

## IMPLEMENTING 6 SIGMA IN A WIRE MANUFACTURING PLANT

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**Abstract:** 6S is a method of organizing and managing a workspace or workflow and aims to improve efficiency and quality by eliminating waste, improving workflow and eliminating useless processes/activities. 6S is also a systematic six-step method for optimizing the work area, environment and operating procedures to ensure the best product quality and customer value creation. In this sense, the article presents the thinking, implementation and implementation of the elements of 6S within the wire drawing section to ensure a predictable, organized and safe workplace.

**Key words:** 6 sigma, organizing, management, wiredrawing, plant

### 1. INTRODUCTION

The 6 sigma management method is based on the 5S methodology and has been improved by including the element "safety" as one of the basic pillars. Each of the original "S" refers to a Japanese word, which has a similar translation in other languages, which names each specific step. The implementation of 6S in the wire drawing section is presented below. Figure 1 shows the application of the 6S method in the metallurgy-heavy wire drawing section.



Figure 1. Application of 6S in the metallurgy department – cleaning of workplaces

Figure 2 presents the application of 6S in the heavy wire drawing section. Figure 2 a presents the cleaning and painting of the workplace. Figure 2b shows the establishment of the arrangement of the wire coils and figure 2c presents the standardization. While figure 2d shows the cleaning of the workplace.

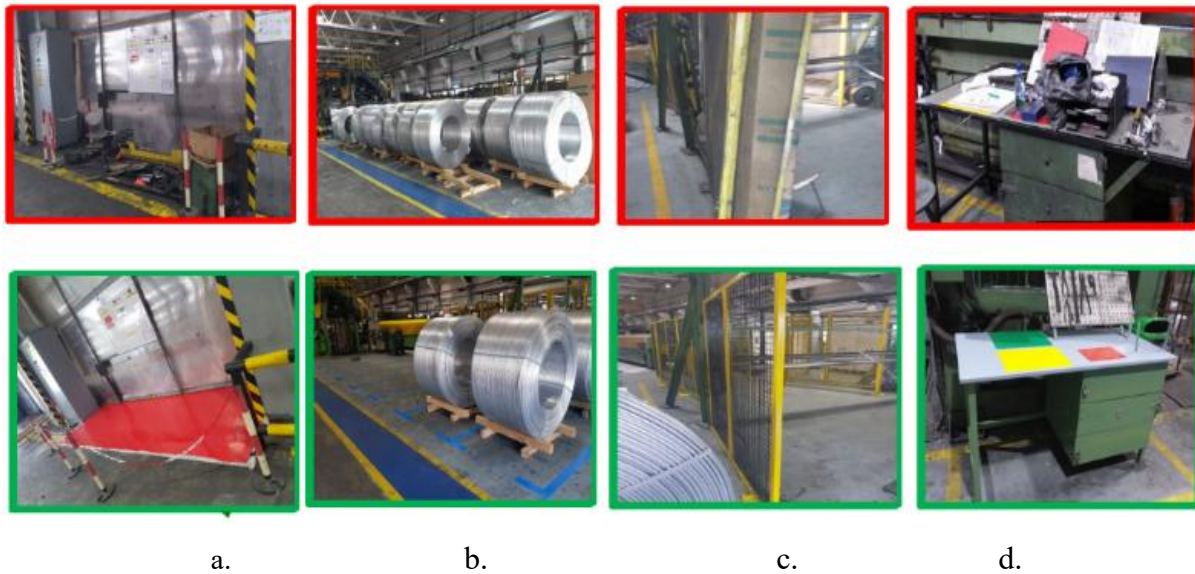


Figure 2. 6S method application – in the heavy drawing section

Within the light wire drawing section, figure 3 shows the cleaning of machines and auxiliary installations as well as their painting.

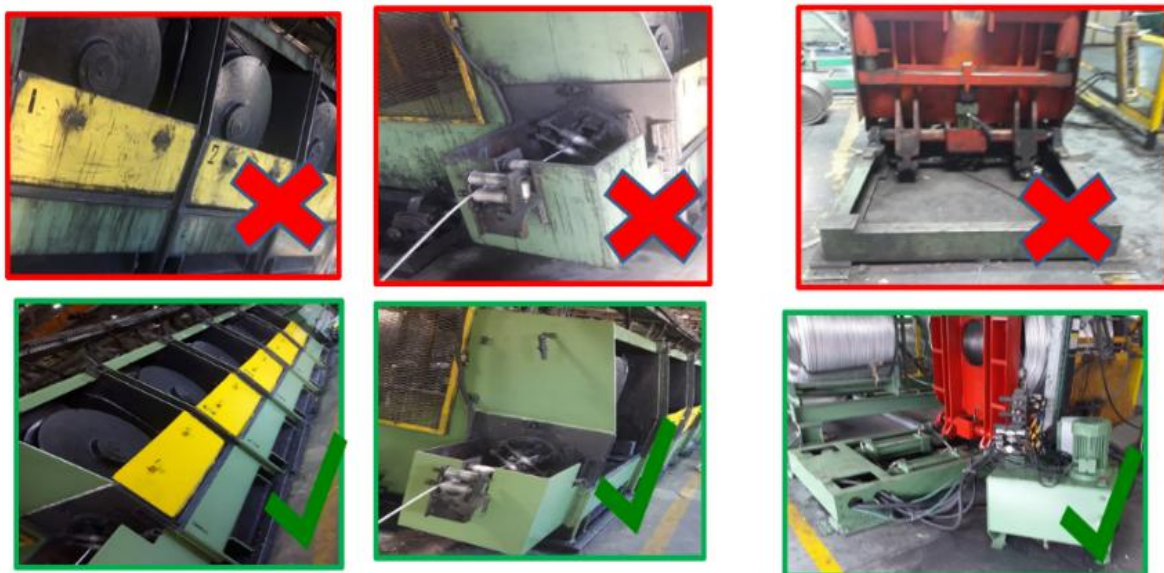


Figure 3. Cleaning of workplaces in the light wire drawing section

Figure 4 also shows the cleaning and painting of the coil supports, the command and control cabinets and the auxiliary equipment.



Fig. 4. Application 6S in the light wire drawing shop

## 2. LEAN SIX SIGMA

To successfully introduce 6S in the workplace, the application of each “S” must be understood by each employee and must be practiced regularly. Training material was created and presented to the company’s employees with the help of Training by the person responsible for the implementation of 6S. The most important tool in 6S is dividing the unit into small areas (functions/processes) and then introducing the methodology step by step, area by area. The main responsibilities of the area manager are:

- identify 6S facilitators in each area
- provide training on methodology and tools
- conduct/coordinate monthly audits
- ensure that operators are involved in decision-making and execution of actions
- transfer the vision to all stakeholders
- support 6S area facilitators in implementing 6S methodology and tools
- coordinate 6S facilitators by sharing knowledge to ensure uniformity of application and ease of implementation
- develop and implement action plans for each area and coordinate them
- develop and support a communication channel with all stakeholders
- continuously improve the performance of the 6S management system

### 2.1. 6S: Sorting

The first step of the 6S process refers to identifying all the elements that exist in a well-defined workspace, establishing their usefulness within the work processes, separating the work tools that are commonly used from those that are not used, freeing up space by eliminating all unnecessary materials and objects. The objectives considered are:

- reducing the loss of time in searching for an object by reducing the number of items;
- reducing the chances of distraction by unnecessary objects;
- simplifying checks;
- increasing the available and useful space;
- increasing safety by eliminating obstacles.

For implementation it must be done.

- appointing a person responsible for the sorting phase
- checking all items in an area and assessing their usefulness or necessity in that area

- sorting and labeling all objects
- moving objects that cannot be discarded immediately to a "red label area" of temporary storage, so that they are easy to identify later.
- analyzing, recording and evaluating the objects in the temporary storage area.
- discarding unnecessary objects as soon as possible.
- keeping the work floor free of materials, except those that are used for ongoing processes.

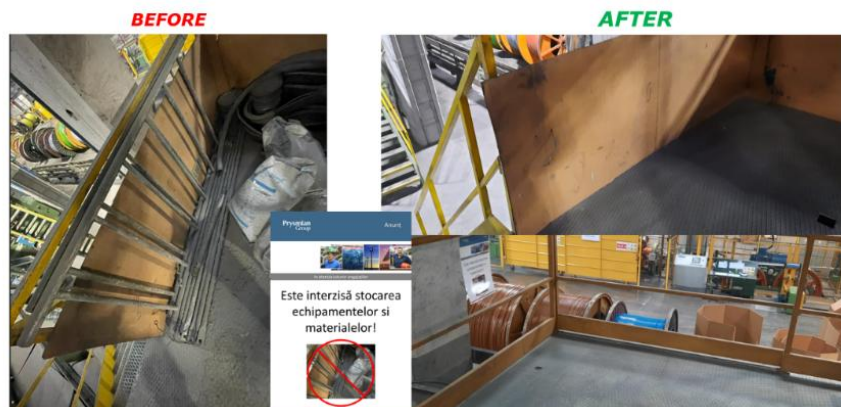


Figure 5. Application of 1S-materials

## 2.2. 6S: Ordering

The second step in the process involves sorting and organizing all objects, equipment, files, data, materials, and resources for quick and easy access. All tools or equipment needed for a job or process should be stored in a predetermined location and in a logical order to facilitate their use, to be easily accessed or brought back to the same place as quickly as possible. Fixed locations should be established, such as boxes, containers, shelves, cabinets with transparent doors, panels, floor markings for access routes, containers for all common materials and tools, and their storage should be done according to the frequency of their use. If everyone has quick access to any item or material, the workflow becomes more efficient and, as a result, the staff becomes more productive. Label all storage spaces, tools, and equipment. The objectives pursued are:

- placing each object needed at the workplace in the optimal place to perform its function and organizing each workstation for maximum efficiency and productivity.
- Creating a storage space that facilitates the return of things to their place and to quickly notice their lack.
- Establishing fixed locations, limits for the quantities allowed for each necessary item, in order to maintain order and ensure easy access, respectively to perform visual control of the workstation.
- The existence of clearly established places for positioning reduces the time of searching for items and the stress, annoyance, risks of endless searches in crisis situations.
- Moreover, if everyone has quick access to any element needed to perform their work tasks, the workflow becomes more efficient and, as a result, the staff becomes more productive.

To achieve the implementation of this objective, it is necessary to:

- analyze the production flow or technological flow;
- defining autonomous production areas – annexes to the main production within the analyzed technological flow.

- grouping the equipment so that the entry and exit allow a clearance of the workspace, without blockages.
- establish which tools and devices are needed in a timely manner to react to any production change.



Figure 6. Aplicarea 2S-unelte de lucru

- establish the location for each object and the coding of objects and spaces / locations at the workstation, depending on the production process and the type of production
- mark the chosen locations by painting, with adhesive tape or other type of dividing elements
- label or mark the objects used in the processes

Figure 6 shows the application of 2S for workplaces where there are work tools. Figure 7 shows the 2S application for the device storage area, the area that we also reorganized.



Figure 7. Application of 2S – devices

### 2.3. 6S: Cleaning

The third step of the 5S process is to clean the workplace (floors, machines, cabinets, desks, etc.) so well that they “shine”. Shine means that all objects and equipment in the workplace are kept clean and in proper working order. This is the easiest to understand step and yet the most often overlooked in the implementation of 5S. Keeping things clean and in working order go hand in hand, thus eliminating interruptions, repairs and maintaining a constant

production flow. In this sense, we have set new standards for cleanliness. We have aimed to clean and remove garbage, grease and dirt. Everything must be clean, tidy and well placed in the right place. Cleanliness provides a safe workplace and makes potential problems immediately visible. The objectives pursued were:

- improving the efficiency and safety of the production process, reducing losses, preventing errors and defects;
- the employees of the department will be happy to come to work in a clean environment;
- because keeping the equipment and workspace in excellent shape will lead to fewer incidents and fewer equipment failures. This means higher productivity and lower costs;
- a tidy and clean workplace contributes to a good working climate and to the quality of the products and services produced, obtained in an efficient, safe and motivating working environment;



Figure 8. Application of 3S: a. - machines cleaning; b. – equipment cleaning.

- in a clean environment, it is obvious that any abnormal situation can be detected more easily and quickly – the lack of a material, a different noise of the computer fan, etc.;

In short, clean everything and everywhere in your workplace.

#### 2.4 6S: Standardization

The fourth step of the 6S process is to define the standards (rules, customs, and standard procedures) that staff must refer to in measuring and maintaining the optimal degree of order

and cleanliness. Creating a routine for completing tasks can ensure that things are done correctly and efficiently every time. When a certain type of task is performed more than once, the most efficient way to complete that task must be identified and a standard must be created. Production often has different processes on different shifts. This means that at least two of the shifts perform the work in a less than optimal way. Standardizing processes will help avoid mistakes and improve efficiency.

The objectives pursued are:

- creating a system of tasks and procedures to ensure that the 5S principles are met daily

For implementation, it is necessary to:

- develop a work structure that supports new practices and makes them part of the daily routine.
- ensuring that everyone knows their responsibilities in sorting, organizing and cleaning.
- using photos and visual controls to help keep everything as it should be.
- periodically reviewing the status of 6S implementation using checklists and audits.

For a successful implementation it is recommended:

- standardization activities should be promoted by a board for the first time
- to strengthen the company identity the central team should be contacted to comply with the group standards
- a collaboration should be established to establish common approaches for creating documentation, visual aids, etc.

- When creating or reviewing documents, use images to make them easy to understand for everyone

- Try to maximize the use of standard documents to accelerate the learning process and minimize the risk of mistakes

To exemplify the implementation of 4S in the wire drawing area where we thought and coordinated all the actions, figure 9 a presents the delimitation of the waste, raw material, semi-finished products with epoxy paint areas.



a.

b.

Figure 9. Application of 4S: a. - semi-finished product marking; b. - equipment storage marking

Figure 10 a shows the application of 4S-raw material marking and figure 10. b the identification of storage areas is presented

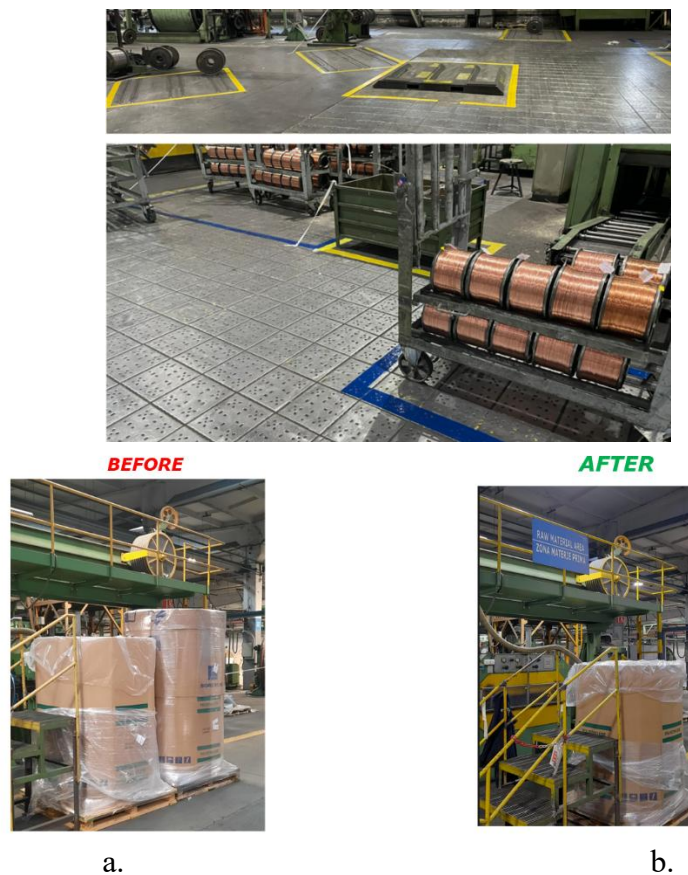


Figure 10. Application of 4S; a. - raw material marking; b. - storage area identification

### 2.5 6S: Support

Support also means the effort to develop a culture that follows the 5S steps both now and in the future. The 5S system must be part of the employee culture and embedded in the company philosophy. 5S must become one of the organizational values, so that everyone thinks in 5S. Integrate the 5S methodology into the performance management system.

The objectives of 5S: support are:

- ensuring that the 5S approach is respected.
- the foundation of support is the elimination of bad habits and the generalization of good practices in the work environment - at a technical and technological level, but especially at a social, ethical and moral level.

The implementation of 5S: support must take into account:

- organizing training sessions.
- conducting periodic audits to ensure that all defined standards are implemented and respected.
- implementing improvements whenever possible. Employee opinions can be very valuable for identifying improvements.
- when problems arise, the cause must be identified and the necessary changes implemented to avoid recurrence.

### 2.6 6S: Safety

The safety of operators, each employee, and the user depends on the application of the 5s discussed above. Safety is the result of organized work, everyone's attention to non-

conformities and risks and their reporting. Figure 10 shows the warning regarding the observance of health and safety at work.



Figure 11. Warning regarding compliance with health and safety at work.

For a successful implementation it is recommended:

- create a safety mindset to exceed safety requirements
- follow up on the above points daily, not only when the audit takes place
- be proactive in highlighting potential safety concerns o Involve the local HSE team
- cooperate closely with maintenance to drive safety actions with the highest priority

### 3. CONCLUSION

The paper presents the application of the 6 Sigma management method in a wire drawing factory. All the criteria that had to be achieved in this regard in the factory are exemplified one by one.

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