УДК 621+658.7 DOI: 10.37142/2076-2151/2024-1(53)215

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CONTINUOUS IMPROVEMENT: KAIZEN IN THE MATERIALS PROCESSING INDUSTRY

The study examines current issues related to the implementation of the Kaizen concept in the materials processing industry, based on continuous improvement. Theoretical and practical issues of using the Kaizen concept are considered in order to improve all aspects of the functioning of materials processing enterprises, solve many production issues and problems, improve the quality of products and services, increase competitiveness, efficient use of resources, increase efficiency and effectiveness, reduce costs and achieve gradual improvements in various aspects of production. Kaizen has become a universal method aimed at continuous improvement in accordance with the requirements of the modern competitive environment. Three sets of Kaizen principles and the benefits that its use provides in the materials processing industry are discussed. The application of Kaizen principles solves the problems of optimizing production processes, standardization, establishing standard operating procedures and best practices, and involving all employees of the enterprise in improvement processes. It is recommended to implement changes using Kaizen using the PDCA approach. A list of principles of the Kaizen philosophy is given that should guide the implementation of changes. The Kaizen philosophy emphasizes the importance of the participation of all employees in the process of continuous improvement. Kaizen methodology, as a systematic approach to continuous improvement, actively uses standardization, data to make decisions and identify areas for improvement. Examples of the possible use of Kaizen to improve individual elements of production are given. It has been shown that Kaizen can be successfully combined with other approaches and technologies, such as 5S, Kanban, Value Stream Mapping, Six Sigma, DMAIC, and digital technologies.

***Key words**: Kaizen concept, materials processing industry, continuous improvement, product quality, competitiveness, resource efficiency, cost reduction.*

The materials handling industry faces a number of challenges related to efficiency, quality and cost-effectiveness. Traditional manufacturing processes often suffer from inefficiencies, waste, and suboptimal use of resources. These challenges affect productivity, product quality, and overall competitiveness. Therefore, there is a need for continuous improvement methodologies to effectively address these challenges. One such methodology is a widely Kaizen system used all over the world. Kaizen, or lean manufacturing, is a Japanese management system based on continuous improvement. This allows you to minimize losses and make work as efficient as possible. The application of Kaizen principles in the materials processing industry aims to achieve incremental improvements in various aspects of production.

The application of Kaizen in the materials processing industry is of high relevance for reasons of increasing competitiveness and resource efficiency. In a globalized market, companies must continuously improve their processes to remain competitive. Kaizen provides a systematic approach to achieving competitiveness, focusing on continuous improvement. Kaizen helps optimize resource utilization, reduce waste, and increase productivity.

Research and publications related to the application of the Kaizen methodology in production provide valuable scientific results and practical recommendations. Studies show that the introduction of Kaizen into production processes leads to reduced cycle times, improved product quality and reduced costs [1, 2]. Research also highlights the importance of training employees in Kaizen principles and creating a culture of sharing experiences [3, 4]. Studies are looking at the possibility of integrating Kaizen with other methodologies such as Lean, Six Sigma, and Agile [5-8]. Studies help to identify unsolved aspects of the application of Kaizen in this area [1, 2, 5].

In this article, we focus on the fact that the application of the Kaizen methodology can be effective in solving many production issues and problems, such as: eliminating bottlenecks (in material forming processes, there are often bottlenecks that slow down production and reduce efficiency); implementing Kaizen in corporate culture and employee relationships; applying Kaizen to specific production processes; optimization of production processes.

The purpose of the work is to study the theoretical and practical issues of using the concept (philosophy, methodology) of Kaizen in order to improve all aspects of the functioning of material

processing enterprises, improve product quality, increase competitiveness and efficient use of resources.

Kaizen has its roots in Japan after World War II. After the devastating effects of the war, Japanese companies were faced with the need to improve production efficiency in order to become more competitive in the global market. One of the methods developed in Japan was the Quality Management (QC) format. In 1949, Japanese scientist Kaoru Ishikawa introduced the concept of the QC circle, where workers worked together to optimize processes, solve problems, and improve thinking. The QC approach sought to involve employees at all levels in identifying and solving production problems. This laid the groundwork for what later became the broader Kaizen philosophy.

The Japanese kaizen management system, based on the ideas of Deming, Juran, Feigenbaum and their Japanese colleagues Ishikawa, Taguchi and Shingu, includes the concept of lean thinking and production, Six Sigma, Five C's methods, TQM (Total Quality Management System), TPM (Total Production Performance Assurance System), JIT (Just-in-Time), KANBAN [9, 10], etc. Kaizen (translated from Japanese as "continuous improvement") is the basis of any effective production system. With the greatest efficiency, the Kaizen philosophy was implemented within the Toyota production system, which is now the benchmark for industrial companies. In the conditions of the devastation of Japanese industry, this company had to catch up and surpass the Americans in the production of cars. After Japanese automobiles conquered the U.S. market, U.S. manufacturing experts began to study Toyota's experience in order to extract techniques that could ensure the success of any organization that mastered them. Therefore, when making a decision on the use of management tools, the company's management must understand that kaizen is the base, the basis of the production system.

For many years, Japan, developing and introducing new technologies, has been ranked first in many industries. In many ways, this is facilitated by advanced technologies for organizing production. Being organic and natural for Japan, the concept of Kaizen can be very appropriate and effective for businesses in other countries due to its cost-effectiveness and consistency. According to Masaaki Imai, it is applicable not only in large companies, but also in medium and small companies. However, this largely depends on the organizations themselves, the mentality of people and the conditions of application.

The word "Kaizen" has several interpretations, the main one being continuous improvement. On its own, Kaizen doesn't offer a ready-made turn-based strategy that you can follow to make sure everything goes well. There is no universal instruction book for kaizen either. Rather, it is a set of ideas and principles that should be built upon. The basic tenet of Kaizen goes something like this: small steps in the right directions help you get a lot. This means that in order to achieve impressive results, you do not need drastic innovations, but slow and gradual, but daily work.

Since there is no official Kaizen "bible," there is some confusion in the descriptions of this approach.

For example, on the website of the Kaizen Institute, the author of the book "Kaizen. The Key to Japan's Strategy for Success" by Masaaki Imai provides these five elements, which are also called the core of kaizen.

Get to know your customer. This means having a clear picture of the person you are providing services to or selling goods: their values, desires, needs, and pains.

Get rid of garbage. Kaizen is closely related to the ideas of the concept of zero waste and lean manufacturing. However, this principle can also be understood more broadly: strive not to use anything superfluous in your work, to take only what you really need, to destroy garbage, both physical and informational.

Go to the "production". The original word used is gemba, which can be translated from Japanese as "a place where work takes place." The essence of this element of kaizen is that the manager must have a good understanding of work processes and throw all their efforts into implementing changes there in the first place.

Be based on facts. On statistics, changes in significant indicators and specific figures, and not on your own feelings.

Inspire your team. In this case, we are talking about setting specific goals for people and helping them achieve them.

In various sources, there are several other principles that are associated with kaizen.

Gather employee feedback. Kaizen suggests that every team member should be heard if they have something to say. You can brainstorm together, conduct one-on-one interviews, or put up a "suggestion box." The ideas that people express should be considered and slowly implemented if they are worth it.

Give up perfectionism. It's better to work slowly every day than to try to do everything flawlessly.

Look for the root of the problem. You can't take difficulties and problems for granted. You need to ask yourself at least five times why this is happening in order to get to the bottom of it and find a solution.

Avoid the status quo. This means that it is necessary to strive not for stability and balance, but for continuous development.

Maintain personal discipline. Each team member needs to follow the rules of time management and work on themselves.

Build team spirit. People in the company should have common clear goals, values, and principles. It inspires, motivates, helps everyone move in the same direction and work together.

The third set of Kaizen principles concerns lean manufacturing. It consists of five S's:

– Seiri (sorting). Sort work tools, approaches, and tasks, identify what you don't really need.

– Seiton (systematization). Keep your workspace tidy, find a well-defined position for each tool and object. And it doesn't matter whether you're working at a machine, at an easel, or in an office at a desk.

– Seiso (kept clean). The workplace should be clean. Clean it up at the end of each day.

– Seiketsu (standardization). Make the previous three actions automatic, and make them standard.

– Shitsuke (Enhancement). Check how effective the system is. Troubleshoot issues and improve workflows.

Kaizen has become a universal method of restructuring business processes in various industries. Its focus on continuous improvement meets the demands of today's competitive environment. Organizations that accept Kaizen receive the following benefits:

Increased efficiency and effectiveness: Continuous improvement of processes leads to increased productivity and more efficient use of resources. Every small improvement in the process, implemented gradually, accumulates and leads to an overall increase in productivity. Reduce redundant operations and streamline workflows increase efficiency.

Improving the quality of products or services: Kaizen promotes the creation of high-quality products or services, which increases customer satisfaction. The high quality of the products attracts satisfied customers and contributes to loyalty.

Promoting communication and collaboration: Kaizen promotes open communication and collaboration between employees, breaking down barriers and facilitating the exchange of ideas.

Cost Reduction: Streamlining processes and eliminating redundant operations have a direct impact on costs. Kaizen helps to identify ineffective steps and eliminate them. Every loss reduced is a savings for the organization.

Customer satisfaction. Product quality and timely fulfillment of promises satisfy customers. Satisfied customers are the best advertisement and reason for returns.

Increased competitiveness.

Kaizen is a universal method of restructuring business processes in many industries and areas of activity. Its focus on continuous improvement meets the demands of today's competitive environment.

The application of Kaizen principles in the materials processing industry aims to achieve incremental improvements in various aspects of production. Among the tasks that this approach includes:

1. Process Optimization: Identify bottlenecks, wastes, and inefficiencies in existing processes and develop strategies to optimize them. This includes streamlining workflows, reducing cycle times, and minimizing defects.

Standardization: Establishing standard operating procedures and best practices. Kaizen emphasizes the importance of consistency and repeatability to achieve continuous improvement.

Employee involvement: Involving all levels of the organization in the improvement process. Employees are encouraged to provide ideas, participate in problem-solving, and own their workspaces.

Data-driven decision-making: Collect and analyze data to identify opportunities for improvement. Metrics such as cycle time, defect rate, and resource utilization guide decision-making.

Small, incremental change: Kaizen supports the concept of "small steps" or "continuous small improvements." These incremental changes accumulate over time, leading to significant overall improvements.

How do I implement changes using Kaizen? This system strongly welcomes the PDCA (Plan-Do-Check-Act) approach, or as it is also called, the Deming-Shewhart control cycle. It is clear from the abbreviation that it consists of four stages:

Plan. Change should not be spontaneous; it is always necessary to analyze the situation first and make a strategy.

Act. In the case of Kaizen, this means trying to implement some small improvement.

Check. You should study how the previous step affected the company's work or personal results, compare indicators, and talk to colleagues who were affected by the changes.

Correct. If necessary, you need to fix the problems that have arisen, slightly change the approach, or completely abandon the improvements if they do not work.

When implementing changes, you should be guided by the following principles of the Kaizen philosophy:

Gradual change: Instead of radical changes that can cause resistance and destabilization, Kaizen calls for continuous small steps. These can include improvements in workflows, time optimization, reduction of waste, and elimination of unnecessary operations.

Participation of all employees: every employee, regardless of position, can contribute their ideas and suggestions. Kaizen fosters a culture where employees are invited to participate in the improvement process. This contributes to the creation of a unified team that is ready for continuous improvement.

Standardization and Measurement: Kaizen emphasizes the importance of standardizing work procedures. Stable and predictable processes make it easier to implement improvements. Measuring production metrics (e.g., cycle time, product quality) allows you to evaluate the effectiveness of changes. As an example, here are a few ways to apply the Kaizen philosophy in the material forming industry.

An example of improving equipment changeover times. The Material Forming team decided to use Kaizen to reduce changeover times between different batches of products. They analyzed the process, identified bottlenecks, and implemented small changes. As a result, changeover times have been reduced by 20%, resulting in increased productivity.

An example of improving product quality. The team found that some parts had a high percentage of defects. With the help of Kaizen, they conducted a root analysis of the problem, made small changes to the processing process, and established standard operating procedures. The quality of products has improved, and the number of defects has decreased.

Inventory optimization can also be considered as an example. The company faced excess inventories of raw materials. With the help of Kaizen, they developed a precision ordering system, taking into account the real needs of production. This has reduced storage costs and improved inventory management.

The next example is employee participation in process improvement. Regular training and feedback sessions helped to engage employees in the process of continuous improvement. They came up with a lot of ideas to streamline processes, which led to significant improvements.

These examples demonstrate how small steps and continuous improvement can lead to significant results in material forming.

The Kaizen philosophy emphasizes the importance of all employees participating in the continuous improvement process. Regardless of the position, each employee is invited to contribute their ideas, suggestions and participate in the optimization of work processes. Each employee has unique experience and knowledge. An invitation to participate allows employees to come up with innovative ideas that can lead to process improvements. The involvement of all employees facilitates the exchange of opinions and feedback. This helps to identify problems, deficiencies, and opportunities for improvement. Kaizen fosters a culture where employees feel comfortable expressing their ideas. This contributes to the creation of an open and innovative environment. Involving employees in the improvement process is also a form of learning. Employees learn to analyze processes, propose solutions, and work in a team. As a result, a culture of participation of all employees in continuous improvement contributes to the improvement of efficiency, product quality and overall competitiveness of the organization.

One of the key aspects of the Kaizen methodology is standardization. Its importance lies in increasing predictability, simplifying training, and reducing errors. Standardization of work procedures ensures stability and predictability. When every employee follows the same rules, processes become more manageable. Standardized procedures make it easier to train new employees. They can quickly master work tasks as they know what to expect. Standardization helps to avoid accidental mistakes. Employees know how to perform tasks correctly, which reduces the risk of defects.

The Kaizen methodology, as a systematic approach to continuous improvement, actively uses data to make decisions and identify areas for improvement. Kaizen is not based on assumptions or intuition. It is based on facts and data. By measuring production metrics such as cycle time, product quality, and resource utilization, you can identify areas that need attention. Data analysis helps to identify bottlenecks in production processes. These can be long cycles, frequent defects, or inefficient use of resources. Kaizen provides tools to optimize these areas. Measurement allows you to track progress after changes have been implemented. If the metrics improve, it indicates the positive impact of Kaizen. Let's imagine that there is a problem with a high rate of defects in the process of forming materials. With the help of data analysis, we found out that most defects occur at some stage of production. We decide to make changes at this stage, such as improving equipment or training employees. After the implementation of the changes, we continue to monitor production metrics. If the defect rate decreases, it confirms the successful application of Kaizen. In this way, the use of data in Kaizen helps to make informed decisions, improve production processes, and achieve continuous improvement.

Kaizen can be successfully combined with other approaches and technologies.

Combination with the Lean approach. Lean is another Japanese methodology that aims to eliminate redundancies and streamline processes. The integration of Kaizen with Lean allows you to create a more harmonious improvement system, where both approaches complement each other. Using Lean tools such as 5S, Kanban, and Value Stream Mapping helps identify bottlenecks and streamline workflows.

Combined with Six Sigma. Six Sigma is a methodology that aims to reduce variation and improve product quality. Kaizen's integration with Six Sigma allows you to focus on improving critical parameters and eliminating defects. Using Six Sigma tools such as DMAIC (Define, Measure, Analyze, Improve, Control) helps to systematically solve problems and achieve consistent results.

Use of digital technologies. Digital technologies play an important role in modern industry. Kaizen integration with the Internet of Things (IoT), Big Data, and Artificial Intelligence (AI) allows you to quickly analyze data, identify trends, and predict potential problems. Digital platforms also facilitate the implementation of Kaizen by making it easier to collect feedback from employees and automate improvement processes.

Integration of Kaizen with other methodologies requires constant training of employees. Lean, Six Sigma, and digital training helps create a shared culture of continuous improvement.

Leadership also plays a key role. Leaders must support and implement new approaches to ensure successful integration.

So, the integration of Kaizen with other methodologies, tools and technologies allows you to create a more balanced and effective improvement system that contributes to the growth of product quality and productivity.

CONCLUSION

A study of the Kaizen methodology in the context of the materials processing industry allows us to draw the following conclusions:

Kaizen Efficacy: The application of Kaizen in this area has proven to be effective. Small steps, standardization and the participation of all employees contribute to the continuous improvement of production processes.

Cost reduction: Kaizen helps to reduce costs, optimize the use of resources, and improve product quality. This is important for the competitiveness of companies.

Continuous Improvement Culture: Creating a culture where every employee actively participates in improvement is a key aspect of successful Kaizen implementation.

Recommendations:

Learning and Sharing Experiences: Continue to train employees in Kaizen principles and exchange experiences. Regular training and feedback sessions will help maintain a focus on continuous improvement.

Integration with other methodologies: Explore the possibilities of integrating Kaizen with other methodologies of quality management and operational efficiency.

Prospects:

Exploring new areas: Further research could be directed to the application of Kaizen in specific material processing processes. This may include comparing with other methodologies and exploring new technologies.

Innovation and Technology: Given the rapidly changing technological environment, research may also encompass the application of Kaizen to new technologies and innovations.

Overall, Kaizen remains a powerful tool for achieving continuous improvement in the material forming industry. Its successful implementation requires the efforts of the entire team and a constant desire for improvement.

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Подлєсний С. В. Неперервне вдосконалення: Кайдзен в індустрії обробки матеріалів

Дослідження присвячене розгляду актуальних питань, пов'язаних із впровадженням концепції Кайдзена в індустрію обробки матеріалів, засновану на безперервному вдосконаленні. Розглянуто теоретичні та практичні питання використання концепції Кайдзен з метою удосконалення всіх аспектів функціонування підприємств з обробки матеріалів, вирішення багатьох виробничих питань та проблем, покращення якості продукції та послуг, підвищення конкурентоспроможності, ефективного використання ресурсів, підвищення ефективності та результативності, зниження витрат та досягнення поступових покращень у різних аспектах виробництва. Кайдзен став універсальним методом, спрямованим на безперервне покращення відповідно до вимог сучасного конкурентного середовища. Розглянуто три набори принципів Кайдзен і переваги, що дає його використання у промисловості обробки матеріалів. Застосування принципів Кайдзен вирішує завдання оптимізації процесів виробництва, стандартизації, встановлення стандартних робочих процедур та кращих практик, залучення всіх працівників підприємства до процесів поліпшення. Впроваджувати зміни за допомогою Кайдзена рекомендується за допомогою підходу PDCA. Наведено перелік принципів філософії Кайдзен, якими слід керуватися при впровадженні змін. Філософія Кайдзен акцентує увагу на важливості участі всіх співробітників у процесі безперервного покращення. Методологія Кайдзен як системний підхід до безперервного поліпшення активно використовує стандартизацію, дані для прийняття рішень та визначення областей для поліпшення. Наведено приклади можливого використання Кайдзена для покращення окремих елементів виробництва. Показано, що Кайдзен може успішно поєднуватися з іншими підходами та технологіями, такими як 5S, Kanban, Value Stream Mapping, Six Sigma, DMAIC, цифровими технологіями.

Ключові слова: *концепція Кайдзен, індустрія обробки матеріалів, безперервне покращення, якість продукції, конкурентоспроможність, ефективність використання ресурсів, зниження витрат.*

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The article was received by the editors on 10.05.24