CHAPTER 6

CONTINUOUS IMPROVEMENT

LEAN MANUFACTURING
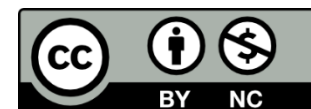
Continuous Improvement (Kaizen) is a fundamental element of Lean Manufacturing, focusing on gradual process improvements, employee engagement, and waste elimination.


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Stadnicka D., Antosz K.: Continuous Improvement in Lean Manufacturing in Large Enterprises: study results. International Conference Business Sustainability 2013. Management, Technology and Learning for Individuals, Organisations and Society in Turbulent Environments. November 20-22, 2013. Póvoa de Varzim, Portugal.

Helmold, M., & Helmold, M. (2021). Kaizen: Continuous improvements in small steps. Successful Management Strategies and Tools: Industry Insights, Case Studies and Best Practices, 165-169.

Kaizen is a Japanese philosophy of continuous improvement, meaning "change for the better." It emphasises making small, incremental changes in processes, systems, and behaviours to enhance efficiency, quality, and workplace satisfaction. At its core, Kaizen focuses on eliminating waste (Muda), standardising processes, and fostering employee engagement. Unlike dramatic overhauls, Kaizen relies on steady, consistent improvements driven by teamwork and collaboration. It integrates everyone, from top management to frontline workers, in identifying and implementing changes that add value to the organisation and its customers.

Definition of KAIZEN™

Empower People

Go to Gemba

Everyone, Everyday, Everywhere
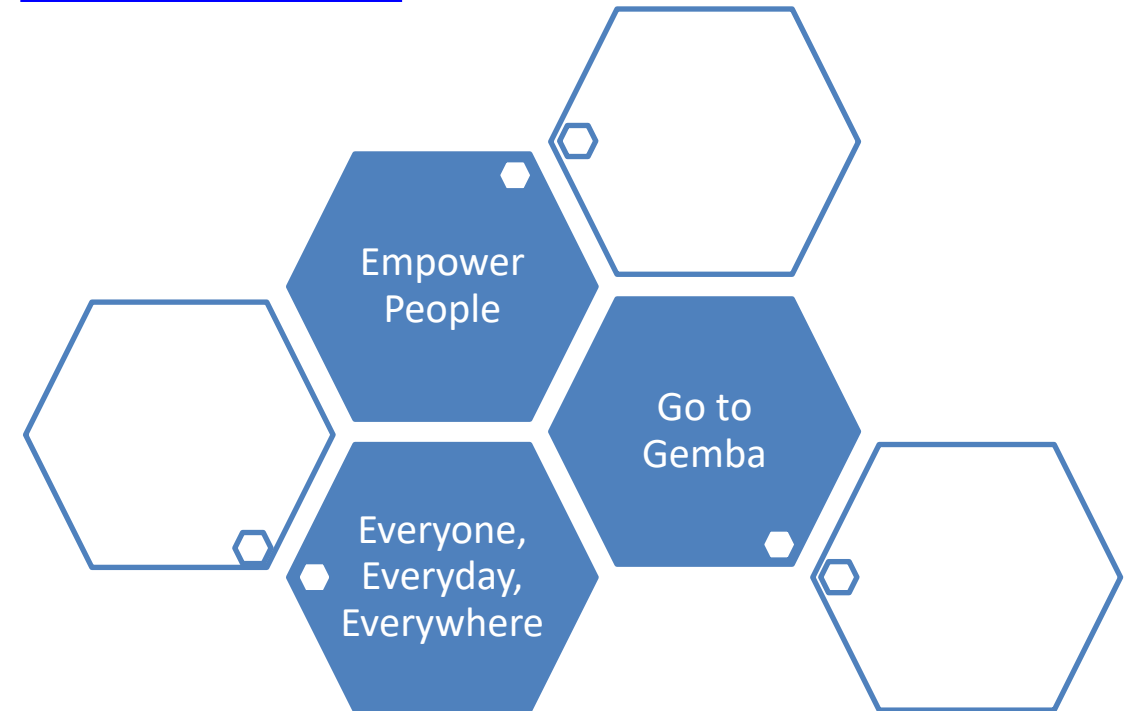
Kaizen Culture

Kaizen Culture refers to the organisational mindset and practices centred around continuous improvement. It promotes a shared commitment to identifying and eliminating waste, improving processes, and fostering innovation at all levels.

In a Kaizen culture, every employee, from management to the shop floor, is empowered to suggest and implement improvements. Collaboration, respect, and problem-solving are core values, creating an environment where incremental changes are encouraged and celebrated. This culture enhances efficiency, quality, and employee engagement, driving sustainable growth and long-term success.

Stadnicka D., Sakano K., Employees Motivation and Openness for Continuous Improvement: Comparative Study in Polish and Japanese Companies. Management and Production Engineering Review. Vol. 8, Number 3, September 2017, pp. 70–86. DOI: 10.1515/mper-2017-0030

Vinodh, S., Antony, J., Agrawal, R., & Douglas, J. A. (2021). Integration of continuous improvement strategies with Industry 4.0: a systematic review and agenda for further research. The TQM Journal, 33(2), 441-472.
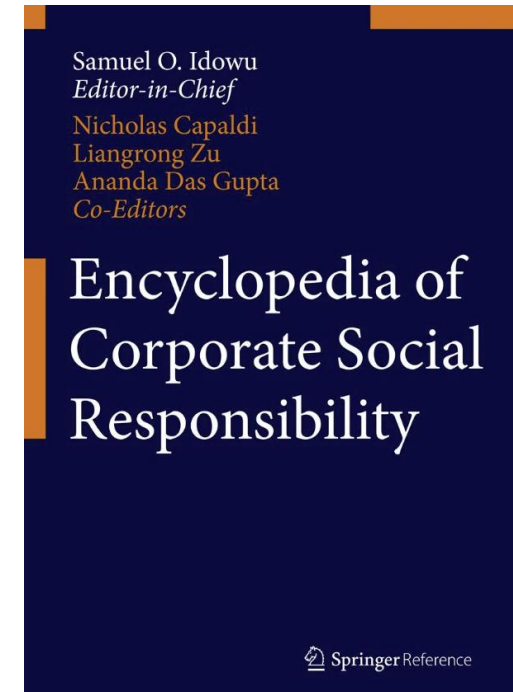
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Continuous improvement, or Kaizen, is a cornerstone of Lean Manufacturing, driving the elimination of waste (Muda) and the enhancement of value-added activities. Its role is to ensure processes are continually refined for greater efficiency, quality, and adaptability. By engaging employees in identifying and solving problems, Kaizen fosters a culture of accountability and innovation. It supports Lean principles like Just-In-Time and standardisation, enabling organisations to achieve smoother workflows, lower costs, and higher customer satisfaction. Continuous improvement sustains Lean's goal of long-term operational excellence.

Idowu, S. O., Capaldi, N., Zu, L., & Gupta, A. D. (Eds.). (2013).

Encyclopedia of corporate social responsibility (Vol. 21).

New York: Springer.

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Key performance indicators for continuous improvement:

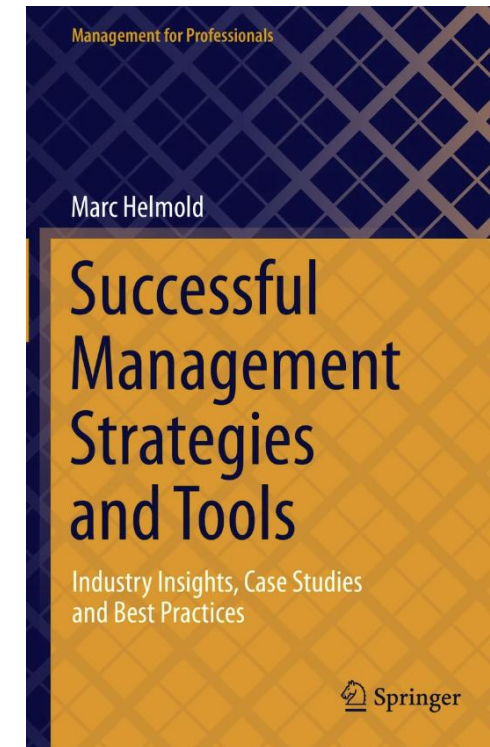- Number of implemented ideas.

- Reduction in cycle time.

- Improvement in OEE (Overall Equipment Effectiveness).

Methods for visualising results:

- Kaizen boards.

- Dashboards.

Helmold, M. (2021). [Successful Management Strategies and Tools](#).

Springer International Publishing.

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Seven + 1 Types of Waste (Muda) in Lean Manufacturing

Lean Manufacturing identifies seven main types of waste that do not add value to the customer and burden processes. Eliminating these wastes is a key goal of continuous improvement.

Overproduction – Producing more than what is required or producing too early. This leads to increased storage costs and wasted resources.

Waiting – Idle time for machines, workers, or materials due to delays in processes or lack of coordination.

Excess Inventory – Excessive amounts of raw materials, work-in-progress, or finished goods. This ties up capital and incurs storage costs.

Unnecessary Transportation – Unneeded movement of materials, semi-finished goods, or finished products. This can lead to damage and delays.

What are the 7 Wastes in Lean?
VIDEOS

And You Forgot About Overproduction
John Shook, March 23, 2009

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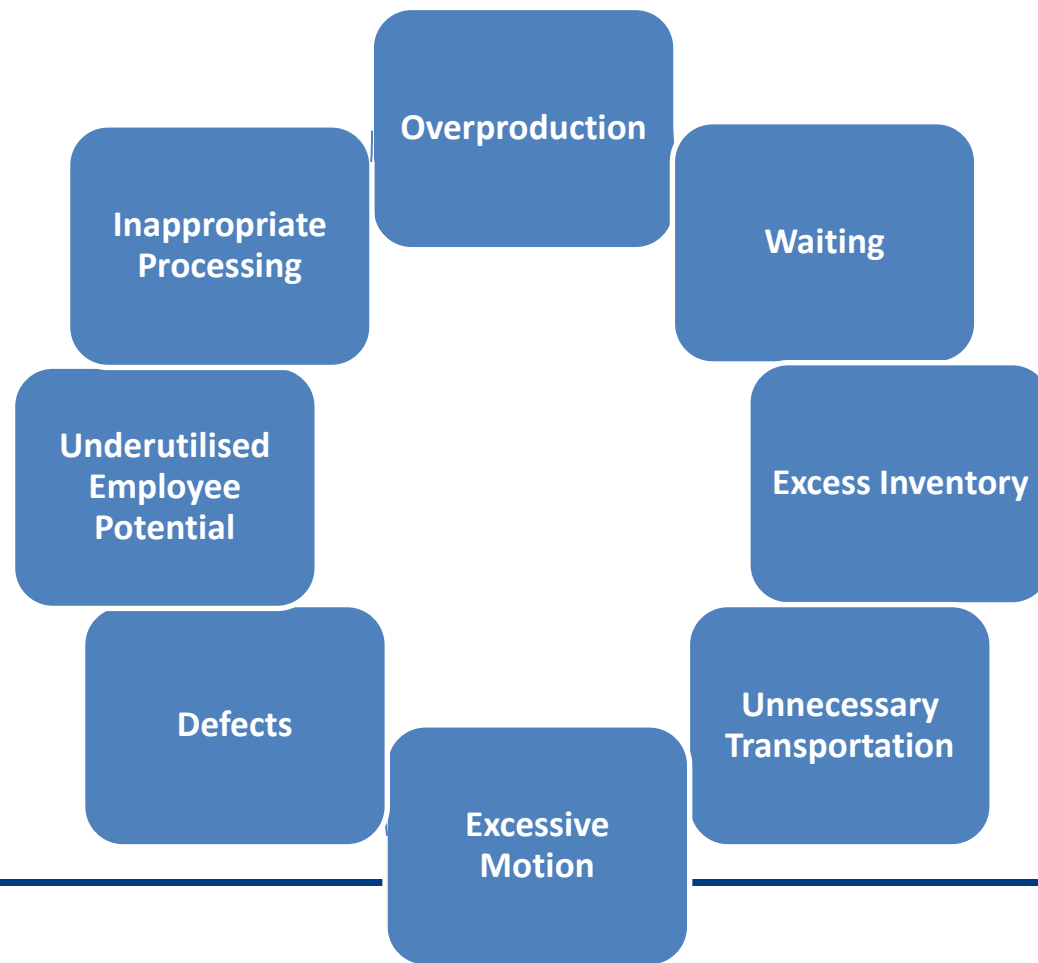
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Eliminating the wastes helps enhance efficiency, reduce costs, and focus resources on activities that create value for the customer.

Excessive Motion – Inefficient actions by operators, such as reaching, walking, or searching for tools. This reduces productivity and increases worker fatigue.

Defects – Products or components that require rework, repair, or rejection. This increases costs and wastes materials.

Inappropriate Processing – Using more expensive or complex equipment than necessary.

Underutilised Employee Potential – Failure to engage the knowledge, skills, and ideas of employees. This limits innovation and improvement opportunities.

Overproduction

Waiting

Excess Inventory

Unnecessary Transportation

Excessive Motion

Defects

Underutilised Employee Potential

Inappropriate Processing

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Other Types of Waste (Muda) in Lean Manufacturing

Unused Floor Space – Space within a facility that is left idle or underutilised is regarded as a form of inefficiency.

Producing Goods or Services Not Meeting Customer Needs – Womack identified this as a potential category of waste, emphasising the inefficiency caused by creating products or services that fail to align with customer requirements or preferences.

Confusion – A lack of clarity in processes is wasteful, although it is difficult to measure directly. Often, confusion arises from other types of waste rather than existing independently. Nevertheless, addressing confusion can improve overall efficiency.

Unsafe Working Conditions – Hazardous work environments create significant risks for employees. While this could fall under the category of "overburden" (muri), it is significant enough to warrant its own classification.

Wasted Opportunities – Opportunities that are not leveraged effectively are a form of waste, although they are often challenging to measure or quantify.

Excessive Time in Meetings – Spending too much time in meetings can hinder productivity, but this issue may be too specific to classify universally as waste.

Source: https://www.allaboutlean.com/muda/

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Equipment Failure – Machine breakdowns can be classified under traditional waste categories such as waiting, unnecessary motion, or defects, depending on their consequences.

Time Wasted on Trends – Pursuing short-term trends can consume time and resources unnecessarily. Ironically, chasing trends can sometimes become a trend in itself.

Sub-Optimisation – Failing to fully optimise processes or resources often results in inefficiencies such as overproduction, delays, or defects. While it is a valid concern, it frequently overlaps with other categories of waste.

Ignoring Historical Lessons – Refers to neglecting past experiences, mistakes, or successes, leading to repeated errors, inefficiencies, or missed opportunities for improvement.
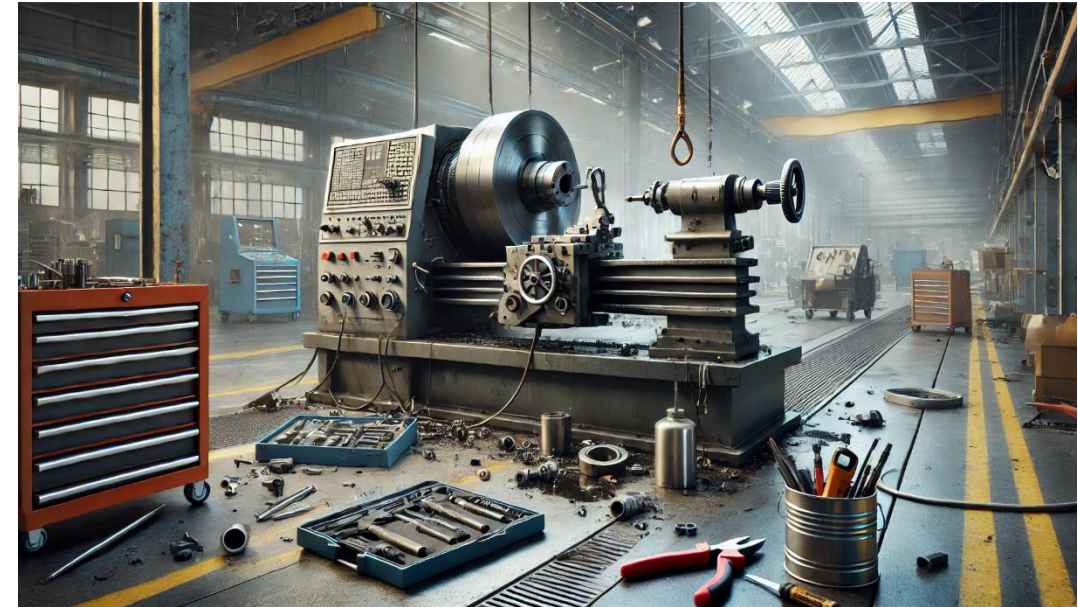
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Source: https://www.allaboutlean.com/muda/

Changeovers and Tool Changes – These activities are already included in traditional waste categories like downtime or process inefficiency.

Ramp-Up Losses – These refer to inefficiencies that occur during the scaling of production and closely resemble other waste categories.

Short Stops and Small Breakdowns – These minor disruptions are typically associated with loss categories defined within Overall Equipment Effectiveness (OEE).

Speed Losses – When systems run at less than their optimal speed, these losses are typically classified within the categories of Overall Equipment Effectiveness (OEE).

Planned Stops – Scheduled downtime, classified under another OEE category, adds to overall process inefficiency.

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Source: https://www.allaboutlean.com/muda/

Other Types of Waste (Muda) in Lean Manufacturing

Management Losses – refer to inefficiencies caused by poor decision-making, such as unclear instructions, insufficient materials, or overproduction due to planning errors.

Line Organisation Losses – refer to inefficiencies caused by poorly designed production lines, including improper layout, bottlenecks, or misaligned workflows. These losses can lead to increased downtime, unnecessary motion, and suboptimal resource utilisation, impacting overall productivity and efficiency.

Logistics Losses – Delays during loading and unloading processes interrupt workflow and contribute to inefficiencies and waste in operations.

Measuring and Adjusting Losses – Halting production for measurements or adjustments is frequently excessive and can often be avoided.

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Source: https://www.allaboutlean.com/muda/

Usage Losses – Inefficient utilisation of materials, such as overly durable designs or excessive waste, represents another type of operational inefficiency.

Energy Losses – Wasting energy has become increasingly significant, reflecting the growing emphasis on sustainability and eco-friendly practices in modern industries.

Forms, Dies, and Tool Losses – Losses caused by redesigns necessitating tool changes are legitimate but often too specific for practical use.

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Source: https://www.allaboutlean.com/muda/

Barriers to Implementing Continuous Improvement

Resistance to Change Among Employees and Leadership

One of the biggest challenges in implementing continuous improvement is human resistance to change. Employees may fear additional responsibilities and feel uncertain about how new initiatives will impact their daily work. On the other hand, leadership may fail to recognise the immediate benefits of Kaizen efforts, leading to a lack of engagement. Without support from leaders, building a culture of Kaizen becomes significantly more difficult.

Lack of Systematic Approach in Implementing Kaizen Initiatives

Continuous improvement requires regularity and commitment. In some organisations, Kaizen initiatives are treated as one-time projects rather than an ongoing process. The absence of clearly defined goals, schedules, and performance metrics results in inconsistency in execution. Without a systematic approach, the benefits of Kaizen may be limited, and improvements achieved could be short-lived.

Ways to Overcome Barriers

Resistance to Change

- Regularly communicate the benefits of Kaizen at all levels of the organisation.
- Engage employees in decision-making and the implementation of changes.
- Organise training sessions and workshops to build trust and knowledge.

Overcoming these barriers requires time, commitment, and consistency, but it is essential for successfully embedding a culture of continuous improvement within the organisation.

Lack of Systematic Approach

- Implement standardised procedures and schedules for Kaizen activities.
- Regularly monitor progress and report results.
- Establish leaders or teams responsible for executing initiatives.

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Overcoming Resistance to Change

Education and Communication

- Explain to employees what Kaizen is and how it benefits them personally and the organisation as a whole.
- Hold regular meetings and workshops to share successes and results of Kaizen initiatives.

Employee Engagement

- Involve employees in every stage of continuous improvement efforts, from identifying problems to implementing solutions.
- Recognise and reward employee ideas and efforts through incentives, appreciation, or motivational systems.

Leadership Support

- Leaders should actively support and model behaviours aligned with continuous improvement.
- Organise Gemba Walks, enabling leaders to observe work processes on-site and identify issues collaboratively.

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Systematic Approach to Kaizen Initiatives

Standardised Procedures and Tools

- Implement frameworks like PDCA (Plan-Do-Check-Act) and conduct regular Gemba Walks to ensure continuity.
- Use Kaizen boards and visual indicators to track progress.

Appointing Kaizen Leaders

- Establish teams or select Kaizen ambassadors to coordinate continuous improvement activities.
- Conduct regular reviews and reports of Kaizen initiatives at the management level.

Setting Goals and Performance Metrics

- Define measurable objectives (e.g., number of ideas implemented, cycle time reduction, improved OEE).
- Monitor progress and present results transparently across the organisation.

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Building a Culture of Continuous Improvement

Developing Employee Skills

- Provide regular training on Lean tools (e.g., 5S, 5 Why?, root cause analysis).
- Build competencies in problem-solving and identifying waste (Muda).

Promoting Collaboration

- Create interdisciplinary teams to address challenges.
- Encourage sharing ideas across departments and areas.

Celebrating Successes

- Publicly acknowledge and reward team or individual contributions to continuous improvement.
- Organise events or meetings to celebrate achievements and inspire further efforts.

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Leadership as a Foundation

Leadership Engagement

- Leaders should actively participate in Kaizen initiatives, promote openness, and support improvement efforts.

Establishing a Clear Vision

- Leadership must clearly define the goals of continuous improvement as a key element of the company's strategy.

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Technologies associated with Industry 4.0 and Industry 5.0 significantly support the philosophy of continuous improvement (Kaizen) in manufacturing organisations. Their implementation enables better process monitoring, waste elimination, and enhanced operational efficiency while placing humans at the centre of change.

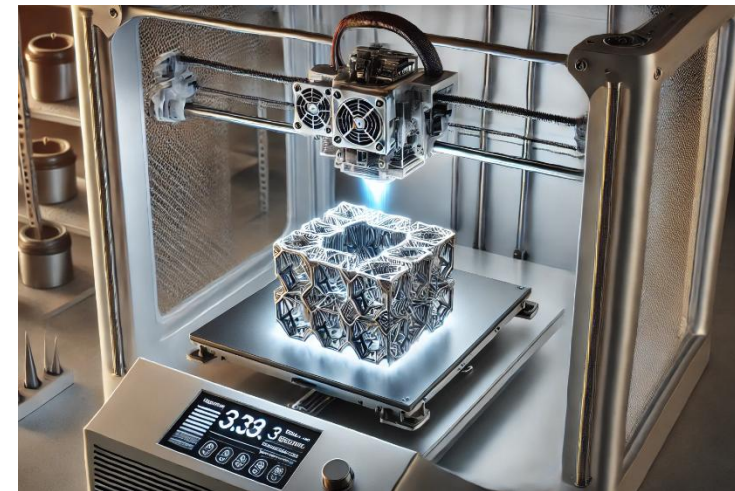**Internet of Things (IoT)**

- IoT sensors enable real-time monitoring of machine and process parameters.
- Data allows for the identification of deviations and the rapid implementation of corrective actions.

Big Data and Data Analytics

- Advanced analytics identifies patterns and inefficiencies that are difficult to detect using traditional methods. Facilitates problem prediction and prevention.

3D Printing (Additive Manufacturing)

- Enables rapid prototyping and testing of new concepts.
- Reduces the time and cost of introducing innovations.

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Artificial Intelligence (AI)

- AI supports process optimisation through automatic improvement recommendations and predictive maintenance.

- Analyses historical data to suggest best practices and minimise downtime.

Robotics and Automation

- Automated transport systems, assembly lines, and industrial robots eliminate unnecessary movements and increase precision.

- Collaborative robots (cobots) assist workers in repetitive and physically demanding tasks.

Cloud Computing

- Provides remote access to data and real-time process management.

- Facilitates collaboration across departments and locations.

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Industry 5.0 complements Industry 4.0 by placing greater emphasis on human-machine collaboration and sustainable development.

Human-Machine Collaboration

- Cobots and intelligent systems support workers, allowing them to focus on tasks requiring creativity and expertise.

- Reduces physical strain on employees and improves workplace safety.

Process Personalisation

- Industry 5.0 technologies enable more flexible production processes tailored to individual customer needs.

- Reduces waste through on-demand manufacturing.

Empathy in Technology

- Worker-supporting solutions, such as AI-assisted decision-making, promote employee well-being.

- Fosters the creation of more worker-friendly environments.

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Support from Industry 5.0 Technologies

Industry 5.0 complements Industry 4.0 by placing greater emphasis on human-machine collaboration and sustainable development.

Sustainability

- Energy and emissions monitoring systems help reduce the carbon footprint.
- Technologies leveraging recycling and circular economy practices enhance resource efficiency.

Empathy in Technology

- Worker-supporting solutions, such as AI-assisted decision-making, promote employee well-being.
- Fosters the creation of more worker-friendly environments.

Creativity-Enhancing Technologies

- Industry 5.0 promotes using technology to drive innovation, such as AI-generated ideas or virtual design.
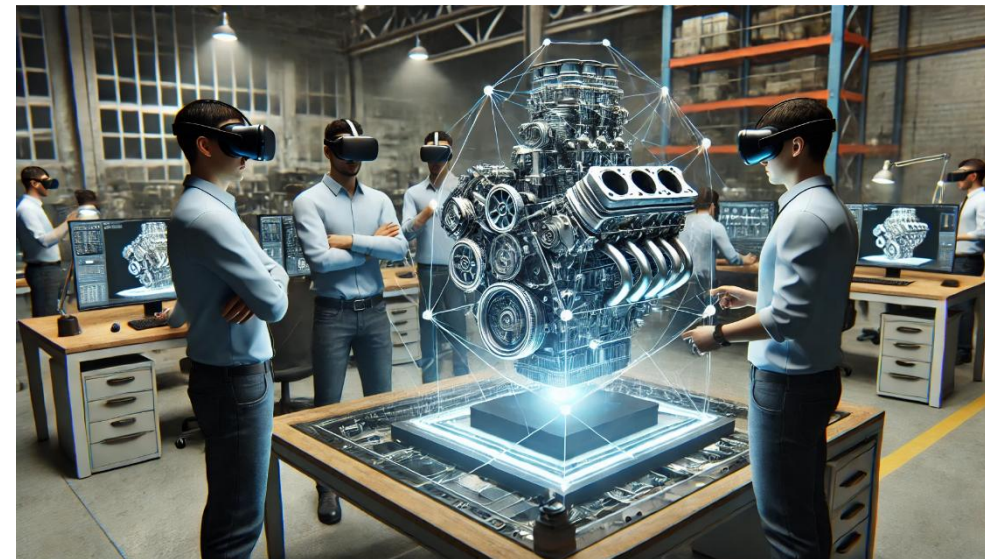
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Increased Efficiency

- Automation and process monitoring enable faster identification and elimination of waste.

Improved Collaboration

- Integrated systems foster better collaboration between departments and employees.

Innovation

- Easier implementation of new ideas through rapid prototyping and data analysis.

Sustainability

- Reduced resource waste and decreased environmental impact.

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- **5 Why** – A method for root cause analysis of a problem by asking "Why?" five times to identify the underlying cause.

- **PDCA** (Plan-Do-Check-Act) – The Deming Cycle, serving as the foundation for continuous improvement.

- **Gemba Walk** – Observing processes directly at the place where work is performed to identify inefficiencies and opportunities for improvement.

- **Kaizen Blitz** – Intensive workshops focused on solving a specific problem within a short period.
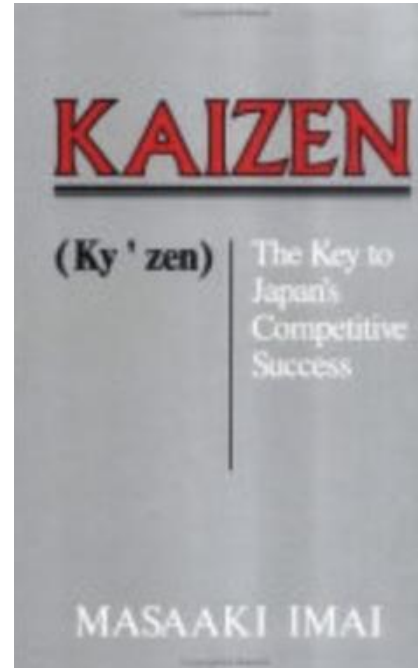
Masaaki Imai (1986). Kaizen: The Key To Japan's Competitive Success. McGraw-Hill Education.

Example goals of Kaizen

- Reduction of production cycle time.

- Minimization of waste.

- Improvement of material flow.

- Enhancement of work efficiency at a specific workstation.

- Elimination of process errors.

Question 1
What is the main goal of the Kaizen philosophy?
a) Maximizing profits without considering process quality.
b) Radical process changes and elimination of job positions.
c) Gradual process improvements, employee engagement, and waste elimination.

Question 2
What characterizes a Kaizen culture?
a) Delegating decision-making exclusively to management.
b) Promoting collaboration and problem-solving at all levels of the organization.
c) Fostering competition among employees instead of teamwork.

Question 3
Which of the following is NOT part of Kaizen culture?
a) Promoting collaboration and respect.
b) Encouraging employees to propose and implement improvements.
c) Delegating sole responsibility for improvements to management.

Question 4
What types of waste (Muda) does Kaizen eliminate?
a) Overproduction, waiting, excess inventory.
b) Process optimization and reduction of energy costs.
c) Organizing too many meetings.

Question 5
What is one of the biggest challenges in implementing Kaizen?
a) Conducting workshops too frequently.
b) Resistance to change from employees and lack of leadership engagement.
c) Lack of appropriate digital tools for process implementation.

Question 6
What indicators can be used to assess continuous improvement?
a) Number of implemented ideas, improvement in OEE, reduction in cycle time.
b) Number of workshop participants and training costs.
c) Increase in the number of meetings within the organization.

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Thank you for your attention.

Dorota Stadnicka