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PROBLEM-SOLVING ON THE EXAMPLE OF A SELECTED ENTERPRISE FROM THE INDUSTRIAL SECTOR

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Purpose: The article presents a general outline of problem-solving based on both domestic and foreign literature. Problem-solving is an example of a system that should be considered in the context of efficiently functioning production processes within a company. The analysis of the internal problem-solving process is conducted based on staged process.
Design/methodology/approach: The following research methods were utilized in the article: analysis of domestic and foreign literature. Article also presents an original approach to the practical application of the problem-solving process concerning internal operational issues.
Findings: It was found that the process of resolving internal operational problems in the examined company consists of stages. The essence of staged problem-solving supports coping with the problem.
Originality/value: The results of the problem-solving process analysis in the company can be directed towards individuals involved in improving processes and problem-solving systems within organizations. Due to its cognitive value and significance for business practice, the article also contributes to the discussion on problem-solving methodology.
Keywords: problem-solving, root causes, Deming cycle.
Category of the paper: Research paper, Case study.

Introduction

According to what was found in the overview of the internal operational problem-solving process issue, a research gap was identified as the insufficient use of data and analytical tools to identify the root causes of operational problems. The research gap may be due to limited access to data (organizations do not always provide operational data), the complexity of operational processes or the difficulty in identifying causes. The article analyzes the staging of problem solving considering best practices, data and tools for identifying the root causes of operational problems in an enterprise. The purpose of the article is to analyze the process of

solving internal problems based on the staging of the process in terms of the smooth operation of production processes. The study uses literature analysis and a case stage.

In many companies problems appear as unavoidable challenges that must be met. However, these problems can also be seen as hidden opportunities for improving the company's performance and growth. Adopting this perspective not only promotes a proactive and innovative approach but also lays the foundation for long-term success.

Increasing organizational performance is one of the key considerations on both theoretical and practical grounds. One of the elements influencing this cycle is the organization's ability to solve problems. The selection and application of appropriate problem-solving methods and tools can contribute to being more competitive while eliminating any operations that bring losses to the organization. This approach meets stakeholders' expectations and generates the organization's ability to eliminate losses and create effective solutions, as well as involve all employees in continuous process improvement, including the problem-solving process.

Problem-solving also provides an opportunity to engage employees and promote a culture of cooperation and creativity. When employees face challenges together it encourages teamwork, gives individuals a sense of responsibility and boosts morale. Such an environment stimulates the generation of innovative approaches to problem-solving which ultimately contributes to improving company performance. Including employees in the problem-solving process can be facilitated by middle-level managers who facilitate knowledge and information exchange among employees, encourage the submission of new ideas, experimentation, and continuous improvement implementation (Floyd, Lane 2000).

Problem-solving - an overview of the issue

The problem-solving system is found primarily in organizations that practice a culture of continuous development and improvement where both management and employees strive to maximize reduction of occurring problems.

In the classical method, a problem is defined as a difficult condition from which a solution must be found. A problem is a mismatch between the existing conditions of an organization and the conditions its members strive for, it is the difference between standard conditions and actual conditions. In addition, a problem should be viewed as an opportunity to improve organizational performance (Harry, Schroeder, 2000; Watanabe, 2009; Michalko, Thinkertoys, 2006; Lockwood, 2009).

A company that recognizes problems as opportunities for improvement adopts a culture of continuous learning. Each problem solved becomes a lesson that allows the organization to accumulate knowledge and experience that can be applied to future challenges. Learning from

mistakes and failures become a powerful catalyst for progress and development. By adopting this perspective companies can turn adversity into an advantage and improve performance.

A limitation of most problem-solving research is that it focuses primarily on methods to improve problem solving. Most researches on problem-solving have focused on methods to improve problem-solving. Fewer studies have looked at decision-making in terms of problem-solving. Theoretically we do not find a systematic model of instructional design that can be applied to different types of problems (Jonassen). However, a distinction has been made between schema-based and search-based problem-solving strategies (Glick).

A classic problem-solving technique says that the most common mistake is a quick fix without conducting first a comprehensive analysis or attempting to understand the situation. A specific countermeasure will not permanently solve the problem unless the root cause is identified and determined as the problem may reappear. The key is to define the root cause to properly assess the situation otherwise results of the analysis will be unsatisfactory.

A clearly defined problem helps to avoid searching for the cause in the wrong place (Barsalou, Perkin, 2022; 2023). Another common mistake is to try to solve the abnormal problem. In such case the comprehensive approach to problem-solving is essential. It is also incorrect to seek a solution only for a single scenario as this is opposite to the entire Problem-Solving process where the basic idea is to prevent the problem from occurring in the future and not just to find an immediate solution. In some cases, problem will be solved and both corrective and preventive actions will be developed but a comprehensive analysis of the presented solution and its impact to the entire process and organization is omitted.

Examples of standard practices include manuals, diagrams, guidelines and any other tools that provide a common way to represent and share knowledge (Cowan et al., 2000). The extent to which employees use these standard practices affects how they analyze situations when solving problems (Delbridge, Barton, 2002; Cantor, MacDonald, 2009). A study by Choo et al. (2007) found that adherence to standard practices in quality improvement recommends how employees seek information and ask questions that lead to the creation of new knowledge to find solutions. As a result, once a solution is implemented it is important to evaluate whether it has had the expected effect.

A problem should not be treated as a failure but should be skillfully used to continuously learn and improve the organization. The correct approach to problem-solving is used in the Lean concept where the employee is encouraged by the management to work together to solve the problem with the full support and involvement of superiors taking the responsibility. Lean is one of the most popular practices for continuous improvement (Welo, Ringen, 2015). Continuous improvement should be also considered a key factor in a company's success (Harrington, 1995). Other studies point to the need for organizations to continuously improve to be competitive (Delbridge, Barton, 2002).

The process of continuous and methodical improvement is usually based on the Deming cycle. The Deming cycle is a schematic system of action for continuous improvement that is constantly detecting errors or work waste and finding solutions to the problems. It creates the basis of problem-solving within the Kaizen philosophy. The Deming cycle consists of four stages: Plan, Do, Check, Act. Depending on the stage specific problem-solving tools can be applied (Deming, 2018; 2000; Delavigne, 1994).

In the first step the company's areas for the further improvement must be identified and the process areas that require further developments must be written out.

The list of potential improvements should be evaluated to determine priorities. Afterwards the needs of the customer (internal or external) regarding process improvement must be identified. The next step is to gather information about the process such as the metrics that will be used and what measurements will be taken before, during and after implementation. Once the defects sources and errors have been identified within the process the next step is to identify the potential countermeasures. The result is a comprehensive action plan that includes the main objective, specific objectives, methods and timeframes, checkpoints, and responsible persons. Finalized plan is shared with the team. The most commonly used tools are a flowchart, Pareto-Lorenz diagram, brainstorming, and cause-and-effect diagram (Walton, 1991).

Implementation of established procedures with the help and knowledge of senior management is the second phase of the Deming cycle. In this phase, process improvements are made first and foremost, and the result of this part is to change the process to improve its performance or the nature of the unit, as well as to eliminate the sources of problems. Small-scale activities or findings generated in the previous phase of the cycle can also be tested at this level (Deming, 2018; 2000; Delavigne, 1994). At this point the most used tools include a flowchart, a check sheet and a flow diagram.

Step three involves measuring the results and comparing them with the assumptions from step one. In this step the measurements adopted in the plan should be highlighted. The purpose of this step is to determine whether the earlier improvement activities produced the expected results (Deming, 2018; 2000; Delavigne, 1994). The performance of the activity should be evaluated using predefined indicators and the results should be presented in a report. At this stage, it is important to gather as much information as possible to develop actions for the next phase of the cycle. If irregularities are detected the causes should be identified. In this phase of the cycle the use of check sheets among other things is recommended (Walton, 1991).

In the fourth stage, an important element is to take corrective action especially if inaccuracies are diagnosed in the established plan. The data collected at the end of the cycle should be used to plan the next stage of the improvement cycle (Deming, 2018; 2000; Delavigne, 1994). As a result, the key is to implement those solutions that had a positive impact on the process and improve those with a negative impact. If the established plan is not feasible, a new one should be developed with the resulting conclusions. If there are no abnormalities,

the stage should be continued in the mindset of continuous process improvement without overlooking customer's participation and expectations. Each process activity should be authenticated through appropriate procedural documents. The most commonly used tools at this stage include process mapping and flow diagrams (Walton, 1991).

As a result of using PDCA to solve problems, members of the organization create and implement new challenges and a continuous improvement process is applied in the company which is often considered a critical factor in the company's success (Harrington, 1995).

Proper problem solving in enterprises contributes to the rational use of resources involved in production, improvement of product quality, optimization of production potential and, as a result, to increase the efficiency of the enterprise as a whole (Nakova, Abakova, Kurgambekov, Saule, 2024)

Problem-solving in an enterprise – Case study

The company where the research was performed operates in the metal industry and has been in operation for more than 15 years. Production processes carried out in the organization include the extrusion of sheet metal parts, welding, sealing, varnishing and final assembly at automated, semi-automated and manual stations. At the end of the process products are labeled or marked. A small part of production is directed to customers in Poland, but most products are sold abroad, mainly in Europe.

In 2009, during the economic crisis to prevent the reduction of human resources company decided to invest time and competence in improving the existing processes. At this time the company's problem-solving system was developed and exists till today. Of course, it has went through several changes to respond to "process deviations" and resulted in improvements of problem-solving area. Company also has other systems related to continuous improvement such as the Kaizen system or lean projects that have their origin in value stream mapping, but they are not a part of the problem-solving system, they are functioning independently.

Problem-solving in the examined company involves a system of solving problems when 3 conditions are met:

1. There is a significant difference between the expected state and the actual state which can be defined as a problem. This can be for example an indicator whose target is not met or an adverse event in the form of "passing" a non-conforming product through the machine.
2. The cause is unknown. We are not sure what is the cause of the actual condition, and we need to collect data that will help to determine the issue.

3. It is necessary to find the cause to take effective action. If we have a problem but the other conditions are not met then we are only talking about improvement projects/initiatives for which we use other systems and processes (e.g. Lean projects, Just Do It projects).

In a metal company the problem-solving system consists of several processes depending on the type of problem we are dealing with. These are:

- Internal operational problem-solving process (e.g., for low OEE, high scrap rates, etc.),
- Process for solving quality problems related to customer complaints - QRQC (Quick Response Quality Concern) and 8D for customer communication,
- The process of solving complex problems, mostly connected with the quality that require variability reduction - Six Sigma methodology,
- Process for resolving health and safety incidents (accidents and near misses).

The publication describes the process of solving internal operational problems, meaning, problems where the information source is from within the organization. The first step in problem-solving is awareness of the problem existence. One source of information about the problem is data analysis from the MES (Manufacturing Execution System) which collects real-time information from machines about production performance and downtime. In this case, the most commonly considered indicator is OEE (Overal Equipment Efficiency). Another source of information about the problem is a weekly and monthly analysis of scrap levels by process. At the monthly operational review, decisions are made on which areas and to what extent they will be required to open problem-solving projects. Ownership of the process is taken by the owner of the area usually the coordinator or area production manager. If the scope does not involve production, it is the manager of the department to which the scope applies. For projects related to quality problems, the owner is not a person from the quality department but the coordinator/production manager of the area where the problem was identified. Figure 1 shows the first 4 stages of the problem-solving process related to data collection, data analysis, goal setting and the root causes of problem.

The project owner defines the team but for defined production area the people who support area quality, technology, logistics and maintenance side are indicated. Therefore, most often the owner invites all the people from the supporting departments to the project except those who are not affected by the problem, such as logistics. The CFT or Cross Functional Team takes the challenge to solve the problem.

Before any corrective action is taken, a problem-solving project must begin by gathering detailed information about the problem such as: what exactly is the problem and what is its scale, how was it identified and by whom, how long has the problem been apparent and what is its trend. This is a similar analysis to the 5W2H method. Analysis of this data allows to discard a group of potential causes that the collected data does not support on the early stages of the project. The fourth stage of the process is divided into 4 phases.

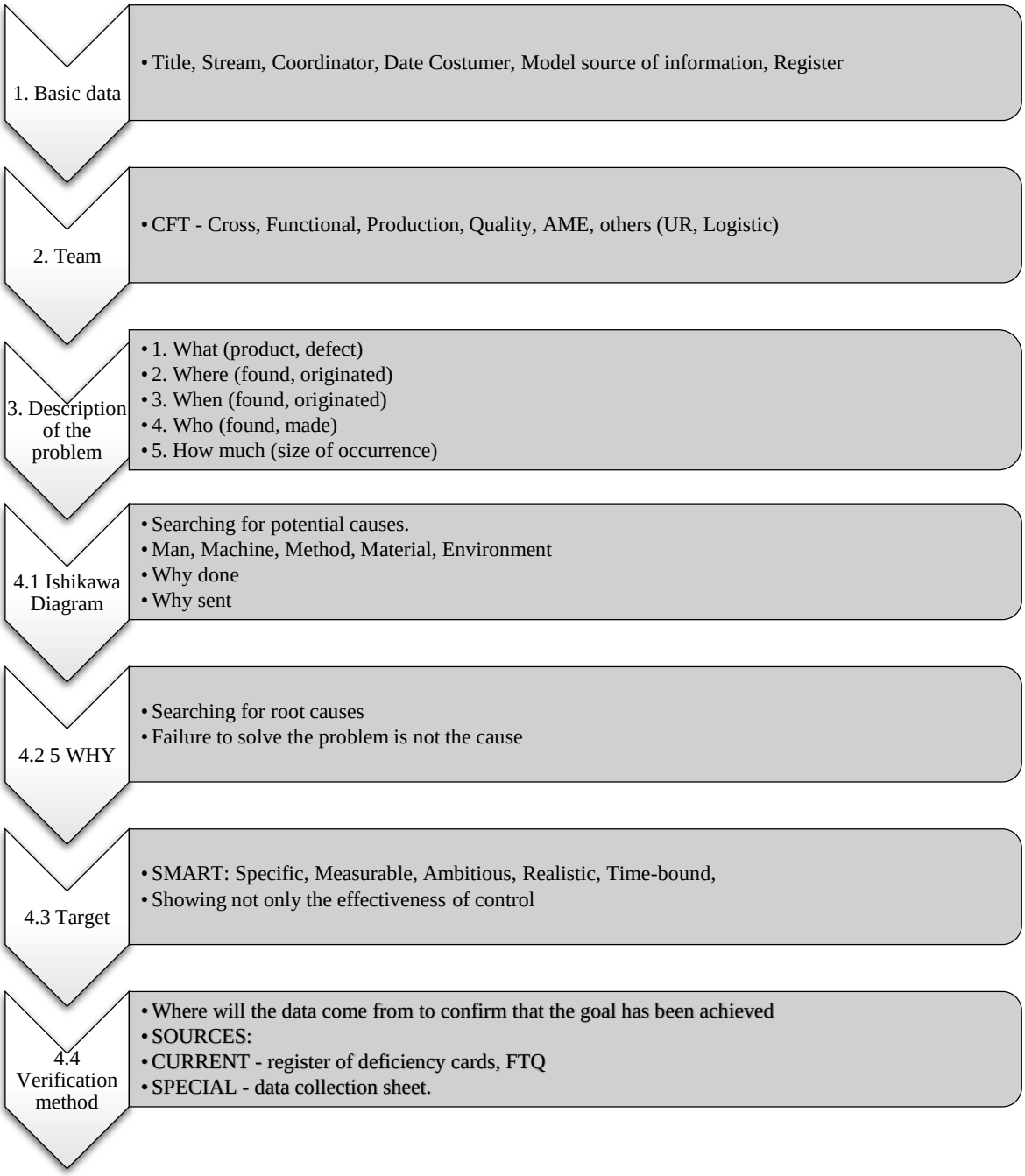

Figure 1. Analytical stages of the problem-solving project.

Source: own elaboration based on company data

The first phase concerns collecting all potential causes of the problem and identifying the most probable ones, which are subjected to verification, i.e. checking whether they are the real reason of the problem existence. Confirmed causes in the next phase of fourth stage are subjected to analysis to determine what is the root cause of the problem (so-called "root cause"), i.e. the elimination of the cause which will significantly affect the solution of the problem, e.g. significantly increase the OEE rate. Here the most common technique is the 5 WHY, or 5 times "why." Some problems will have more than one cause, in which case root cause analysis should be done for each of them. In the third phase of this stage the value of the target

indicator is determined, meaning, the target value (not necessarily representing the ideal state) that meets the SMART rule. The final phase of this stage is to specify by what method and what sources of information will be used to assess whether the defined goal has been achieved.

The first four stages of the problem-solving project are analytical and centered around the collection of data on the current state. Going thought all those stages allows to draw the right conclusions and determine the causes of the problem. The key to problem-solving is not to take improvement actions before full analysis of the problem nature and scale. The next steps (5 to 10) will be centered around the actions needed to eliminate the problem and verify the effectiveness of those actions (Figure 2).

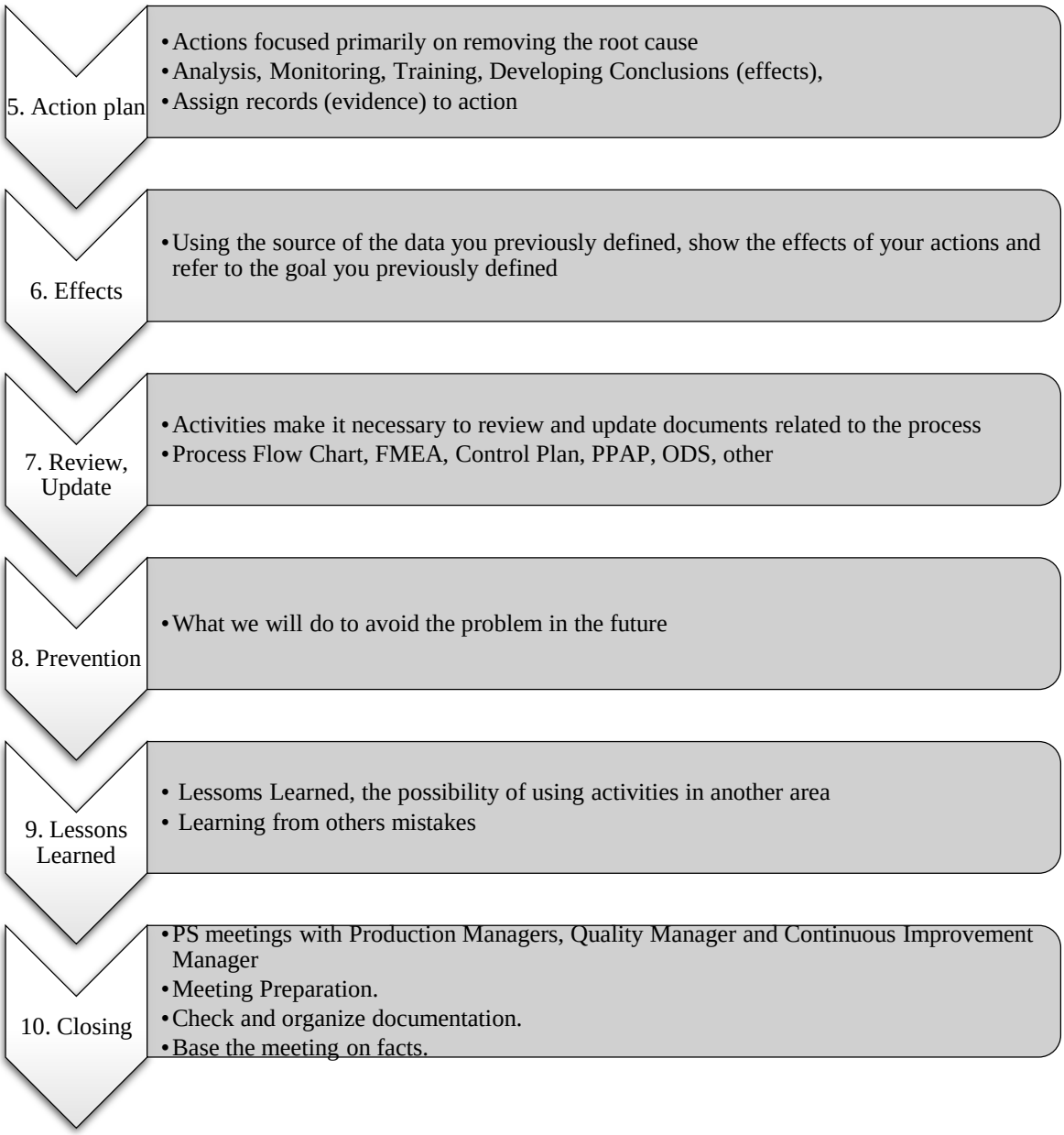

Figure 2. Stages of the problem-solving project including problem-elimination activities and their effectiveness verification.

Source: own elaboration based on company data.

The key to successful problem-solving is the principle of not taking action before the root cause(s) of the problem has been identified and confirmed. Once the cause is known corrective actions should be focused on its elimination. This is what the fifth stage of the problem-solving process is all about. Once all actions are in place the next stage focuses on the results. Results are compared to the value defined as the target (the third phase of the fourth stage) using the verification method defined in the last phase of the fourth stage. If the results obtained are equal to or better than the target established, this confirms the effectiveness of the corrective measures introduced.

The seventh stage helps to maintain the result over the long term and stop the self-reversion to the status quo before the introduction of the measures. To this end, documents and standards are changed to introduce a new "status quo." As a preventive measure, or the next stage, an analysis is made of whether similar causes and actions apply in other areas (e.g., on similar production lines or similar products). Lessons Learned is the eighth stage and allows to reach back to systems and processes and answer the question of whether they require fundamental changes due to the knowledge gained during the problem-solving. However, not every problem-solving ends with the determination of Lessons Learned.

The final stage of problem-solving is the official closing during a specially organized meeting with the company's management. The problem-solving team presents not only the results but the entire process of the project. If there is no doubt about the problem-solving process itself and its results the project is considered successful and officially closed. If not - the actions to be performed by the team before the next attempt to close the project are agreed upon.

All the described stages of problem-solving in the studied enterprise contribute to the organization and knowledge development in this area and its use in the future in terms of solving or eliminating problems more efficiently.

Summary and conclusions

The outline of the problem-solving literature presented in the article indicates the need for research on internal operational problem-solving processes. The analysis of the literature paves the way for further research on problem-solving projects. The article attempts to respond in this area, fitting in with issues such as process improvement, problem-solving or, more specifically, internal operational problem-solving.

The research method used (case stage) contributed to proving the research objective of prioritizing the phasing of problem-solving projects.

The occurring problem is a signal that highlights areas which need attention and improvement. In the company described this results in the opening of a problem-solving project. By identifying the root cause of the problem company can gain valuable insight into inefficiencies or weaknesses in the processes, systems, or strategies. This knowledge is important for creating the effective solutions and improving overall company's performance. Staged problem-solving helps structure and organize the process of solving internal problems by breaking it down into smaller steps or stages. This allows for a better understanding of the problem, the identification of key issues, and the establishment of intermediate goals, all of which contribute to effective problem-solving. What's more, breaking it down into steps allows to track progress and make changes to the process as needed.

The analysis of the problem-solving project can be used to improve the solution of internal operational problems in enterprises. It should also be emphasized that the information obtained contributes to the development of knowledge about problem solving processes. The study also provides valuable information on effective problem-solving strategies in an industrial environment, highlighting the importance of the problem solving stages of internal operational issues.

In summary, a properly structured problem-solving can help companies to remain adaptable and resilient in a dynamic market landscape. Problem-solving can lead to process optimization and productivity gains. In the aspect of the described case study, through Lessons Learned it is possible to re-evaluate existing workflows and procedures and company can identify bottlenecks and improve operations.

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