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IMPROVING QUALITY THROUGH THE LEAN SIX SIGMA APPROACH

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Abstract:

This article discusses improving quality through the lean six sigma approach at SMA Nurul Jadid Paiton. This research uses a qualitative case study approach, the research subjects consist of the Principal and several Deputy Heads. Data collection techniques use interviews, documentation, observation. Data analysis techniques use data reduction, data presentation, and drawing conclusions. The focus of this research is that the researcher wants to describe improving quality through the lean six sigma approach at SMA Nurul Jadid Paiton. The research results show that quality improvement through the lean six sigma approach at SMA Nurul Jadid Paiton greatly improve the quality of the institution through the five stages implemented , namely _ _ *Define , Measure , Analyze , Improve* And *Control* . We can see from the various performances that have been carried out by the staff in accordance with the Lean Six Sigma Approach or not, and we must be more careful in the performance or prioritization of human resources at Nurul Jadid High School . Improving the quality of educational institutions through the Lean Six Sigma Approach is very superior, this shows several positions between the good and bad approaches of the Lean Six Sigma Approach. And the Nurul Jadid High School institution proves that through the processes of the head and his subordinates they are the spearhead of improving the quality of the institution, and Nurul Jadid High School proves this with good performance, the results are also better through this Lean Six Sigma Approach. Nurul Jadid High School .

Keywords: *Improvement , Quality , Lean Six Sigma*

INTRODUCTION

The development of manufacturing technology today is increasingly rapid. So that it encourages manufacturing companies to master this technology with the aim of producing quality finished products. Technology is a source of strength in the industrial sector to increase productivity and help performance development. Technology plays an important role in improving operational performance, including reducing defective products, speeding up production process times, distributing products on time, increasing productivity, eliminating waste , and controlling quality (Sarmono et al., 2020) .

Efforts to improve the quality of education are an issue that will continue to be discussed in education management. Improving the quality of education is an effort that must be pursued continuously so that hopes for quality and relevant education can be achieved (Latifa, 2022) .

Some time ago management tools were discovered as another alternative to TQM (Total Quality Management), also focused on quality control and customer

satisfaction but with added value. Namely paying more attention to the production system as a whole. This aims to eliminate production defects, save production time, and reduce costs (Shinta & Ain, 2021) .

The tool in question is six sigma. It is a scientific discipline with a formal model, DMAIC (Define, Measure, Analyze, Improve, Control) . Six sigma is experienced and has made significant results in industry, health, and services. Meanwhile, in the education sector, it is considered less relevant to implement six sigma, on the grounds that the education sector does not have statistical-based and strongly controlled methodological standards. For example, standards for production equipment, input, output, real and asset recording. Meanwhile, the educational aspect, which includes teaching materials, individual performance and student success, is deemed not to be compatible with the methodology developed in six sigma, which is statistically based and controlled. (Patel & Patel, 2020)

However, progressive thinking states that education can also implement six sigma. With the fact that education focuses on customer satisfaction , both internally and externally. Through improvements it is hoped that it can meet the needs and desires of clients. The application of the six sigma methodology in schools offers a new alternative to improve the quality of educational institutions. This methodology has been applied to educational institutions in developed countries and has proven to be useful (Utari & Wijayanti, 2017) .

improvement research has been carried out, such as (Maryatul Kibtiyah, 2022) who said in his research that the Driving School Program is an effort to improve quality, where the driving school is a program that focuses on developing student learning outcomes holistically by realizing the Pancasila Student Profile which includes cognitive competencies. (literacy and numeracy) and non-cognitive (character) starting with superior human resources (school principals and teachers).

According to (Ruwiyanto et al., 2021) said that to improve the quality of schools there must be an evaluation that must be carried out by the school from various management including developing the professionalism of teachers or educators. Apart from that (Fujiawati et al., 2020) explained that the implementation of ISO is able to give birth to good governance. manage quality administration towards the development and improvement of the quality of Islamic boarding school higher education. And there is a need for teamwork to increase self-confidence, communication and develop independence.

Meanwhile, in terms of lean six sigma (Ridwan et al., 2020) argue that Lean Six Sigma is a combination of two continuous improvement methods, namely Lean and Six Sigma. Lean is a set of principles, practices and tools that aim to maximize customer value, while Six Sigma is a structured approach that aims to improve the quality of products and services by focusing on processes. Lean Six Sigma uses a comprehensive approach and has been proven to change organizations, such as reducing costs and making employees happier. This method focuses on improving performance by eliminating waste and defects in the process (Manesah et al., 2022) .

In Lean Six Sigma, there are several tools that are commonly used in continuous improvement problems. Some of them are tools for displaying data and tools for determining the root of the problem and the results of the solution. (Nurhasimah et al., 2020) The difference between Six Sigma and Lean Six Sigma lies in their focus. Six Sigma focuses on reducing process variation and improving process control, while Lean Six Sigma focuses on eliminating non-value-added processes and procedures and promoting the use of standardization of work and flow aimed at creating competitive advantage (Hartoyo, 2022) .

Lean Six Sigma has been proven to help many companies change the way they operate and compete more competitively. This approach is always based on data and facts in the field, with a focus on preventing defects rather than detecting defects in the production of goods or services. In its application, Lean Six Sigma uses the DMAIC (Define, Measure, Analyze, Improve, Control) and DMADV (Define, Measure, Analyze, Design, Validate) methods. With the successful implementation of Lean Six Sigma, companies can produce several benefits, such as improving product quality, reducing costs, reducing production cycles, increasing market share growth, and increasing

customer retention (Sarmono et al., 2020) .

Departing from the research above, the novelty of this research lies in the context improving the quality of education through Lean Six Sigma. By implementing Lean Six Sigma in the education system, we create an innovation laboratory to polish the core of learning. Like modern alchemy, this methodology combines the benefits of Lean that eliminate waste with the expertise of Six Sigma that details every aspect of learning. The result is not just a more efficient class, but a comprehensive educational masterpiece, carved by precision and colored by effectiveness. This marks a significant and different contribution from previous research (Fitriani et al., 2022) .

This research aims at how to improve quality through the Lean Six Sigma approach. Lean Six Sigma aims to identify and eliminate waste or activities that do not add value in the educational process (Kustiwi, 2020) . By reducing waste, companies can increase efficiency and productivity, as well as reduce production costs. Improving the quality of products and services The Lean Six Sigma approach focuses on improving the quality of products and services by focusing on processes. By identifying and eliminating root causes in business processes, companies can reduce defects and improve the quality of products and services provided (Fakih Khusni et al., 2022) . By improving the quality of products and services, companies can increase customer satisfaction. Customers will feel more satisfied with high quality products and services that meet their expectations (Daga, 2021) .

Lean Six Sigma can also have a positive impact on employee morale and motivation. By involving employees in the improvement process and providing them with clear tools and frameworks, companies can create a better work environment and make employees feel more involved in quality improvement efforts. So, the main goal of the Lean Six Sigma approach is to eliminate waste, improve product and service quality, increase customer satisfaction, increase operational efficiency, increase profits, and increase employee morale (Muljo, 2016) .

RESEARCH METHODS

This research is a qualitative descriptive study that focuses on improving quality through the lean six sigma approach. Data was obtained through interviews, observation and document study. Data sources come from interviews with teachers, Deputy Head of Student Affairs, Deputy Head of Public Relations, Students and direct observation at the research location at Nurul Jadid Paiton High School. Data collection techniques involve interviews and observation. Interviews are used as a systematic method to obtain verbal information from teachers, which involves research into the ongoing learning process. Data analysis was carried out using the Milles & Huberman concept, which includes presenting the data as a whole, data reduction, and sorting and selecting data according to the research theme. This process aims to conclude research findings carefully and in depth.

This research uses a qualitative case study type method with a multi-site design. The case study in this research is in-depth research about an individual, a group, an organization, an activity program, and so on at a certain time. The data collection technique in this research was carried out circularly using three approaches, namely; l) participant observation; 2) in-depth interviews with 4 people (Teacher, Deputy Head of Student Affairs, Deputy Head of Public Relations, and Students; and 3) documentation. Meanwhile, data analysis in this research was carried out through; data reduction, data presentation, and drawing conclusions or verification.

This research describes the implementation of several problem solving procedures studied by presenting data about the Lean Six Sigma measurement process which focuses on four things which are the main components in the management process of educational institutions to improve quality. The four components are DCMA (Define, Control, Measure, analyze)

RESULTS AND DISCUSSION

Lean Six Sigma is a methodology that combines two continuous improvement approaches, namely Lean and Six Sigma. Lean is a set of principles, practices and tools

that aim to maximize customer value by eliminating waste in the production process (Basis & Supat, 2020) . Meanwhile, Six Sigma is a structured approach that aims to improve the quality of products and services with a focus on continuous quality control. In its use, Lean Six Sigma always focuses on preventing defects rather than detecting defects in the production of goods or services. This methodology is based on data and facts in the field, and aims to improve company performance by reducing waste, improving quality, and optimizing production processes (Millennial, 2022) .

By implementing Lean Six Sigma, companies can experience various benefits, such as improving product and service quality, reducing costs, increasing profits, and increasing employee morale (Millennial, 2022)

Define

In Lean Six Sigma, the Define phase is the first step in the DMAIC (Define, Measure, Analyze, Improve, Control) methodology. This phase involves defining the problem or opportunity for improvement, establishing project goals and objectives, and identifying customer needs and expectations. Key activities in this phase include: Determining the project scope and boundaries, Identifying stakeholders and their needs, Defining project goals and objectives, Developing a project charter or plan, Creating a high-level process map or flow diagram and Forming a project team and assigning roles and responsibilities answer.

Implementing Define in Lean Six Sigma at Nurul Jadid High School involves setting clear goals and in-depth understanding of the problem to be addressed. *First* , problem identification, namely determining specific goals related to improving the quality of education at Nurul Jadid High School. And identify problems or challenges that need to be addressed, such as improving exam results, administrative efficiency, or the quality of teaching that occurs at Nurul Jadid High School. *Second* , Project Scope Definition, Define project boundaries and scope clearly, including the parameters to be measured. And ensure that the project has a positive impact on the student's educational experience and the operational efficiency of the school. *Third* , Identify Stakeholders. Determine the parties involved and have an interest in this project, such as teachers, students, administrative staff and parents. *Fourth* , Team Structure, Form a diverse team with representatives from various departments in the school and ensure that each team member has a clear role in achieving project goals. *Fifth* , Initial Data Collection, collecting data to understand the initial conditions of the education system at Nurul Jadid High School. And use data to identify areas that need improvement. Sixth, Preparing a Process Flow Map. Draw a flow map of the educational process from student admission to the final educational results and identify potential waste.

Measure

Measure is the second stage. Identification of the Current State Map depiction in the form of a description of process flow and information flow, cycle time, number of workers involved, working time, production amount, and amount of work in process. Determine the most critical waste that occurs in the entire process using the Pareto Diagram to determine the most critical waste and choose it as the focus for further improvement. The measurement carried out at this stage is the calculation of the possibility of a defect occurring every one million opportunities. and Sigma level measurement is carried out with the help of the Sigma Table. Cost of Poor Quality (COPQ) measurement is carried out to determine the cost of losses resulting from not achieving quality targets. Process Capability (Cp) calculations are used to determine whether the work process currently running meets the specifications that have been set.

The Measure phase is the second step in the DMAIC methodology. In this phase, data is collected to understand the current state of the process and establish a basis for improvement. The main objectives of this phase are to Identify key process metrics or performance indicators, Develop a data collection plan, Collect and analyze data to measure current process performance, Identify sources of variation and potential causes of defects or errors, and Validate the measurement system used to collect data.

Implementation of Measures in Lean Six Sigma at Nurul Jadid High School

involves measuring performance and collecting data to gain a deeper understanding of existing conditions. First, the Measurement Objective, namely the Main Objective: Improving student academic results and Secondary Objective: Identifying factors that influence student absenteeism. *Second* , identify measurement variables, namely variables for the main objective: average student exam scores in each subject and variables for secondary objectives: the level of student absences in each semester. *Third* , Development of Key Performance Indicators (KPI). Examples of KPIs: Average semester exam scores, absence rate, and student pass percentage. *Fourth* , Data Collection, Data Source: Archives of test scores, student attendance records, and graduation data. Data Collection Methods: Surveys, interviews with students and teachers, analysis of academic track records. *Fifth* , Data Analysis: Comparison of Average Test Scores: Compare students' average test scores between subjects to identify weaknesses or strengths. Absence Rates: Analyze trends in absence rates to identify patterns or correlations with academic performance. Sixth, Data Validation and Verification: ensuring the data collected is valid and representative and using statistical techniques to verify the accuracy of the data.

The results of this measurement will provide a clearer picture of the educational conditions at Nurul Jadid High School, helping the Lean Six Sigma team to identify priority areas for improvement and design more effective solutions.

Analyze

The Analysis Phase is the third step in the DMAIC methodology. In this phase, the data collected in the Measure phase is analyzed to identify the root cause of the problem or process defect. Key activities in this phase include: Conducting detailed data analysis to identify patterns, trends, and relationships.

Detailed data analysis can help identify patterns, trends, and relationships in the data. By using the right analysis methods, we can understand past customer behavior, predict future behavior, and make better decisions based on the information found.

Implementation of Analyze in Lean Six Sigma at SMA Nurul Jadid involves in-depth analysis of the data that has been collected to identify the root causes of the problems identified in the Measure stage. *First* , Selection of Analysis Focus: Primary Focus: Low average student test scores in certain subjects and Secondary Focus: High level of absences on Mondays. *Second* , Data Grouping: Group A (Subjects): Data on student test scores in subjects whose performance is below average, and Group B (Monday): Data on student absence rates on Monday. *Third* , Statistical Analysis: Regression Analysis: Determines whether there is a relationship between certain factors and a decrease in test scores. Frequency Analysis: Determine student attendance patterns on Mondays. *Fourth* , Ursache-Wirkung Analysis (Fishbone Diagram): Subject Factors: Quality of teaching, textbooks, or learning support. Absence Factors: Attendance policy, student motivation, or transportation conditions. *Fifth* , Use of the 5 Whys Technique: Identify the root cause of low performance in a subject by asking "why" repeatedly until the root of the problem is revealed. *Sixth* , Validation of Findings: Involving teachers and students in discussions to validate analysis findings and verify with additional data if necessary.

The results of this analysis will help the Lean Six Sigma team to better understand the factors that influence student performance and absenteeism. With this understanding, they can design more targeted and effective solutions in the next stage, namely Improve.

Improve

The Improvement Phase is the fourth step in the DMAIC methodology (Ridwan et al., 2020) . In this phase, potential solutions or improvements are identified and implemented to address the root problems identified in the Analysis phase. The main objectives of this phase are to Generate and evaluate potential solutions or improvement ideas, Develop an implementation plan for the selected solution, Implement the solution and measure its impact on process performance, Conduct trials or simulations to validate the effectiveness of the solution, Optimize the process and

make adjustments as necessary.

Implementing Improve in Lean Six Sigma in SMA involves developing and implementing solutions to address the root causes of problems that have been identified in the Analyze stage. *First* , the Solution to Low Average Test Scores, Teacher Training: Providing additional training to teachers in certain subjects to improve the quality of teaching. Textbook Update: Evaluation and update of textbooks used in low-performing courses. *Second* , Solution to Absence Rates on Mondays, Motivational Programs: Implement motivational programs for students on Mondays, for example, attendance awards or interesting activities. Evaluate Attendance Policies: Review attendance policies and consider more supportive adjustments. *Third* , Measurement of Solution Success, Average Test Scores: Compare the average test scores before and after teacher training and textbook updates. Absence Rates: Monitor changes in student absence rates following implementation of motivational programs and policy adjustments. Fourth, Monitoring Effectiveness Through Control Charts. Create control charts to monitor changes in student performance and absenteeism rates over time. Determine control limits and corrective actions if deviations from expected improvements occur. *Fifth* , Continuation of Improvements, Carry out regular evaluations to ensure continuity of improvements. Involve stakeholders to get feedback and identify areas that still need improvement.

Through the implementation of carefully designed solutions, Nurul Jadid High School can achieve continuous improvements in educational quality, improve student performance, and create a more effective learning environment.

Controls

The Control Phase is the final step in the DMAIC methodology. In this phase, improvements made in the previous phase are documented, standardized, and maintained to ensure long-term success (Romadhani et al., 2021) . Key activities in this phase include: Developing a control plan to monitor and sustain improvements, Establishing process controls and performance metrics, Implementing error-proofing measures, Training and engaging employees to ensure compliance with the new process, Conducting regular audits and reviews to monitor process performance, Continuously improve and refine control measures to prevent regression.

It is important to note that Lean Six Sigma is a data-driven methodology that combines Lean manufacturing and Six Sigma principles to increase process efficiency, reduce waste, and improve quality. The DMAIC methodology provides a structured approach to problem solving and process improvement, enabling organizations to achieve measurable and sustainable results (Kholik et al., 2022) .

Control in Lean Six Sigma at SMA Nurul Jadid involves creating and implementing control measures to ensure the sustainability and consistency of the results of improvements that have been made in the Improve stage. *First* , Development of Solution Implementation Guides, Create clear guidelines for teachers regarding additional training and use of the new textbook. Include step-by-step instructions for engaging students in a motivational program on Monday. *Second* , Monitoring Average Test Scores. Form a team or committee that is responsible for regularly monitoring the average test scores in each subject. Determine the frequency and methods of data collection, as well as relevant control limits. *Third* , Evaluation of Motivational Programs, Use surveys or student feedback to evaluate the sustainability and effectiveness of motivational programs. Establish indicators of success, such as increased student participation. *Fourth* , Review the Attendance Policy. Set a schedule for conducting periodic reviews of the attendance policy that has been changed. Consider collecting feedback from students, teachers, and parents. *Fifth* , Implementation of Control Charts. Use control charts to continuously monitor average exam scores and absenteeism rates. Determine control limits and corrective actions if results are outside established limits. *Sixth* , Socialization of New Programs and Procedures. Socialize new programs and procedures to all stakeholders, including teachers, students and parents. Ensure a good understanding of the changes that have been made.

Through the implementation of these control measures, Nurul Jadid High

School can ensure that the changes that have been implemented in the education system continue as planned, provide consistent results, and maintain the improved quality of education.

CONCLUSION

Based on the results and observations that have been made Improving the Quality of Educational Institutions Through the Lean Six Sigma Approach at Nurul Jadid High School greatly improves the quality of the institution through five stages that are implemented , namely *Define , Measure , Analyze , Improve* And *Control* . We can see from the various performances that have been carried out by the staff whether they are in accordance with the Lean Six Sigma Approach or not, and we must be more careful in the performance or prioritization of human resources at Nurul Jadid High School .

From here we can see that improving the quality of educational institutions through the Lean Six Sigma Approach is very superior, this shows several positions between good and bad approaches to the Lean Six Sigma Approach. And the Nurul Jadid High School institution proves that through the processes of the head and his subordinates it is the spearhead of improving the quality of the institution, and Nurul Jadid High School proves this with good performance, the results are also better through this Lean Six Sigma Approach. Nurul Jadid High School (Kholik et al., 2022) .

Developing a hypothesis and conducting experiments are important steps in validating the root of a problem in scientific research. By following the steps mentioned above, you can test your hypothesis and gain a better understanding of the problem being researched by SMA Nurul Jadid .

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