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IMPROVEMENT OF QUALITY MANAGEMENT SYSTEM IN THE ENTERPRISE – CASE STUDY

The article presents the improvement of the quality management system through the example of a selected manufacturing enterprise. Lean Management tools were applied, showing how the development of the enterprise is affected when using appropriate methods, tools, principles, and techniques of quality management. The article presents various stages of the 5S method, which was aimed at maintaining order and discipline at workstations through the development of appropriate habits by employees. In addition, a questionnaire was used to determine the knowledge and attitude of employees concerning the operation of the solutions introduced in the enterprise studied. The research presented in the article shows how it is possible to strive for a significant improvement in quality in the operation of a manufacturing enterprise without the involvement of financial resources.

Keywords: quality management system improvement, Lean Management, 5S method, enterprise, optimization, production, case research.

1. INTRODUCTION

The pursuit of excellence in a enterprise is based on various aspects of an organization. Among others, it concerns products, products or processes. Continuous improvement, the introduction of new improvements relies on the involvement of top management and all employees. It involves quest new solutions in the day-to-day operations of the production processes performed. An important activity is to learn from previous mistakes. Ideas for improvements should come from employees, they are closest to where the problems occur and their involvement in continuous improvement is high (Zimniewicz, 2000).

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The introduction of the 5S method is aimed at maintaining order, discipline at workstations through the development of appropriate habits by employees. The 5S method methodology is not expensive and is used in both manufacturing and service companies. It consists of five steps, which include: sorting, systematization, cleaning, standardization and self-discipline.

The purpose of the research was to implement the 5S method in a manufacturing enterprise and to check the effectiveness of the implemented system based on surveys of the enterprise's employees.

The scope of work includes:

- Characteristics of the principles of the 5S method as one of the tools of Lean Management,
- Description of the selected enterprise,
- Propose changes to improve quality management,
- Preparation of support materials in maintaining and improving the 5S method,
- Operation of the introduced solutions in the surveyed enterprise based on the questionnaire.

2. CHARACTERISTICS OF THE PRINCIPLES OF THE 5S METHOD AS ONE OF THE TOOLS OF LEAN MANAGEMENT

Among the basic tools of Lean Management is 5S, which aims to introduce and maintain the necessary order in the processes to improve the management system and also to ensure safety at workplaces. The method was developed in 1995 by Hirano, a Japanese scientist. The name 5S comes from the first stages of the letters of Japanese words beginning with "S". The five pillars of 5S include:

- Seiri – sorting;
- Seiton – systematics,
- Seiso – cleaning,
- Seiketsu – standardization,
- Shitsuke – self-discipline (Franke, 2016).

The 5S method is about improving quality, productivity, work streamlining and management (Pacana et al., 2014). It is a set of simple steps leading to the introduction of good habits, which will contribute to increasing the effectiveness and efficiency of work at a given workplace. According to Myrczek (2002), the result of using the 5S method is the elimination of waste and the improvement of the comfort of the work performed.

The first stage is sorting. This process involves distinguishing items that are needed and eliminating unnecessary items, which may include broken and unused machinery, damaged products, non-conforming products, documents, and waste. This stage is intended to improve the process of keeping the workplace clean and the efficiency of searching and retrieving items, while reducing the time of performing operations (Mroczko, 2012).

It can be difficult to distinguish between items needed to do a job and unnecessary items. It is necessary to think about whether an item is definitely unnecessary before it is disposed of. An accompanying activity in the first step of using the 5S method is the use of red labels. It involves labelling red all items deemed unnecessary by employees, moving them to a designated place, and deciding whether to permanently locate them or dispose of them at a certain time according to established procedures (Grycuk, 2012). The use of a red label makes it possible to identify the reason for disposal, the quantity and date of

disposal, and other necessary information needed to identify items as unnecessary (Matysek et al., 2014).

The next step of the 5S stage is systematization. It involves labeling tools, parts and machines and designating where they will be located (Detyna, 2011). It is important to organize the workspace and secure workstations with additional pallets or racks, for example. Ensuring the elimination of waste can be achieved by ensuring cleanliness at the workstation, hence the importance of being aware of regular cleaning (Mazur and Golas, 2010). The main goal of this step is to reduce physical effort and unnecessary movement of workers. Systematization involves preparing tools in a way that makes it easy to find them quickly and easily. Machines, tools used frequently should be located closest to the workstation, so that the employee will save time to find them (Mroczko, 2012). It is helpful to use visual management techniques to implement systematization. Shadow boards, colored lines, labels, marking maximum and minimum levels for production materials, for finished goods and for commodities, captions, arrow marking (https://lean.org.pl/5s-na-produkcji-i-w-biurze/) are used to identify the location of items. A helpful activity in the second pillar of 5S can be the proper labeling of items. According to Niewczas (2010), cardboard boxes should be properly signed, whether they are tucked away or in a visible location. Practical and well-liked among employees are shadow boards, they help keep tools organized on the enterprise's premises, while the use of surface markings on the shop floor helps people remember where equipment is stored.

Another pillar is cleaning. According to Mroczko (2012), keeping workplaces tidy makes it possible to increase the safety of the work performed and to control the correct operation of equipment and machinery. An important goal of this action step is to raise awareness among employees that maintaining cleanliness of equipment, machinery and work surfaces should be a repetitive and systematic activity rather than a one-time event. Ongoing and daily removal of dust, shavings, dirt and other contaminants reinforces in employees a sense of awareness about keeping the workplace neat and clean (Matysek et al., 2014). These activities lead to a safe workplace, a clear and clean space, and an increase in employee morale and well-being (Mazur and Golas, 2010). The enterprise must provide adequate cleaning supplies and tools, which are stored in a designated area (Pascal, 2015). An important measure is to create and adhere to cleaning schedules and machine inspections. Cleaning helps eliminate damage, defects and breakdowns among machines (Mroczko 2012). The use of a checklist check sheet is an excellent solution for cleaning verification. A properly developed checklist should be placed next to the workstation on a notice board and filled out and checked by another employee (Jedrzejak et al., 2014).

The fourth step is standardization, which is related to the development and implementation of instructions, procedures or schemes to ensure that order is maintained (Mroczko, 2012). These are primarily standardized and documented solutions developed jointly with all employees during the first three steps. The developed procedures should be well explained and understood by employees. For this reason, single-topic lessons in the form of training and audits are increasingly common and used among companies (Matysek et al., 2014). Standardization is the maintenance of developed working conditions so that they become the habits of employees in their daily work. Prepared checklists, schedules, instructions should be the basis for checking whether employees are fulfilling their tasks. The checklist sheet can address the following questions: “has the employee performed the activity”, “how often is the employee supposed to perform the activity” (Jedrzejak et al., 2014). Maintaining order and tidiness at workstations is indispensable in quality improvement processes. According to Niewczas (2010), standards are needed to show the

relationship between cause and effect, standards enable management (maintenance and improvement), avoid international conflicts, ensure quality and safety, and to maintain existing know-how.

The final step of the 5S method is self-discipline. According to Detyn (2011), self-discipline involves following and working out the rules adopted in the organization. Staff training plays an important role so that they can eliminate bad habits on their own. This contributes to increased awareness among employees, raising awareness of the work being done, improving interpersonal relations and reducing non-compliance (Mroczko 2012). In order for the final stage of the 5S method to function smoothly, a team should be set up to inspect workstations, present achievements, successes, and analyze the developed evaluation sheets (Selejdak et al., 2012). Self-discipline is the most important pillar of the method, and without its maintenance the first stages of 5s are meaningless. It is important that conscious employees follow the 5S principle (Lunarski, 2012). A friendly and easy way to take care of order should be created. An important role is played by an incentive allowance, for example, in the form of vouchers, trips or a cash bonus for employees who show great commitment to implementing the method (Pacana et al., 2014).

3. RESEARCH MATERIAL AND METHODS

The research object was a manufacturing enterprise engaged in the production of garden furniture and summer and year-round log and amphibious houses. The enterprise is headquartered in Podkarpackie province, Krosno district. The author became familiarized with the specifics of the enterprise and the work performed in it by employees.

The research consisted of several stages. The first step in introducing the 5S method was to explain to employees the purpose of the activities being carried out. The next step was to observe the employees finding out their level of knowledge in quality management. After the observation, it was decided to implement a schedule of activities, and the estimated lead time for the introduction of activities to improve working conditions was presented. The next step was to introduce the five pillars of the 5S method. Pictures of workstations before and after the introduction of the 5S method were taken. The first step of the 5S method was selection, which consisted of distinguishing items needed and using red labels. The next step was systematization, which involved determining how to store needed materials. The next step attempted to eliminate dust, chips, dirt and debris, and took steps to maintain order. The application of the last two pillars of the 5S method was to establish standards and implement them, as well as adherence to the first four principles and self-discipline among employees.

The research material is the results of a questionnaire survey conducted in April/May 2022, where group of fifteen employees was surveyed. The purpose of the survey was to check the functioning of the 5S method in the enterprise. The survey questionnaire included a form including gender, age, education and seniority, as well as factual questions related to the purpose and scope of work. These were closed questions. They concerned the evaluation of the implementation of the 5S method in the enterprise. Respondents were asked, among other things, whether they had knowledge of the functioning of the 5S method, an assessment of how the method was implemented, perceived improvements at the workplace, an indication of the tools that characterize the 5S method, and an indication of which activities resulting from the implementation of 5S are the most important. On the basis of the answers given by the surveyed enterprise employees, analysis and

interpretation were carried out in order to draw conclusions about the evaluation of the implementation of the 5S method.

The collected empirical material was collected and analysed using a Microsoft Excel spreadsheet from Office 2010. Basic statistics (% of indications, abundance) were calculated. The collected and analysed material was presented using descriptive and graphical form.

4. PRESENTATION AND ANALYSIS OF RESEARCH RESULTS

The enterprise under research has been operating in the Podkarpackie province of Krosno county, Rymanow municipality since 2014. It employs fifteen people and is housed in two carpentry shops. The smaller carpentry shop is dedicated to making small details for furniture, swings, among other things. Meanwhile, the second production hall of the carpentry plant was built in 2019 to meet the enterprise's needs for the production of wooden houses.

The carpentry enterprise creates garden furniture (tables, benches, chairs) and summer and year-round houses. The houses are built using the traditional highlander method. In addition, the enterprise also offers: playgrounds, garden swings, flower pots, pergolas, wooden balustrades, stairs, gazebos and canopies. The offers are aimed at private individuals as well as the public. Thanks to its highly qualified staff and modern machinery, the enterprise can perform individual customer orders.

5. PROPOSED DIRECTIONS FOR CHANGES IN QUALITY MANAGEMENT IN THE ENTERPRISE

Observations made at a manufacturing enterprise revealed the problem the enterprise is facing. Despite well-qualified employees and machinery facilities, a problem was observed regarding disorder, lack of discipline and clutter in workplaces. Lack of good organization of the workplace, often searching for the equipment needed at the time, not putting the tool in the right place causes chaos and nervousness among the entire team. After interviews with employees and the owner of the enterprise, it became clear that attempts had already been made to implement corrective measures to facilitate the work. In order to maintain order, introduce discipline among employees and improve the entire Management System, it was decided to implement the 5S method, thanks to the help of a student. The philosophy of the 5S method is characterized by a low financial outlay, and thanks to this, it enables the creation of a well-organized workplace and increases the safety of the workplace.

6. IMPLEMENTATION OF THE PRINCIPLES OF THE 5S METHOD IN AN ENTERPRISE – CASE STUDY

The surveyed enterprise in Q1 and Q2 of 2022 decided to implement elements of the 5S method to streamline workplaces and improve productivity. The first step in implementing the new method was to promote the 5S method. This consisted of presenting the main benefits of the method. The goal of 5S is to raise awareness in the employee so that keeping the workplace tidy becomes a standard.

The next activity was to present a schedule of implementation activities. The owner of the enterprise, in order to implement the 5S method smoothly, asked for the assistance of the Quality Management Supervisor. With the help and involvement, the duration and implementation of the 5S method in the enterprise was estimated and planned. The implementation plan for the 5S method is shown in the table.

Table 1. Schedule for implementation of the 5S method

Pillar 5S	Activities performed	Duration (days)	Person in charge
Selection	- Sort items into needed and unneeded, - Implementation of red cards, - Removal of unnecessary items - Determine the purpose of the items in question, - Eliminating threats.	10	Quality Management Officer, business owner, student
Systematics	- Marking places for needed items, - Proper arrangement of items, tools used first.	5	Quality Management Officer, student
Cleaning	- Keeping equipment clean, - Preparation of a schedule for the cleaning work to be carried out - Identification of pollution sources.	10	Quality Management Officer, business owner, student
Standardization	- Developing instructions for controlling the first three pillars of the 5S method, - Designating employees responsible for 5S activities.	15	Quality Management Officer, student
Self-discipline	- Self-control, - Proceeding in accordance with established procedures, - Developing habits to adhere to implemented improvement solutions, - Auditing.	10	Quality Management Officer, student

Source: own elaboration.

7. EVALUATION AND OPERATION OF THE 5S METHOD IN THE ENTERPRISE

In order to check the effectiveness of the changes introduced through the introduction of the 5S method, a survey was conducted among employees. 15 people took part in the survey. An extremely important element is the analysis of the metric, which included responses regarding gender, age, education and job seniority. 15 people took part in the survey, of which men accounted for 100%. Among the respondents, those in the 31–40 age range predominated – 53%. The second group of respondents were those in the 18–30 age bracket, who accounted for 27% of all surveyed respondents. Respondents between the ages of 41–50 accounted for 13% of the respondents. The smallest number of respondents taking part in the survey was the 51–60 age group (7%) and those over 61 (0%). The largest group of respondents surveyed were those with secondary education (40%). The possession of vocational education was declared by 33% of the surveyed employees, while 13% of the respondents were those with primary and higher education. The largest number of respondents, 40%, had work experience of 10 to 15 years. The second largest group, were employees with work experience of more than 15 years (27%). Respondents with work seniority of 5 to 10 years accounted for 20%, while 13% of surveyed employees had work experience of 2 to 5 years. The primary question addressed to employees of the woodworking and craftsmanship plant was whether they had knowledge of how the 5S

method works. From the data presented in Figure 1, it can be seen that all of the respondents have knowledge of how the 5S method works.

According to the survey data conducted by Krawczuk and Kocira (2016) among the employees of the chemistry department, all the people questioned (100%) had knowledge of the 5S method. Another question asked how employees were informed about the implementation of the 5S method in the enterprise. The largest number of respondents, 47%, indicated that they learned about the plans to introduce the 5S method from their co-worker. On the other hand, 40% of respondents were informed about the intention to implement the method at a meeting with the enterprise's owner. A group of 13% of the surveyed respondents said that they read information about the introduction of changes to workstations from a bulletin board. The next question concerned the evaluation of how 5S was implemented in the enterprise. The surveyed group of employees could choose one option from among several given answers. The analysis showed that 60% of the surveyed employees rated the implementation of the 5S method very well. It turns out that 33% of the surveyed respondents rate the way of implementing the new method well. Only 7% of employees indicated that they give an average rating to the method of implementing 5S at workplaces. In the next question, the surveyed employees were asked whether they perceive differences in the improvement of work at the workplace after the implementation of the 5S method. The data shows that all respondents perceive a difference in the performance of work on the job after implementing the 5S method. According to the data conducted by Lean Management Consulting Group, 61.76% of respondents believe that they see an improvement in the work performed after implementing the 5S method. According to 26.47% of the surveyed respondents, it does not matter at all whether there is a visible improvement a workstation. According to 5.88% of respondents, they do not see an improvement in the productivity of their workstations. At the same time, 5.88% say that the introduction of this method is a head-turner (https://www.lmcg.com.pl/artykul-lean-Absorpcja-5S.html). The surveyed employees were asked whether the implementation of the 5S method is associated with an increase in work productivity. Among the respondents, 67% felt that the implementation of the 5S method definitely improved work productivity. More than 13% of the respondents felt that the implementation of the new method did not affect labor productivity. On the other hand, a group of 20% of employees felt that it was difficult to determine the impact of the new solutions on labor productivity.

Another question concerned the evaluation of work at the job of performing work after implementing the 5S method. More than half of the respondents, 53%, indicated that the work is definitely done better at the position after the implementation of the 5S method. Another group is made up of employees who believe that after the implementation of the new method the work is done better – 33%. Only 14% of respondents said that they see no difference after implementing the 5S method in the work performed at their position.

The enterprise's employees were asked to indicate the differences they perceive after implementing the 5S method. The surveyed group of respondents was able to indicate more than one answer option among several. As shown in Figure 1, all employees indicated that the biggest difference perceived after implementing the 5S method is the visibly arranged machinery and equipment. Among those surveyed, 93% of respondents perceived an improvement in the form of a reduction in the need for unnecessary movements. The possibility of increased safety was cited by 80% of employees, while 74% of respondents said that a positive difference from implementing the 5S method was improved

communication between employees. 53% said they saw differences in improved product and work quality. Forty percent of those questioned each said that one of the main differences from the introduction of 5S was that it was easier to see things, due to the fact that they were arranged, and the introduction of more training. Increased responsibilities resulting from the enterprise's changes are perceived by 33% of employees surveyed.

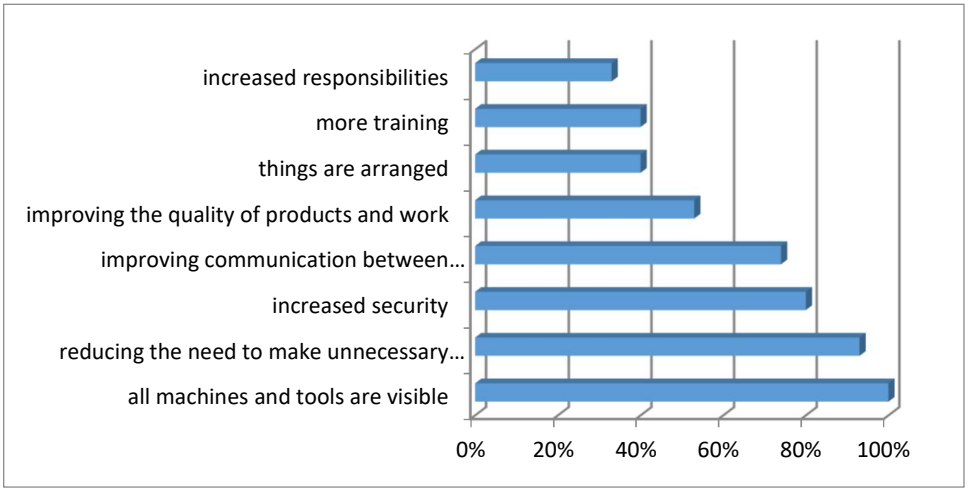

Figure 1. Visible differences after implementation of the 5S method

Source: own research.

Respondents were asked to indicate which pillar of the 5S method they think is the most important on the job. According to 33% of employees, standardization is the most important pillar of the 5S method. 27% of respondents believe systematics, while 20% believe self-discipline. For 13% of employees, sorting is an important element in the correct functioning of the 5S method. Only 7% indicated that, according to them, cleaning is the most important element of the 5S method. Responding to the question about the tools that characterize the 5S method, presented in Figure 2, 80% of people said that, according to them, the red label and self-discipline are the most important tools. According to 73% of those surveyed, the 5S board, as well as signatures and colored lines (67%), are important when implementing the 5S method. When implementing the 5S method, according to 60% of employees, cleaning plays an important role. Also according to 40% of employees, systematics is among the tools for improving the 5S method. Only 33% of respondents indicated that sorting is among the tools that characterize the 5S method and according to 20% of respondents, audits are important. The surveyed group of respondents, among several response options, could indicate more than one.

In a research by Kravchuk and Kocira (2016), the characteristic elements for the 5S method are self-discipline (17%), cleaning and sorting (15%). 14% of respondents said that audits and systematization are important tools when implementing the 5S method. According to 8% of respondents, accompanying elements during the implementation of the 5S method are the 5S board and standardization. According to 6% of respondents, signatures, labels, colored lines and the use of red labels for 3% of employees are integral tools for the functioning of the 5S method.

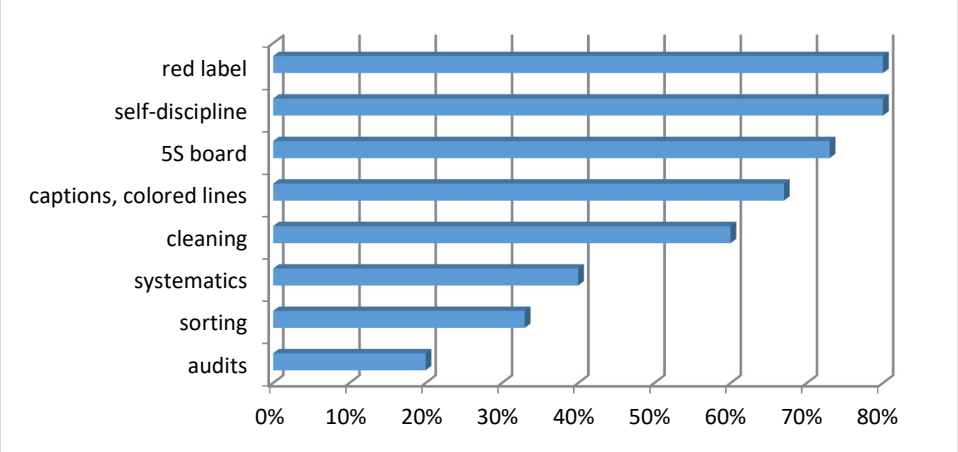

Figure 2. Tools that characterize the 5S method

Sources: own research.

Another question in the survey asked about employees' openness to implementing new methods to facilitate work. 93% of the surveyed employees are open to implementing new methods on the job. Only 7% of respondents believe that the implementation of new methods is unnecessary. The last question addressed to the surveyed employees was to identify the most important activities resulting from the implementation of the 5S method. All of those asked were aware that increased safety was the most important element. For 87% of the surveyed employees, an important factor resulting from the implementation of the 5S method is increased productivity, while 73% indicated orderliness. Putting away and finding items in their place was indicated by 53% of respondents. According to 47% of respondents, they said the process helped improve the production process. The results of the analysis are shown in Figure 3.

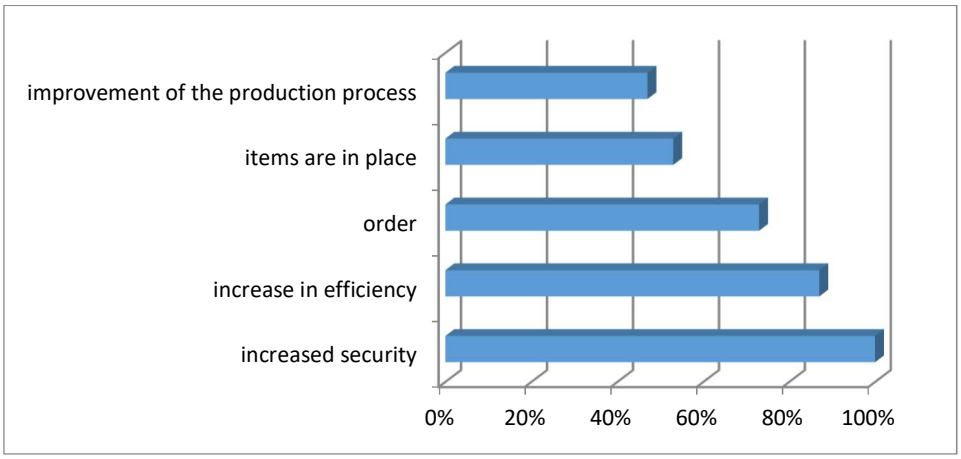

Figure 3. Important activities resulting from the implementation of the 5S method

Source: own research.

8. SUMMARY AND CONCLUSIONS

The implementation of Lean Management tools makes it possible to improve the efficiency of the work performed, at low cost. The 5S method was introduced in the studied enterprise, thanks to which significant changes in quality management were noticed. The introduction of simple solutions with the involvement of employees affected, the quality and efficiency of the work performed. The 5S method has developed in employees simple habits that facilitate the performance of a given activity.

Based on the research, the following conclusions can be drawn:

1. The implementation of the 5S method in the enterprise has influenced, among other things, better organization of work, increased safety in the places where the activity is performed, and better productivity and organization of work. More than 93% of employees are open to implementing new methods to make work easier.
2. The purchase of new equipment and machinery has eliminated shavings, sawdust and dust, and reduced the lead time of the order.
3. The involvement of all employees associated with the implementation of the new method allowed the team to get to know each other better, which had a positive effect on improving communication relations among employees.
4. Organizing and removing unnecessary items and giving items their storage location has reduced the time spent searching for machinery and tools.
5. When it comes to evaluating how the 5S method was implemented at the enterprise, employees believe that it was implemented in a very good, good way at the surveyed plant. The visible differences after implementing the 5S method, according to the employees, were the ability to easily find machines and tools, reducing the need for unnecessary movements, increasing safety and improving communication between employees.
6. According to the employees surveyed, standardization appeared to be the most important pillar in the implementation of the 5S concept.

The implementation of the 5S method in the surveyed enterprise makes it clear that it has had a positive impact on employees and the enterprise as a whole. The surveyed results confirm the idea of implementing the improvement of the quality management system. Maintaining order in workplaces allows for the rapid elimination of faults and failures, thanks to which the level of safety is significantly higher. Adequate involvement of the entire team in the organization of work by submitting their comments, ideas improved the process of implementing the method. Developing habits among employees, such as giving order by putting objects in their place, increased productivity and quality of work and eliminated unnecessary movement.

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