M), all starting with the letter "M": Machine, Methods, Materials, Manpower, Environment, (and Measurement), in order to seek relevant solutions.

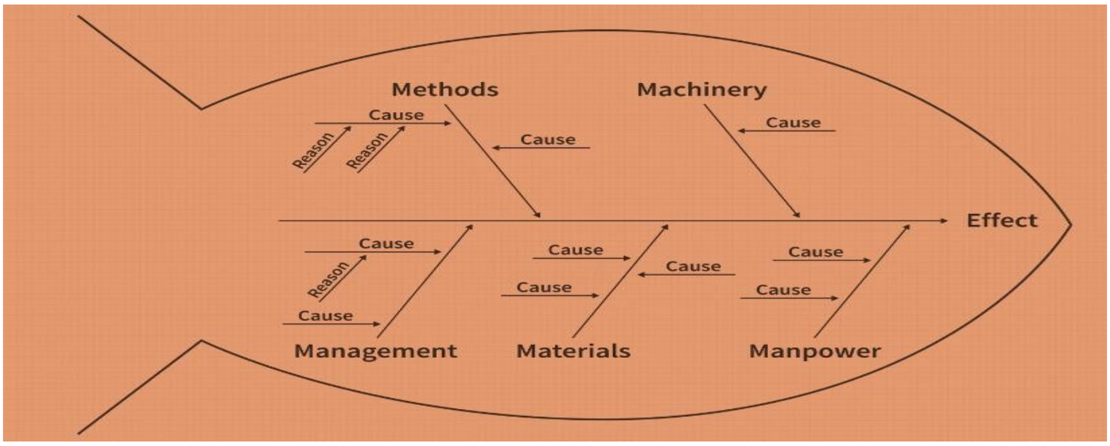

Fig. 4 Ishikawa Diagram **[5]**

The problem (effect) is clearly defined and the possible causes are classified on the diagram according to their category:

- ***Manpower:*** brings together the causes linked to human execution failures and training failures on direct and indirect workforce.
- ***Methods:*** must be understood in the broad sense (this includes product/process design), and includes in particular instructions, manuals, procedures.
- ***Environment:*** brings together the causes linked to the process environment (ambient conditions, cleanliness), physical environment, lighting, noise, layout, relationships, suppliers, market, and legislation.

ISSN: 2961-662X

- ***Machines :***brings together all the equipment used, that is to say the machines, the tools, their capacity, their age, their number and their maintenance, the control tools.
- ***Material***: includes everything related to identification, storage, quality, physical characteristics, handling of raw materials, packaging, parts, assemblies, supplies, etc.

6) The 6S method (7) and (8)

Fig 5. The 6 S [7]:

The 6S represent one of the first management techniques to be implemented to initiate a total quality, just-in-time or continuous improvement approach. Work cannot be effective (quality, performance, safety) when it is carried out in a messy, dirty and cluttered environment.

- **Objective: Build** a functional working environment, governed by precise rules so as to work in efficient conditions.
- **Challenges**
  - Improve quality.
  - Improve security.
  - Promote teamwork.
  - Improve professionalism.
  - Improve the company's image.
- **The 6 S**
  6S is a method used to create and maintain a clean, orderly, and safe work environment. It consists of:
  1. Sort (Get rid of it): Separate what is needed in the work area from what is not; eliminate the latter.
  2. Set in order (Organize): Organize what remains in the work area.
  3. Shine (Clean and solve): Clean and inspect the work area.
  4. Standardize (Make consistent): Standardize cleaning, inspection, and safety practices.
  5. Sustain (Keep it up): Make 6S a way of life.
  6. Safety (Respect workplace and employee): Create a safe place to work.

ISSN: 2961-662X

7) *Visual management*: The common Lean concept of visual management is based on the use of visual indications to guarantee the smooth running of activities. Thus, looking at the process, a part, a pile of stock, information or an operator carrying out a task makes it possible to immediately identify the standard used and the possible existence of a deviation (Liker, 2004).

8) *The control chart*: is a decision support document in progress, allowing the recording of control results by sampling collected at the workstation. It allows you to graphically visualize dimensional variations and determine the appropriate times for adjustment.

The control chart has three lines: a central line and two control limits:

- The central line (LC): represents the average of the monitored statistic.
- The upper control limit (LCS) and lower control limit (LCI): are set so that during normal operation, almost all values of the sample statistic fall within the control limits.

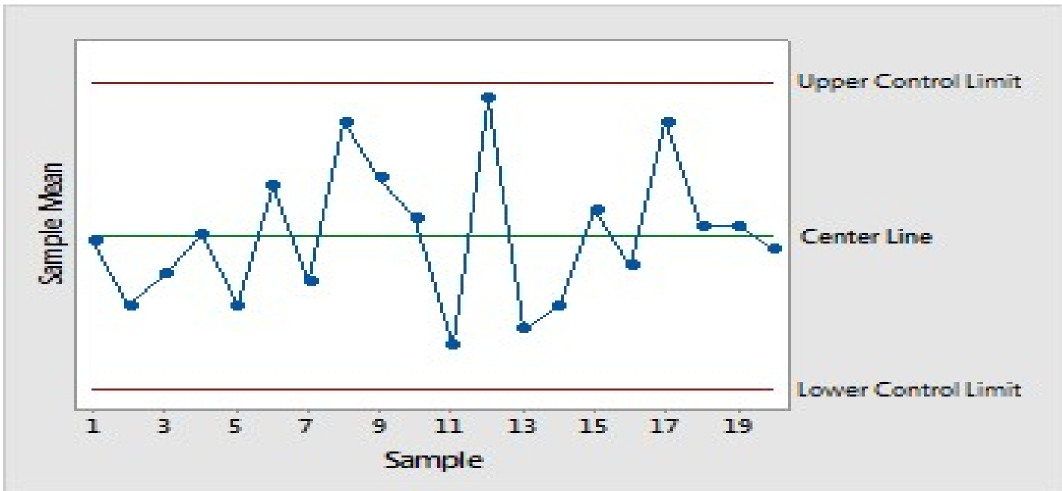

Fig. 6 Example of control chart [9]

9) *Capability* [10]

- Process Capability: the ability, the capacity of a process to respect specifications, to constantly achieve the desired level of quality. The Process Capability Index (Cp) provides an indication of the performance of a process relative to allowable limits; this unitless number indicates the relationship between dispersion (process variability) and the range between tolerances. The larger this number, the more "capable" the process is. The lower the index, the more the variability extends towards the limits, or even exceeds them.
  We calculate the capability (noted Cp) by the ratio: tolerance interval / dispersion
  With: UT = upper tolerance, LT = lower tolerance
- The Cpk is a process capability indicator which measures the offset from the average

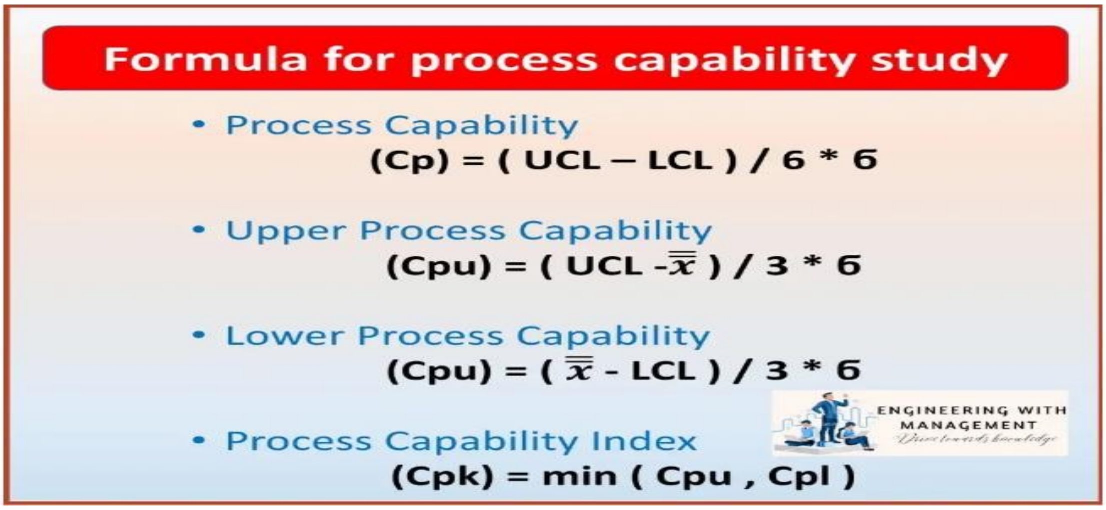

Fig. 7 Capability calculation formulas [11]

ISSN: 2961-662X

II. PRACTICAL FRAMEWORK OF THE LEAN SIX SIGMA APPROACHE

A. *Research methodology*

1) *Research method and objective:* The research method used in our work is applied research, through the case study of the Tunisian Cardboard Company, and which aims to apply the DMAIC of Lean Six Sigma approach, in order to determine the production problem(s) within the Slitter workshop, and to make the appropriate improvements, for the reduction of the average waste rate from 16% to 10%

2) *Research hypothesis*

- Hypothesis 1: production problems are associated with techno-human causes;
- Hypothesis 3: the success of a Lean Six Sigma project is dependent on management commitment and the application of 6S best practices.
- Hypothesis 2: the application of the DMAIC of Lean six sigma approach constitutes the appropriate solution for optimizing production within the company;

B. *General presentation of the Tunisian Cardboard Company*

- Legal form: SA (public limited company)
- Activity: Development, manufacturing and sale of boxboard
- Capital: 4,197,500 DT
- Workforce: 114 (including 16 managers and a management rate of 15.5%)
- Address: Enfidha Industrial Zone BP 214 Enfidha 4030
- Website:www.cartonnerie.com.tn

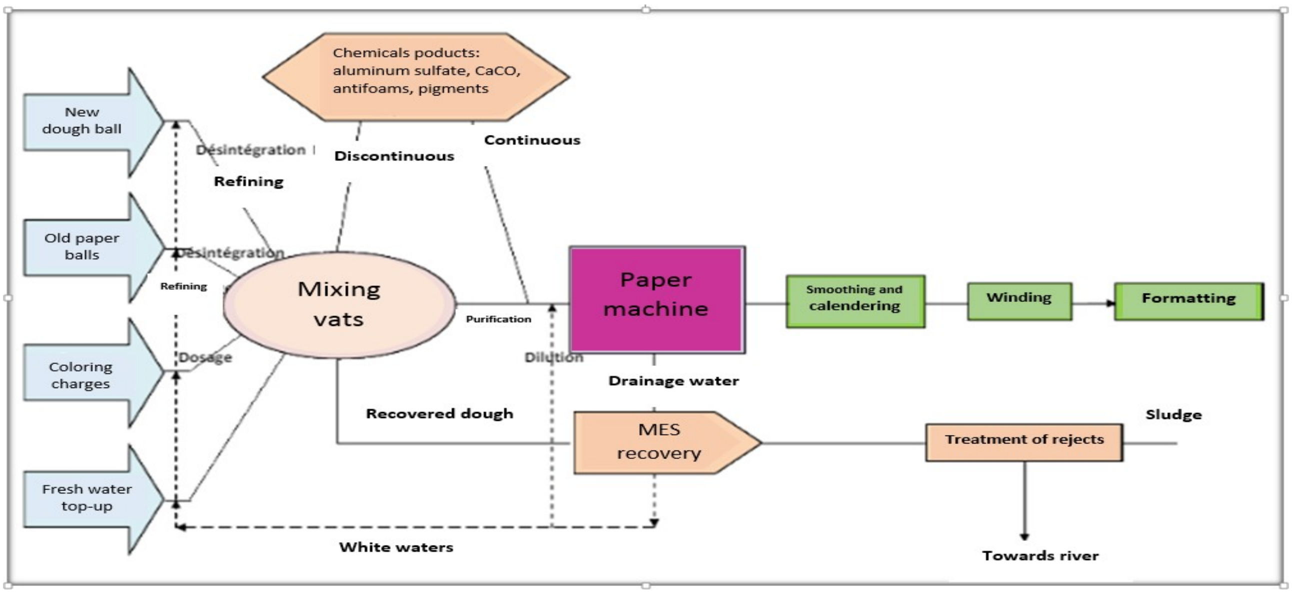

Fig. 8 General diagram of the manufacture of cardboard paper

Fig.9: RIS23 slitter winder

ISSN: 2961-662X

C. Analysis of the results: application of the Lean six sigma method using the DMAIC approach in the Slitter workshop

1) "Define" phase:

- Problem identification: through the use of brainstorming tools we were able to identify all the problems proposed by the participants in the workshop Slitter (almost 22 problems) and subsequently we selected the most recurring ones by the simple voting method and which resulted in finally choosing the most important problem in this workshop, namely: very high waste rate

TABLE 2
CLASSIFICATION OF CAUSES

	Causes	**Participants**						**TOTAL**	**Recurrence of problems**
		1	**2**	**3**	**4**	**5**	**6**		
1	P12.Very high waste rate	2	2	2	2	2	2	12	Very recurring problem
2	P20. Lack of safety equipment	2	2	0	1	0	1	6	Moderately recurring problem
3	P22. Lack of bins for waste disposal	1	0	0	0	0	2	3	Low recurring problem
Total								**21**	

SIPOC Diagram: We will draw up the SIPOC diagram to identify the elements associated with the manufacturing process. The SIPOC diagram allows you to define the scope of a process in a visual and synthetic way.

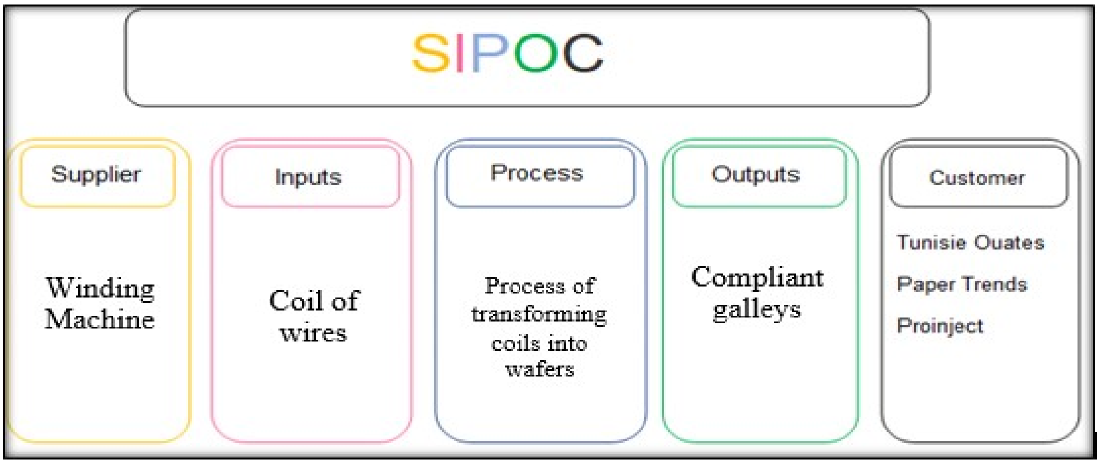

Fig.10 SIPOC Diagram

- WWWWHW method: Formalize the problem using the WWWWHW tool: In order to better understand our problem (high rate of cardboard waste), we carried out a 5W/H. Thanks to this tool, it is possible to target the problem, its actors as well as its ins and outs. This means that it allowed us to have information on the priority subject. The correct definition of the problem is already half of its solution.

TABLE 3
5W and H METHOD

Question	**Answers**
Who ?	Operators of the "slitting machine zone" production line. Head of product quality control.
What ?	Increase in waste rate. (The waste rate reaches 14% and more).
where?	Slitting machine workshop
When ?	Non-compliant product at the end of the production cycle.
How ?	Analyze the current state through performance indicators and Lean tools
Why ?	Reduce the waste rate and improve the quality of production

ISSN: 2961-662X

2) *"Measure" phase:* Using Minitab software, Henry's line and the histogram were plotted, to first check the normality of the data and subsequently, the I-EM type control chart. and the capability of the RIS23 machine for 3 days, to detect the deviation and monitor the stability of the process over time.

- Sampling method
  - The sampling plan: The sampling stage consists of selecting samples to be tested and which are supposed to represent the population made up of all the articles manufactured. A good sample must be representative of the parent population.
  - The sampling frame: This involves identifying the theoretical population (the sampling frame) of our study, then specifying the one to which we had accessed to (select our sample. For time constraints, we will limit our study with a few samples.
  - The size of the sample according to the non-probabilistic method: We chose an empirical sample selected according to the principle of convenience. That is to say, we will measure the different rates of waste drawn from the RIS 23 Slitter machine over 3 days. By applying the programmed drawing method, we randomly selected our samples. The criterion we opted for is time. In fact, first of all, we evenly distributed our sample over 3 working days (Monday, Tuesday and Wednesday). Then, and secondly, to have more effective results, we opted for the hourly criterion and at regular intervals, that is to say that we will take 2 samples per hour. Knowing that the work schedule is 16 hours (two shifts per day), with minimum production of 10 reels/machine, the number of observations will therefore be: 42 samples

TABLE 4
RIS23 MACHINE SAMPLING DATA (WASTE RATE)

	Day 1		Day 2		Day 3	
Samples **Working hours**	**1**	**2**	**1**	**2**	**1**	**2**
6am---> 7am	11.23%	11.02%	17.66%	17.65%	3.56%	4.25%
7am---> 8am	10.36%	10.89%	17.74%	17.69%	4.43%	10.75%
8am--->9am	10.35%	10.74%	16.33%	10.11%	9.83%	10.10%
10am--->11am	4.56%	4.97%	14.22%	13.32%	9.11%	11.09%
11am--->12	12.55%	12.54%	11.12%	11.21%	15.74%	15.99%
12 p.m. --> 1 p.m.	10.86%	16.89%	10.16%	10.44%	17.00%	16.94%
1 p.m. --> 2 p.m.	17.46%	16.99%	12.04%	10.69%	12.22%	10.13%

- Study of normality
  - Henry's right:

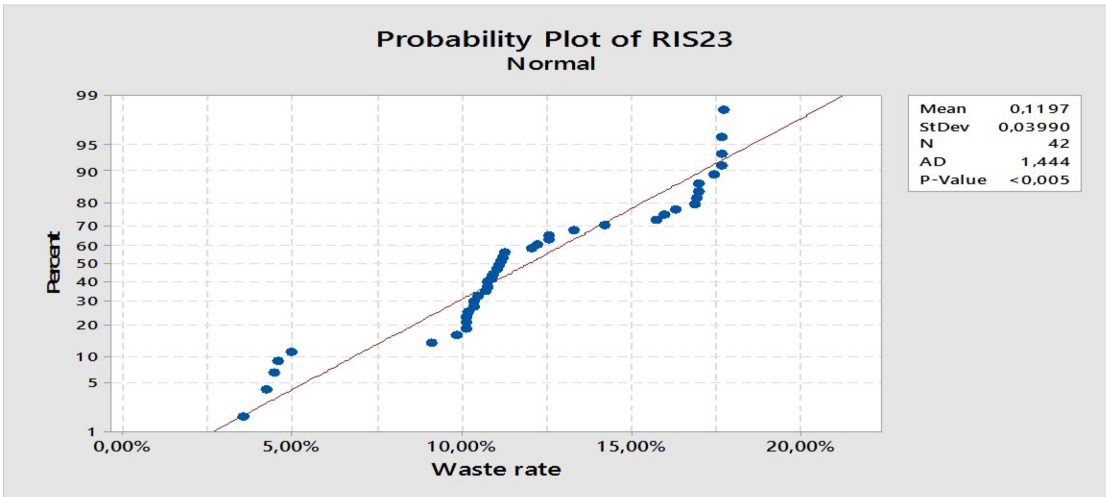

Fig. 11 Right of Henry RIS23

In this probability plot, the data forms a line roughly a straight line along the line. The p-value is less than the significance level of 0.05. Therefore, we retain the null hypothesis (H0) according to which the data follow a normal distribution law.

ISSN: 2961-662X

– Histogram:

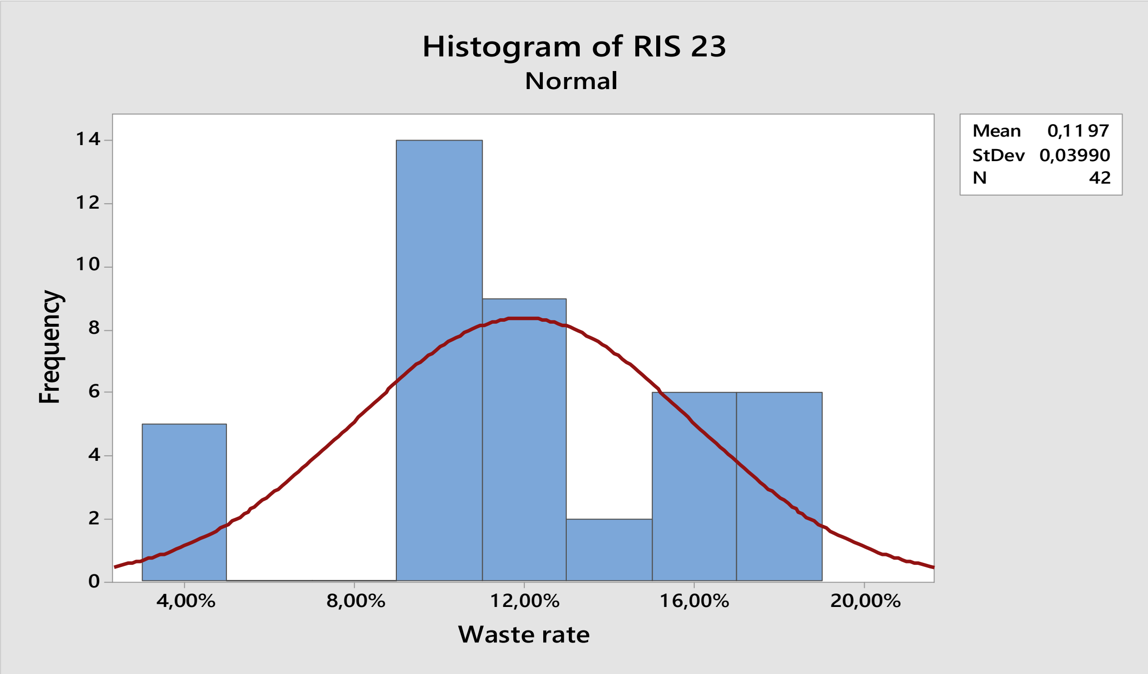

Fig. 12 Histogram of the RIS23 machine

According to the histogram, we notice that the curve is bell-shaped, so the data distribution follows the normal law.

- Study of the stability and capability of the process.

– Control chart:

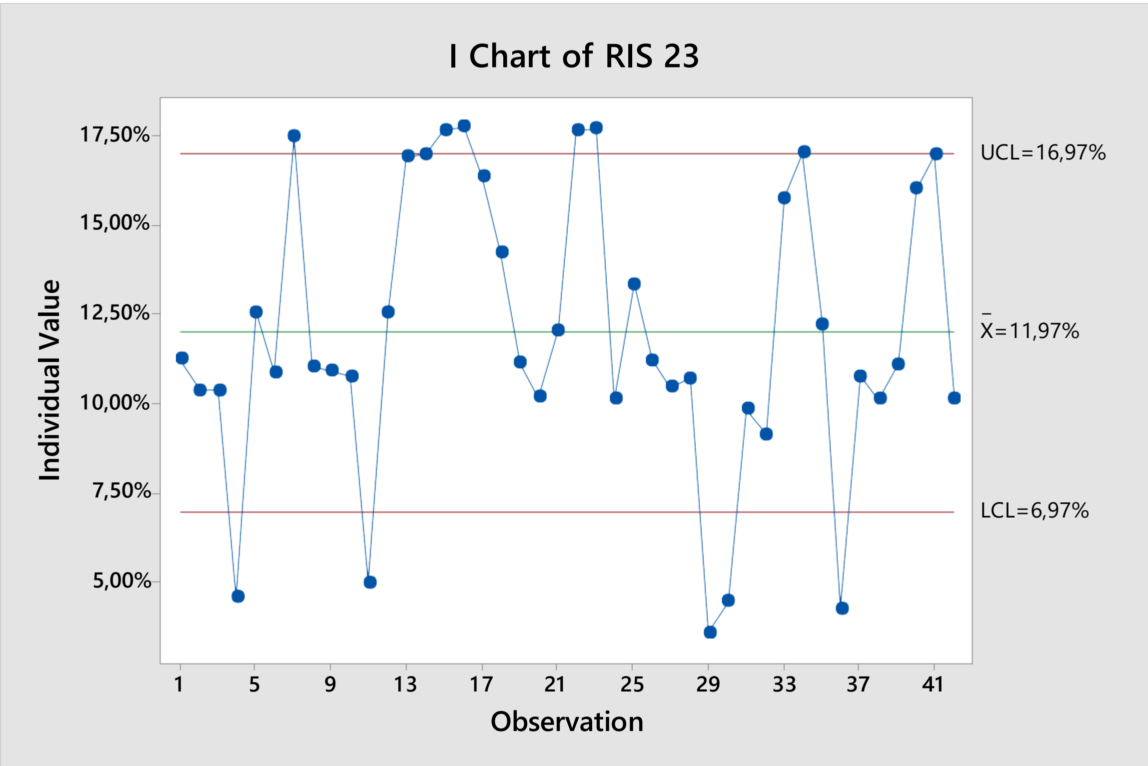

Fig. 13 RIS23 machine control chart

We notice in I Chart that there are 12 points which are outside the control limits (upper and lower). So we can conclude that the process is unstable and there is, therefore, a very high number of waste which does not meet specifications.

ISSN: 2961-662X

– Capability:

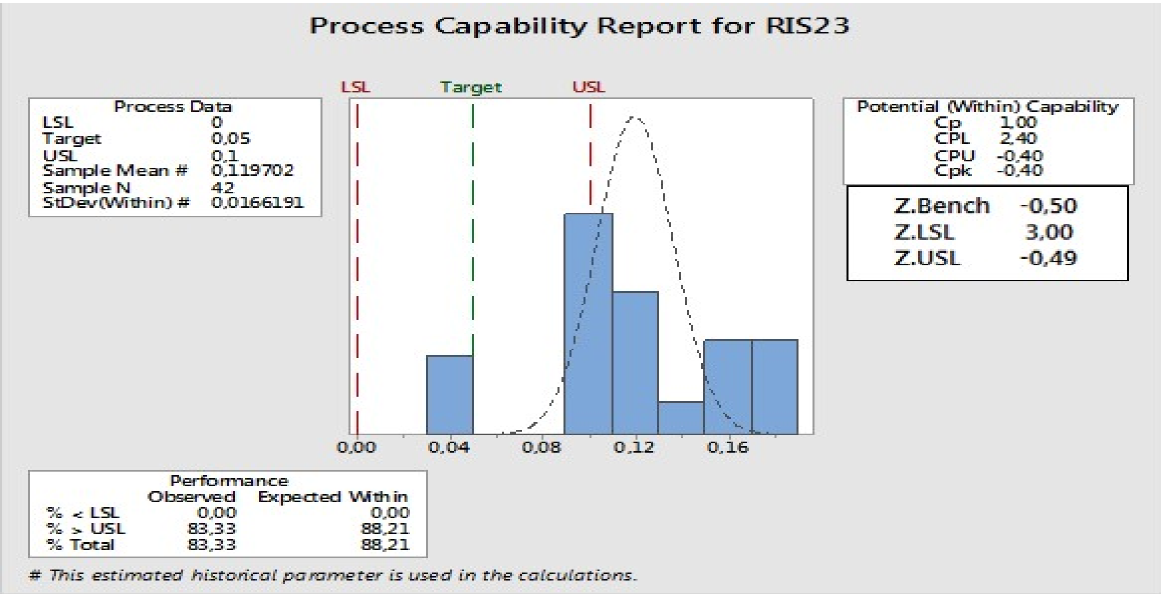

Fig. 14 Capability of the RIS23 process

For a Tolerance = 5% +, we have Cp = 1<1.33 so the process is just acceptable and Cpk = -0.46<1, which proves that the process is also off-center and shifted to the right side of the upper limit. So there is a significant portion of production that is outside of specifications (more than 88%).

In addition, the overall sigma level is low: Z= 2.51 (ZG = ZLSL+ZUSL = 3+ (-0.49) = 2.51), therefore the level of competitiveness of the company in terms of quality is low.

These values further encourage the need for urgent improvement to reduce the proportion of waste in order to respect the preset specifications.

3) *“Analyze” phase*»: we organized a brainstorming session to research all the possible causes linked to our problem, namely a high waste rate from the RIS23 machine.

- Ishikawa: The distribution of causes by family is schematized in the following Ishikawa diagram:

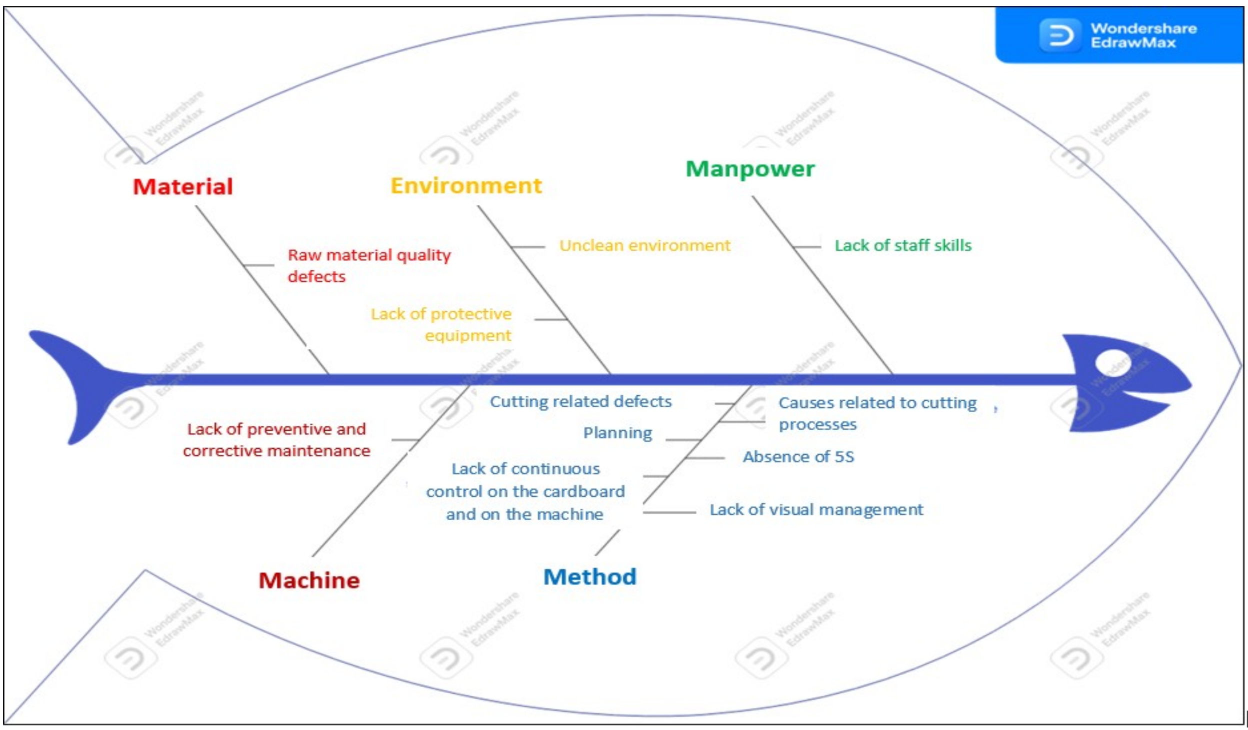

Fig. 15 Ishikawa Diagram

ISSN: 2961-662X

According to the Ishikawa diagram, we notice that the causes of the problem of increasing waste rate are multiple and do not only concern the technical and human aspect, but also they come from the environment, the methods and the machine, so we can reject hypothesis 1 (hypothesis 1 is not valid).

- Cause statement sheet:

TABLE 5
STATEMENT SHEET

	Monday	Tuesday	Wednesday	THURSDAY	Friday	Total
Absence of 6S construction site	////	///	///	///	///	**16**
Cutting related defects	///	////	//	///	///	**15**
Raw material quality defects.	//	///	///	///	/	**12**
Continuous lack of control over the carton and the machine	/	/	///	//	//	**9**
Lack of personal protective equipment	/	//	//			**5**
Planning	///	//	/	/	/	**8**

From the statement sheet we found that the root causes of the increase in the waste rate are “Absence from the 6S site” and “Defects linked to cutting”.

4) *“Improve” phase*: In this step, we will establish an action plan in order to implement the appropriate solutions, to resolve the main causes of our problem.

- Action plan: at the beginning of this phase, we will present an action plan including the measures that we will take to resolve the problems which are the essential basis of the increase in the waste rate and with an objective of optimize production.

TABLE 6
ACTION PLAN

Main causes	Actions	Goals	Responsible	Location	Deadlines
Cutting related defects	• Mastery of preventive maintenance programs. • Buy a dust vacuum cleaner. • Set up a production process controller. • Sharpen the blades weekly	• Reduce the waste rate and improve the quality of paper cutting. • Increase machine speed and subsequently improve machine output rate, thus promoting comfort for operators. • Improve the quality of paper raw material. • Respect the frequency once a week.	Ahmed (Transformation service manager)	Slitting workshop (RIS23 machine)	2 Weeks
Absence of 6S construction site	• Implement the 6S project. • Develop the QHSE culture. • Buy a cage for each machine.	• Organize the workplace • avoid accidents			1 month

- Application of the 6S method:
  - Identification of the problem: Poor organization of the slitting area
  - Define the objective: Before starting any action, it was essential to set our objectives from the start:
    - ✓ Lighten the workstation of anything that is not necessary.
    - ✓ Improve the state of cleanliness and organization of workstations to make it more efficient.
    - ✓ Reduce wasted time and energy and the risk of work accidents.
    - ✓ Reduce the waste rate.
    - ✓ Improve productivity and product quality.
  - Diagram of 6S in the initial state: This diagram will allow us to visualize the percentages of each “S”. The goal of this representation is to know which “S” we are going to play on to balance the “S” and reach the threshold that we are going to set as our objective (the threshold is defined between 70% and 100%).

ISSN: 2961-662X

Satisfaction scale:

- ✓ 70% → 100%: satisfactory
- ✓ 40% → 70%: moderately satisfactory
- ✓ ≤40%: unsatisfactory

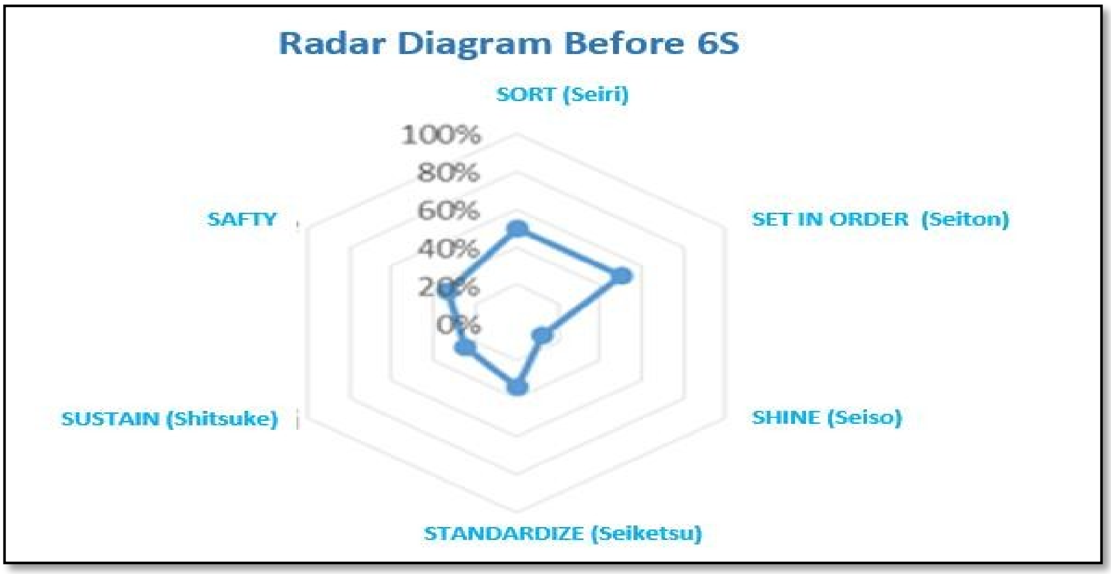

Fig. 16 Radar diagram before 6S application

Interpretation: According to the radar diagram of the initial state, the score obtained is 10/34 so the workshop is at 29.41% out of an objective of 70% set at the start, therefore the result obtained is unsatisfactory.

– Implementation of 6S actions:

Fig. 17 workshop situation before and after 6S

ISSN: 2961-662X

Vol.3 Iss.2 pp.80-96 **Journal of Operational Management & Marketing Strategies (OMMS)**

– Visual management: Visual management is a Lean Management approach based on a set of communication techniques. The objective is to facilitate the transmission of information between all stakeholders and for each hierarchical level (Note: the posters will be written in the mother tongue Arabic and the second language mastered and officially used in Tunisia).

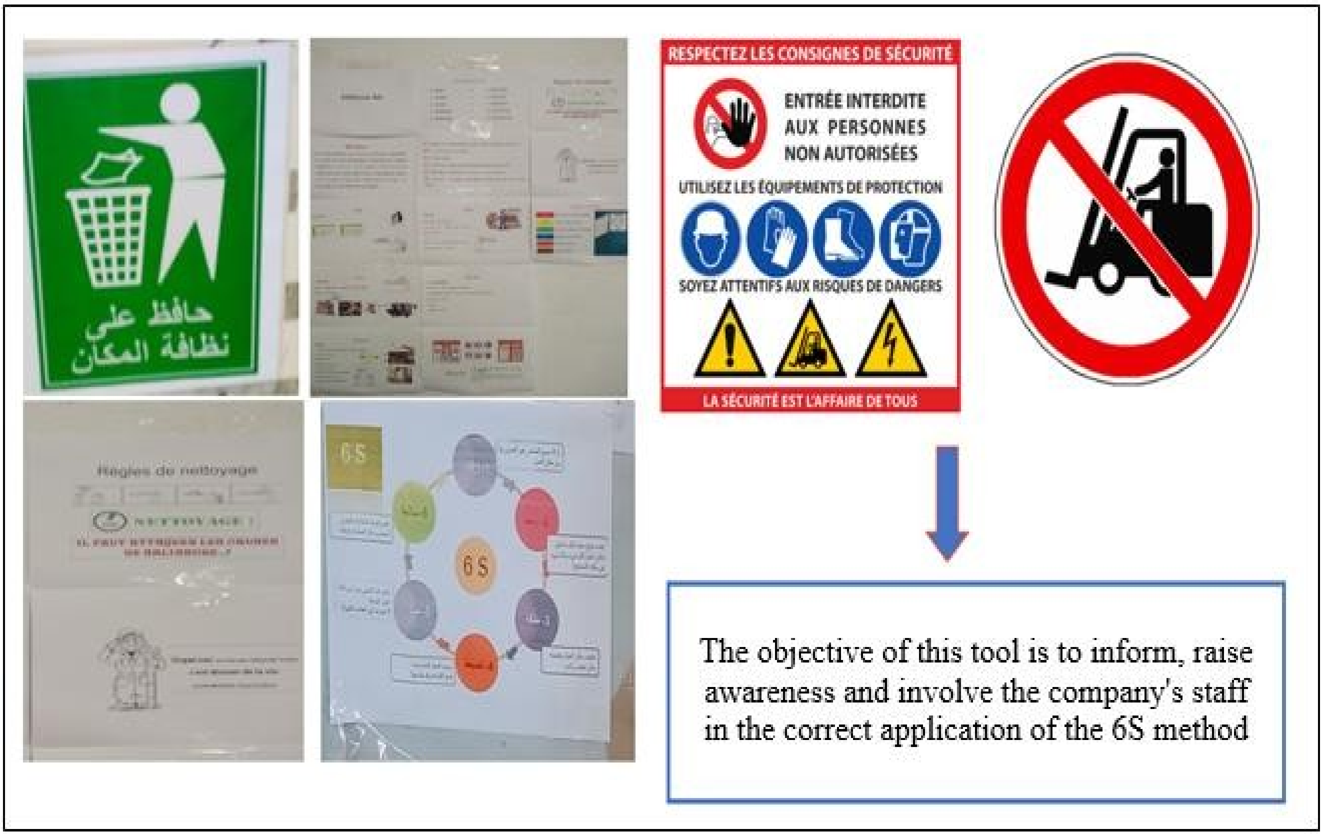

Fig. 18 Visual management displays

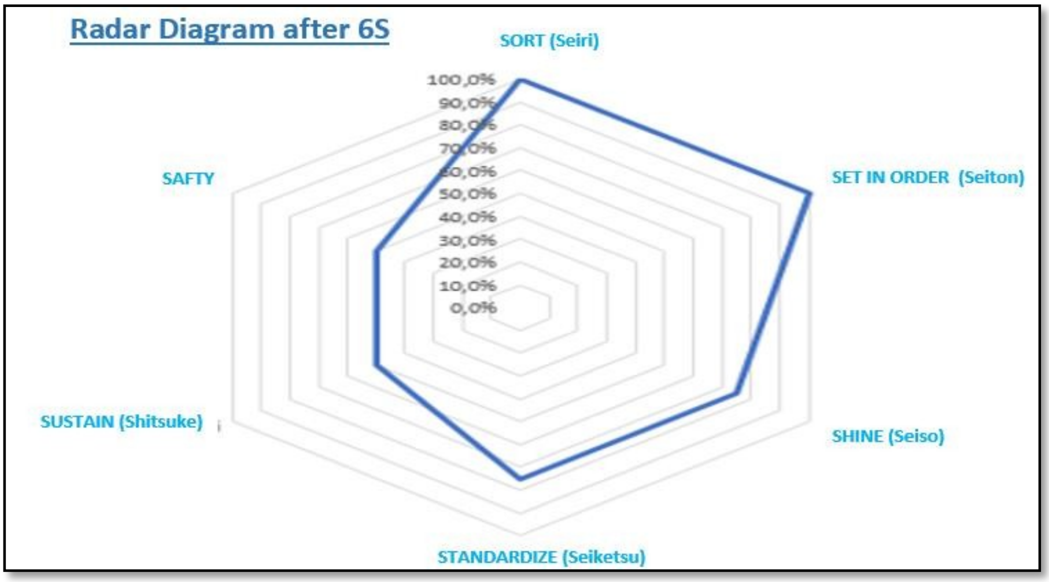

Fig. 19 Radar diagram after 6S application

We see that after the implementation of the 6S actions, that the result of the audit on the performance of the application of the different “S” becomes satisfactory (70.58%) which confirms hypothesis 2, that the successful implementation of a Lean six sigma approach, with the aim of reducing the waste rate and consequently increasing production, is conditional on the prior application of 6S best practices.

ISSN: 2961-662X

- Actions relating to cutting defects:
  - Suggest a quality control officer who must have good knowledge of the various basic rules of cardboard material and cutting rules, in order to serve the movement of product from the beginning to the final check to minimize errors during the cutting phase and subsequently reduce the waste rate.
  - Sharpen the blades weekly.

Fig.20 Cardboard cutting blades

  - Buy a dust vacuum cleaner to avoid:
    - ✓ Maintenance costs and production shutdown when dust enters machines.
    - ✓ The decline in employee motivation and an increase in absenteeism.
    - ✓ Unnecessary cleaning costs and staff whose attention is diverted from their main activity.
  - Propose a training plan to increase the skills of operators in cardboard cutting techniques:
    - ✓ Train operators in versatility and work skills in all stages of cardboard cutting.
    - ✓ Mobilize and empower staff.
    - ✓ Communicate and encourage staff to establish team spirit and achieve the requested collective objectives.
    - ✓ Train the team on the basic rules of cardboard cutting and the rules of preventive maintenance of the machine.
  - Recruit a cleaning team:
    - ✓ The staff will be more and more motivated.
    - ✓ The staff ensures more productivity for the company.
    - ✓ The staff does not risk losing concentration due to the unsanitary conditions of the premises.
  - Purchase a safety cage for each machine for operator protection.

Fig.21 Machine Safety cage

ISSN: 2961-662X

5) *"Control" phase*: in this last phase we will observe the current situation in order to confirm, then maintain, the success of the DMAIC project.

- Sampling method: we used the same sampling method and the same conditions as in the measurement phase (with 42 samples)

TABLE 7
RIS23 MACHINE SAMPLING DATA (WASTE RATE)

	Day 1		Day 2		Day 3	
Samples Working hours	**1**	**2**	**1**	**2**	**1**	**2**
6am---> 7am	4.63%	6.43%	4.93%	4.77%	7.06%	6.80%
7am---> 8am	6.28%	8.10%	4.64%	9.69%	6.72%	12.69%
8am--->9am	11.98%	11.10%	9.09%	10.32%	10.49%	9.52%
10am--->11am	9.28%	5.17%	9.24%	10.57%	7.42%	9.85%
11am--->12	9.97%	9.69%	10.44%	9.97%	9.66%	9.59%
12 p.m. --> 1 p.m.	10.97%	10.82%	11.88%	11.34%	9.81%	10.68%
1 p.m. --> 2 p.m.	9.56%	10.95%	11.54%	10.72%	7.12%	10.21%

From this table, we notice that waste rates have decreased considerably thanks to the actions put in place (6S and actions relating to cutting)

- Study of stability and capability of the process
  - Control chart (After improvement)

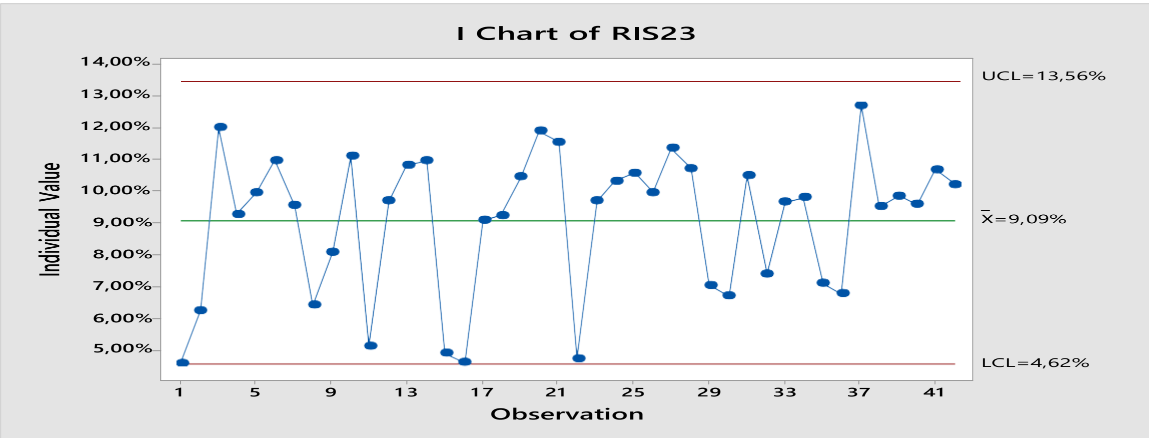

Fig. 22 RIS23 machine control chart

According to the "I control chart" for the RIS 23 machine, there are no points outside the control limits, so the process becomes stable and under control.

- Capability (After improvement)

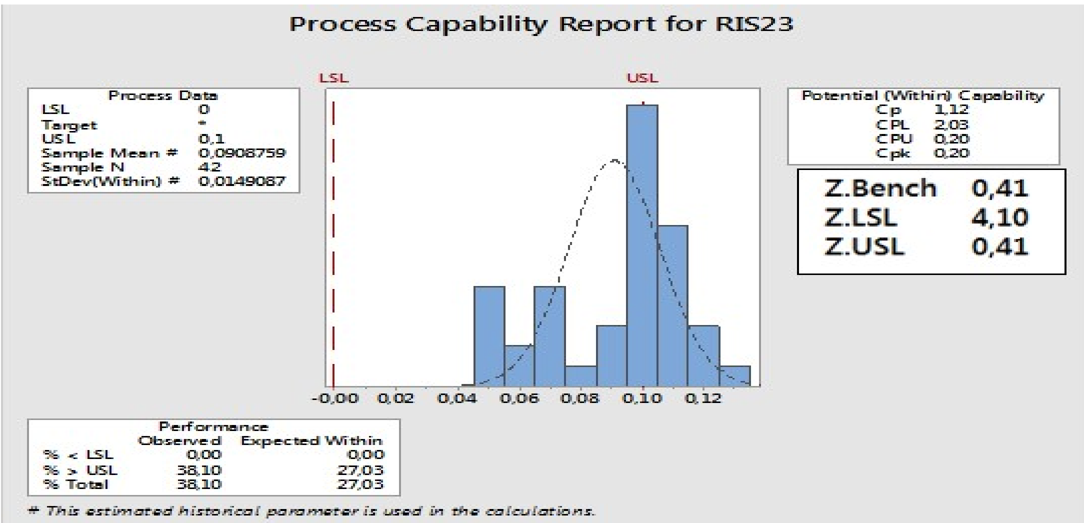

Fig. 23 RIS23 process capability

ISSN: 2961-662X

The capability: 1 < Cp = 1.12 < 1.33, so the process is acceptable and we have Cpk = 0.20 <1, which proves that the process always remains off-center and shifted slightly to the right side of the upper limit. What this means is that the part of production outside the specifications becomes 38%. In addition, the overall sigma level is greatly improved: Z= 4.51, so the level of competitiveness is then important

Finally, at the end of this last stage of the DMAIC approach, we can validate the 3rd hypothesis, since the application of the Lean Six Sigma approach allowed us to optimize production, and this by reducing the rate waste and improvement of various performance indicators.

IV.CONCLUSIONS

This work was carried out in the "Refendeuse" workshop of the company "TCC". It is part of the policy of optimizing production and continuous improvement of the management and organization of production workshops. Therefore, the approach used to improve productivity was based on eliminating the causes which generate losses in terms of product quality, through the application of the Lean Six Sigma approach. This method allowed us to detect multiple waste in terms of increasing the waste rate, and consequently to apply certain actions, among which we chose those which are the most economically advantageous and practically feasible (for example, Buy a dust vacuum cleaner; Mastery of preventive maintenance programs; Develop QHSE culture). These actions allowed us to resolve various problems related to machines, human resources and methods, and they brought improvements in the productivity and competitiveness of the workshop:

- The process becomes stable and capable with a capability > 1
- Better organization of workstations and effective application of 6S best practices
- Increased sigma level by 2.
- Reduction in the average waste rate from 11.97 to 9.09%, i.e. a gain of 2.88% in terms of materials and turnover.

ACKNOWLEDGMENT

We would like to thank the working group within the TCC who helped us carry out this research.

REFERENCES

[1] Consultants Group, Lean Six Lean File. [Online]. Available: www.xl-consultants.com

[2] Sushmith (Published on Oct 5 2023) Six Sigma tools for DMAIC Phases. [Online]. Available : https://www.sprintzeal.com/blog/dmaic-tools#

[3] George ML (2002), Lean Six Sigma: Combining Six Sigma Quality with Lean Speed. The McGraw-Hill Companies.

[4] Sushmith (Published on Sep 30 2023), DMAIC Methodology - The Ultimate Guide. Available: https://www.sprintzeal.com/blog/dmaic-methodology

[5] ADAM HAYES (Updated January 01, 2023), Ishikawa Diagram, Available [Online]: https://www.investopedia.com/terms/i/ishikawa-diagram.asp

[6] Jean-Marc Gallaire (2008): "The tools of industrial performance". Eyrolles Group.

[7] 6S Tutorial for Lean Approach, Available [Online]: https://online.visual-paradigm.com/knowledge/six-sigma/6s-tutorial-for-lean

[8] Christian Hohmann (2006): "Practical guide to 5S". Organization Editions.

[9] Minitab: "control chart": https://support.minitab.com/en-us/minitab/help-and-how-to/quality-and-process-improvement/control-charts/supporting-topics/basics/understanding-control-charts/

[10] Christian Hohmann: "Notion of capability".http://chohmann.free.fr/qualite/cp.htm

[11] Engineering with Management, Process Capability, Available [Online]: https://engineeringwithmanagement.com/process-capability/

ISSN: 2961-662X