Analysis of the 5S method in production enterprise - case study

Katarzyna Łyp-Wrońska[1], and *Bartłomiej* Tyczyński[1]

[1]AGH University of Science and Technology, Faculty of Non- Ferrous Metals, Poland

Abstract. One of the most popular system in production enterprise is Lean Management. 5S is a method which introduces workflows allowing to increase the efficiency. The aim of the research is to analyze the use of the 5S method on the example of a selected company. The scope of work covered the years 2013-2017. Research methods are: analysis of enterprise data, employee opinion survey, participation in audits. One of the ways to maintain a proper level of order and cleanliness according to the 5S method in the factory is to confirm compliance by conducting an audit. Inspections are carried out on two levels. One of them is an internal audit, which is carried out by a foreman who works at a given hall. The second level is an external audit, which is carried out by employees of other halls. Teams with the best results are rewarded with incentive bonuses. The first audit in 2013 at the enterprise showed that the state of order is unsatisfactory. Therefore, corrective actions have been developed and implemented. Analyzing the data in subsequent research periods - up to 2017, it can be stated that due to the introduced changes, the results of all audits, increased.

1 Introduction

The concept as ‘’lean’’ have been used with growing frequency in management. It is a method to eliminate waste and create value at various types of enterprises. The aim of Lean Manufacturing is to reduce waste and make a quality of the product meet the customers expectation also defined a non-value activity consuming the resources. [1] Lean concepts can be put into place procedures and make better use of employee time and company resources. Lean manufacturing is an indispensable supplement to the class of experimental methods such as: TQM, TPM, 5S, SMED, Kanban, Kaizen, and Poka Yoke, 5 S etc. These philosohy, methods and tools are deployed by organizations for realizing consistent manufacturing performance improvements [2,3]. 5S has apotential to improve efficiency, quality, production, delivery adherence, safety, optimized cost, and acts as abaseline requirement for other programs [4,5,6,7]. The 5S method is a tool whose application will bring benefits to the enterprise, and at the same time will make work at a given position more pleasant. The application consists of 5 steps, whose names in Japanese begin with the letter "s", 1S- Selection (Seiri), 2S- Systematyka (Seiton) - 3S- Cleaning - 4S- Standardization, 5S- Self-discipline. 5S is valuable for enhancing the workplace, as well as that, 5S framework facilitates process and item quality guidelines, decrease lead time, and furthermore, obviously, lessen working expenses and improve

overall performance [8] From literaturę perspective several studies have been reported by the practitioners about beneficial impacts of 5S practice in the different enterprises [9,10].

The aim of the research is to analyze the use of the 5S method on the example of a selected company. The scope of work covered the years 2013-2017. Research methods are: analysis of enterprise data, employee opinion survey, participation in audits

2 Implementation 5S

The researched object is a company - a factory in the cable industry, whose production is nearly 25,000. different cables and wires. The products of this company are used in many economic zones, such as construction, mining, renewable energy or telecommunications.

The company has quality certificates, but also uses modern management methods like lean management.

5S is one of the basic Lean Managmenet methods, which is implemented in the company. The meaning and location of this 5S method in the company's organizational structure is shown in Figure 1.

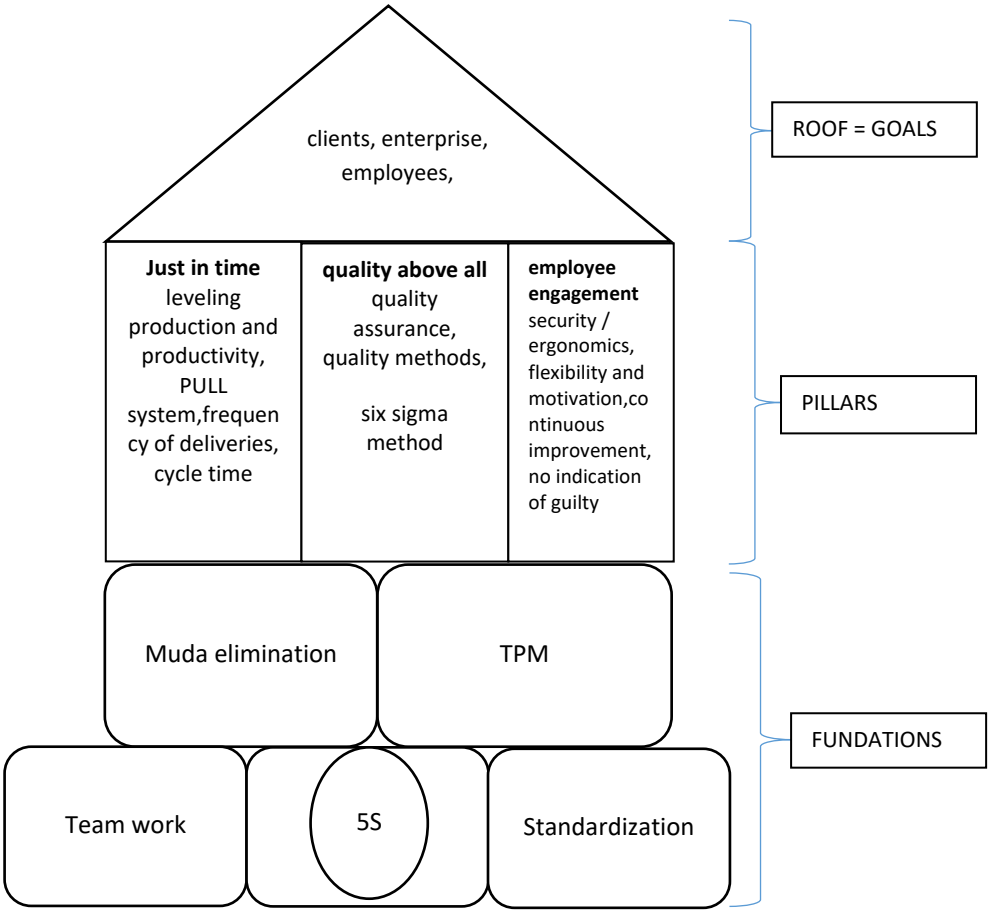

Fig. 1. The importance of the 5S method in the company's production system.

According to the illustrated graphics, 5S is included in the foundations of the entire production system. This system is aimed at meeting customer requirements while managing production, in which waste elimination and the TPM system play an important role. This means that the current operation of the plant could not be achieved without 5S, as well as team work and standardization.

One of the foundations of the 5S method is order and organization of work. In order for each employee to carry out his work in accordance with the assumptions, he must be trained. Then, the task of the management team is to supervise whether the employee / team fulfills his duties and this is done by conducting the audit. It is checking the condition of certain conditions (in this case it will check the cleanliness of machines and halls in the plant). Inspections are carried out on two levels. One of them is an internal audit consisting in checking the maintenance of order at work posts by individual brigades and employees. Then the person responsible for conducting such an audit is the master of change who works at the given hall. The second level is the external audit, whose purpose is the same as the internal audit, with the difference that it is carried out by employees of other halls. The idea of double control is to eliminate possible over-estimation, which would lead to a false state of affairs. In addition, brigades and halls compete with each other, which is an additional stimulus to take care of order. The grading scale is from 1-5. Teams with the best results are rewarded with incentive bonuses for conscientious performance of duties and are an incentive for further effort, resulting in continuous development.
In 2013 (year of implementation), the results of the first 5S audit were at a low level. The audit was carried out every day of the month. Employees were not informed which particular machine and team will be assessed. The company has 4 teams A, B, C, D and 3 halls X, Y, Z separated. The results of the audit are presented in Fig. 2.

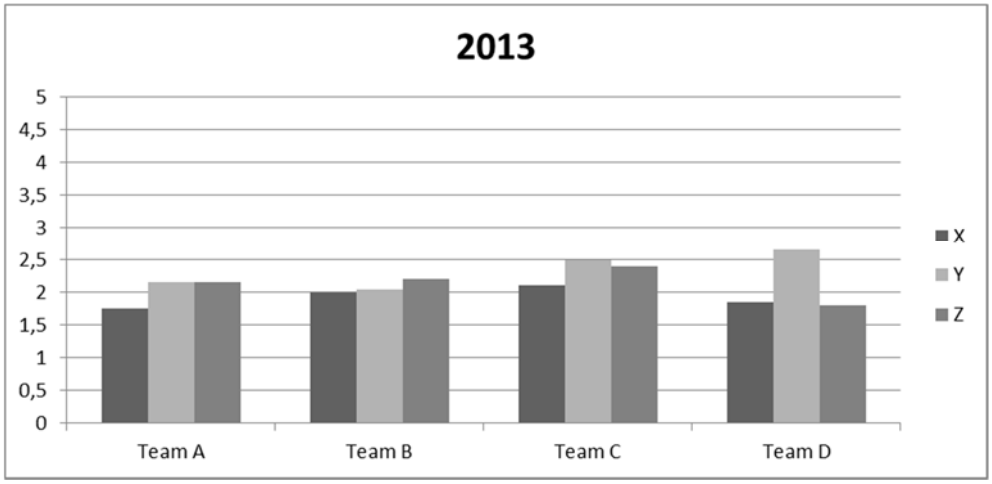

Fig. 2. Results of the audit of 4 teams of all halls.

Due to poor audit results, corrective actions were introduced and a system of division of responsibility for the divisions on individual machines and parts of the halls was developed, because it was believed that the employee / team who is responsible for a smaller area can more accurately take care of the order. The division of responsibility of 4 teams on a selected machine is shown in Fig. 3.

Team A	Team B
In charge of :	In charge of :
winder with extraction	wire guide elements
fence mesh	window sills on the reeds
window sills on the reeds	wire rewinder
Team C	**Team D**
In charge of :	In charge of :
delivery devices	caliber and its components
fence mesh	console
window sills on the reeds	window sills on the reeds
braider number 1	control cabinet
keeping the wire on the revier	braider number 2 and 3
	compensator

Fig. 3. Teams responsibilities.

Figure 3 presents a description of the responsibility of teams on individual departments. When an employee starts working on a new machine, he knows exactly where the elements he must take care of. Detailed determination of places and tasks to be carried out makes their implementation easier, which limits the possibility of a situation in which some part of the machine will not be cleaned for a longer period. This can lead to faster consumption of a given element, which generates costs related to repair or even replacement with a new one. When the part turns out to be so significant that the whole machine will have to be stopped, the plant will incur additional losses resulting from the reduction of the production potential. In smaller areas, not only is it easier to maintain order, but also requires less time to prepare it for work for the next change. You need to set the optimal size of the areas so that employees can spend the maximum amount of time on performing their duties, and the minimum amount to clean up and receive satisfactory results in one and the other time zone.

3 Effects 5S

After the implementation of corrective actions, an audit was carried out in 2015. The final evaluation of this audit, as a component of the grades obtained by each team - A, B, C, D is presented in Fig.4.

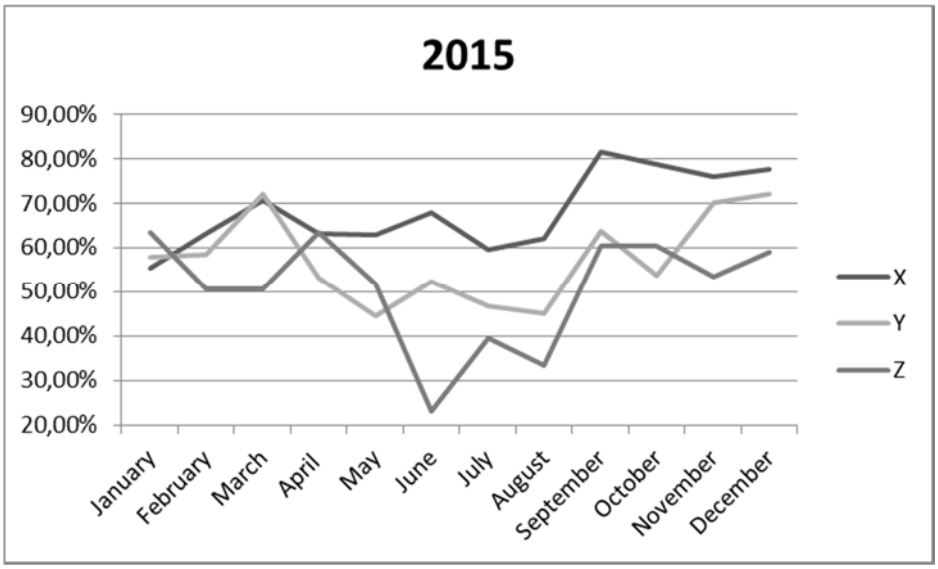

Fig. 4. Results of the 5S audit in 2015 of three halls each month.

The cleanliness of the machines and the area on which I find myself were checked. Almost, each month, the halls gained over 50% of possible points, which was a rarity in 2013 when they were introduced to the 5S plant (Figure 2). In fact, apart from the holiday period (from May to August), the ratings remained at a similar level or even increased. Weaker ratings resulted from the absence of employees responsible for 5S. However, despite this weaker period, the trend line is growing, which confirms that the state of the halls was getting better. Only the "Z" hall did not record an increase due to the highest absenteeism of employees. The next results of the 5S audit in 2016 are presented in Figure 5.

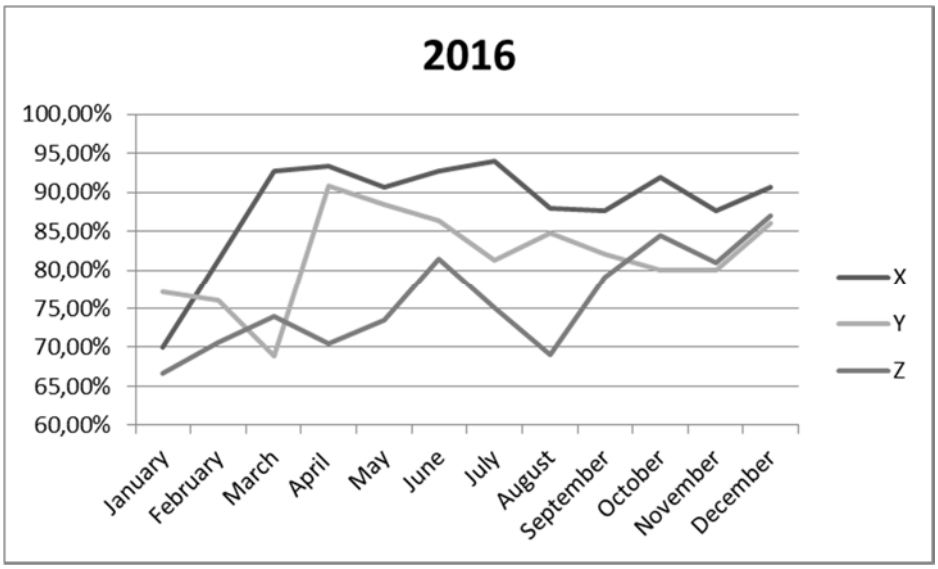

Fig. 5. The results of the 5S audit in 2016. hall of the hall every month.

The improvement of results during 5S audits is visible from year to year. In each month of 2016, better ratings were recorded than in previous years. Despite the clear and satisfactory increase in ratings and, consequently, also the improvement of cleanliness in the halls in 2015, the plant has not stopped improving in this area and 2016 has brought even better results in each hall. The trend line shown in the chart goes clearly sharply up. Even the "Z" hall, which struggled with staffing problems and separated from the other two halls, was better assessed. The company's management has analyzed the situation related to a clear decline and correct conclusions have been drawn. Even periods in which the plant has fewer employees at its disposal are able to maintain high quality. To illustrate all the activities, the results of the audit of all teams from 3 halls are presented, which is shown in Fig. 6.

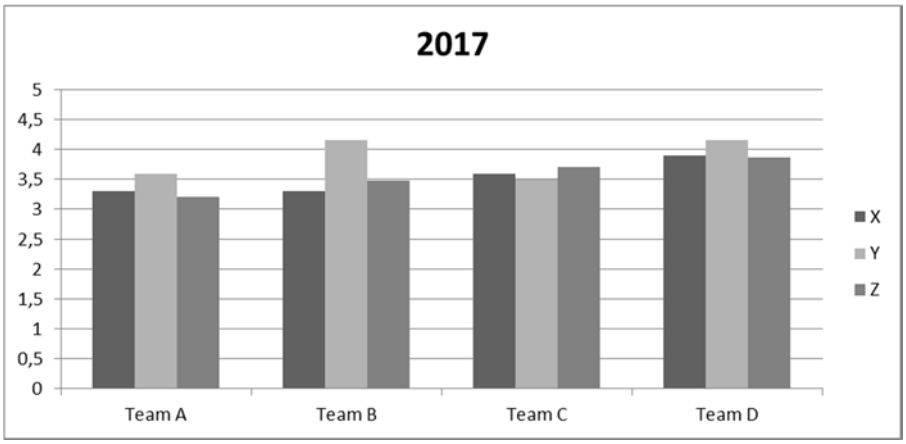

Fig. 6. Results of the audit of 4 teams of all halls.

In comparison to 2013, each hall improved its results. From year to year, audits showed an increasing improvement. An important element of the quest to improve the cleanliness was to plan the plan specifically for each halls separately. Due to the different size of the halls, the arrangement of the machines on it, the intensity of both foot and vehicle traffic, it was impossible to match one universal way that could provide improvement on each of the halls. Each machine and team in 2017 was rated higher than in previous years.

4 Conclusion

All tools at the workstations had a defined, easily accessible, place at any time. In case the situation required the use of more advanced tools, every employee knew exactly where to go. This management method introduced liquidity in the plant's operation process. These are effects from one side of good planning of work and training of employees by the managerial staff and, on the other hand, reliable execution of orders by employees. Few kinds of objects disappeared from the floor, which hindered the work of people staying in the hall. Situations in which the cable waste lying in the wrong place prevented the operator from re-arranging the machine no longer appeared, and protruding drums outside the designated storage area did not pave the passage of forklifts. Easy to implement changes have improved productivity and working conditions on many levels. Downtimes resulting from the lack of required equipment are no longer present, and machines due to improved technical condition spoil a lot less often. An employee who is not distracted from the tasks entrusted to him by removing unnecessary items and many other factors interfering with

work is less frustrated and thus more efficient. According to the philosophy of lean management, in order for the company to generate more profits, it is necessary to reduce waste, i.e. all activities that do not bring benefits. While maintaining the order, the company is able to achieve these profits, but several aspects have to be taken into account. The first one is management in accordance with the possibilities of the plant and the people working there. Proper determination of the area in the hall and machine for the employee is an important issue for maintaining production continuity. Another important issue is the proper use of human resources. Each employee must know exactly what is required of him and how to perform the tasks ordered. Adequate training will increase the productivity of employees, their work comfort while maintaining high quality. Exact instructions will avoid many wastes and keep money in the company. In summary, the data collected should emphasize the importance of the human factor. Even the best management system will not yield satisfactory results if the employees or people who create this system will not perform their duties correctly. The inability to correctly perform tasks, for example due to the lack of appropriate tools or lack of commitment may be due to poor working conditions. Moreover, the 5S system will bring the desired results when all the above-mentioned factors are carried out reliably., what is similar results of another research as [9, 10].

References

1. R. Wolniak, B Skotnicka-Zasadzien, Metalurgija, **53** (2014)
2. K. Hemanand, D. Amuthuselvan, S.C. Raja, G. Sundararaja, International Journal of Lean Thinking **3**(2), (2012)
3. I. Madanhire, Ch. Mbohwa, *Total Productive Maintenance (TPM) Application for Cable Manufacturing Organisation* (6th Int'l Conference on Mechanical, Production & Automobile Engineering, 2014)
4. C. Jaca, E. Viles, L.P Galeano, J.Santos, R. Mateo, International Journal of Production Research, **52** (2014)
5. A. Pacana, L. Bednarova, I. Liberko, Przemysl Chemiczny, **7,** 93 (2014)
6. A. Pacana, L. Bednarova, J. Pacana, Przemysl Chemiczny, **12**, 93 (2014)
7. B. Main, M. Tabutiz, W. Wood, Professional Safety, **1** (2008)
8. J Liker, *The Toyota Way* (Simon & Schuster Inc., New York, 2004)
9. J. Randhawa, I. Ahuja, International Journal of Productivity and Performance Management, **67** (2018)
10. T. Bortolotti, S. Boscari, P. Danese, International Journal Production Economics, **160** (2015)