



32 ESSENTIAL LEAN TOOLS

Here are some of the most popular lean tools—and how companies have used them effectively throughout their facilities.



1. 5S System



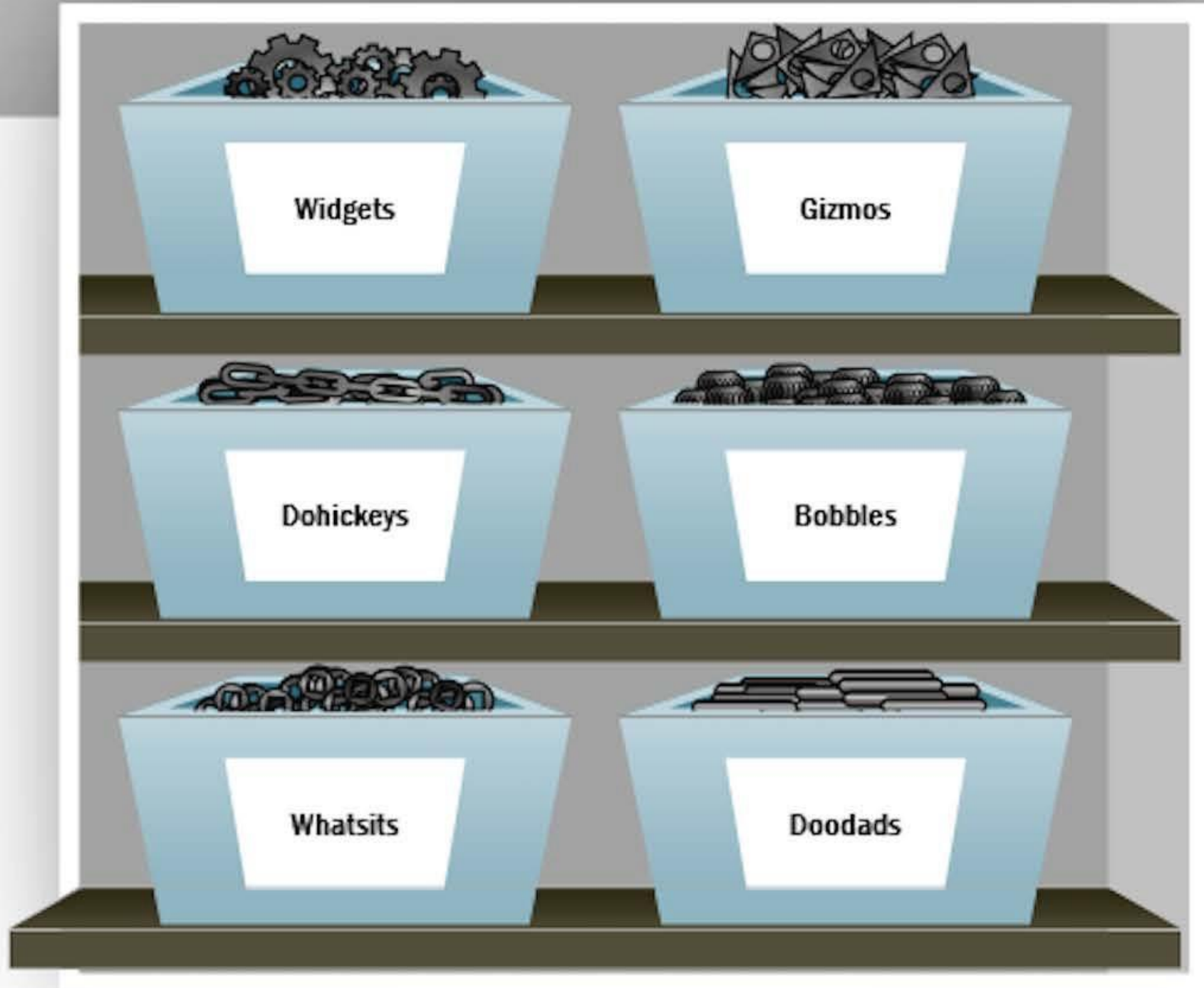
WHAT IT IS

The 5S System offers a systematic approach for rooting out inefficiencies, improving organization, and implementing standardized practices throughout a facility.

5S gets its name from five Japanese words that act as guiding principles for the system:

Seiri: <i>Tidiness</i>	Seiton: <i>Orderliness</i>	Seiso: <i>Cleanliness</i>	Seiketsu: <i>Standardization</i>	Shitsuke: <i>Discipline</i>

Numerous companies have used 5S effectively: Boeing uses a variation of 5S to **simplify operations and improve efficiency**, while the Harley-Davidson Motor Company relies on 5S to save money through **improved safety and streamlined manufacturing**.



HOW IT HELPS

Employers should save time and improve organization, and employees may become more efficient as they find tools more quickly, stay safer in organized work areas, and improve efficiency through standard procedures.

Want more information?

Get our FREE 5S System Guide: GraphicProducts.com/5S-guide



Kaizen
RELIES on
employee
suggestions
for improvement

2. Kaizen

改善

WHAT IT IS

Also known as Continuous Improvement, Kaizen offers a strategy for finding and implementing regular improvement throughout the manufacturing process.

Popularized by Toyota®, **Kaizen relies on employees at all levels making suggestions for improvements throughout a company**—and subsequently communicating those ideas to upper management. As those suggestions are analyzed and approved, companies can cut waste and improve morale.

HOW IT HELPS

Employees feel more engaged, invested, connected, and committed. When Toyota implemented Kaizen at one of its U.S. plants, the auto maker received more than 75,000 suggestions from 7,000 employees for improving the manufacturing process; Toyota subsequently implemented 99% of those ideas.

Want more information?

Get our FREE Kaizen Guide: GraphicProducts.com/kaizen-guide

3. Kanban



WHAT IT IS

Kanban—translated from Japanese, “visual cards”—controls the flow of materials within a supply chain. Most commonly, **Kanban uses cards and other visual signals to adjust inventory or communicate tasks in response to customer demand.**

Spotify® uses Kanban to schedule programming tasks, visually review a department’s workload, and prioritize work requests as they are received. In turn, the company can quickly analyze a team’s capacity for new projects and make more accurate forecasts going forward.



HOW IT HELPS

At its core, Kanban is designed to reduce waste and maximize efficiency. Depending on how many cards are used in a particular process, Kanban can tell manufacturers when to cut back on production—or, when cards are moving quickly through a workflow—ramp up productivity.

Want more information?

Get our FREE Kanban Guide: [GraphicProducts.com/kanban-guide](https://www.graphicproducts.com/kanban-guide)



4. Total Productive Maintenance (TPM)



WHAT IT IS

Total Productive Maintenance (TPM) is a wide-ranging philosophy that promotes proactive and preventative maintenance.

The Eight Pillars of TPM offer techniques for implementing the strategy:

- **Autonomous Maintenance:** Operators keep tabs on their equipment and work areas
- **Process and Machine Improvement:** Operators report information to team leaders; that data is then used to prioritize maintenance and improvements.
- **Preventative Maintenance:** Operators and team leaders work together to establish maintenance tasks and schedules.
- **Early Management of New Equipment:** Based on maintenance reports and the equipment lifecycle, team leaders take proactive approaches to maintenance.
- **Process Quality Management:** Operators and team leaders alike share responsibility for maintenance, creating buy-in from all involved employees.
- **Education and Training:** Machine operators are continually educated on maintenance, safety, and proper usage.
- **Safety and Sustained Success:** Employees throughout a facility are encouraged to focus on safety and, where applicable, ongoing machine maintenance.



HOW IT HELPS

At its core, TPM aims to save on maintenance costs and reduce machine downtime—which, in turn, increases productivity, cuts down on defects, and improves employee morale.

Want more information?

Get our FREE TPM Guide:

GraphicProducts.com/TPM-guide

5. Andon

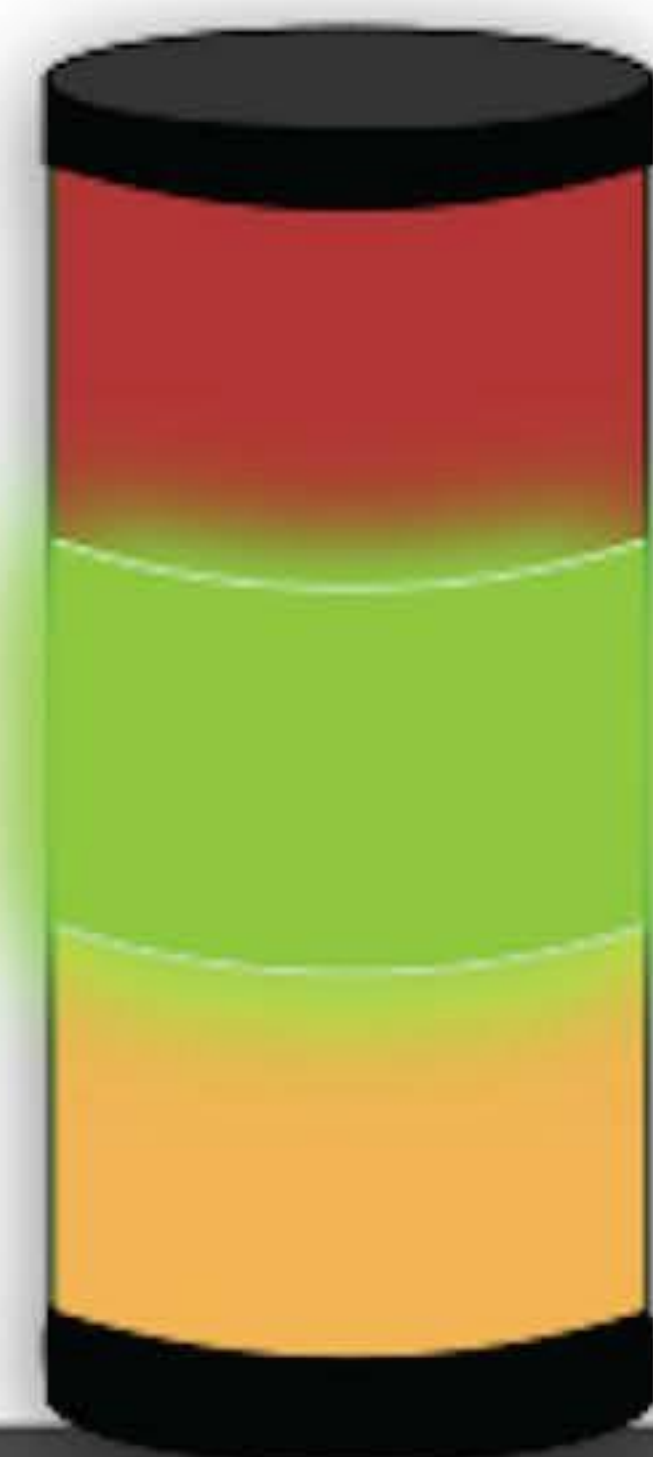


WHAT IT IS

Designed for workers on the plant floor, Andon offers a real-time visual feedback system that shows the status of a machine or process—and alerts others when and where assistance is required. Most commonly, **Andon uses a combination of lights and sounds to communicate status updates, issues, and challenges.**

HOW IT HELPS

Popular on assembly lines (including those run by Toyota and Nissan), Andon communicates problems as they arise and allows employees to alter the production process, as necessary. By empowering employees on the front lines, Andon keeps workers engaged with their tasks—all while working as an effective quality control system.



6. Gemba



WHAT IT IS

Roughly translated as “The Real Place” in Japanese, **Gemba encourages facility management to connect with employees** wherever they work, whether on a plant floor or the assembly line, **and find problems and sources of waste.**

This is most commonly done through a regularly-scheduled Gemba Walk to assess a plant’s productivity and learn about ongoing issues. Employers should use the following five rules for conducting a successful Gemba Walk:

- 1. Have a specific purpose.** Know why you’re taking the Gemba Walk, and have an idea of what you’re looking for.
- 2. Be familiar with the area you’re visiting.** Know what goes on, how it happens, and the purpose it serves before starting the Gemba Walk.
- 3. Understand the overall process.** You should be familiar with the machinery in place, the tasks it facilitates, and where it fits into the broader manufacturing process.
- 4. Correctly understand what you’re seeing.** Talk with workers to see if what you’re seeing is an accurate reflection of the typical process. Are there defects slowing employees down, glaring inefficiencies, or other problems that need to be addressed?
- 5. Know what to ask.** Have a list of questions to better understand the work: What is the task, who performs each task, where is a task taking place, when is the task done, why is it being done, and how is it being performed?

HOW IT HELPS

Gemba encourages a deep, thorough, and expansive understanding of manufacturing inefficiencies and issues through first-hand observation and discussions with key employees.



7. Heijunka



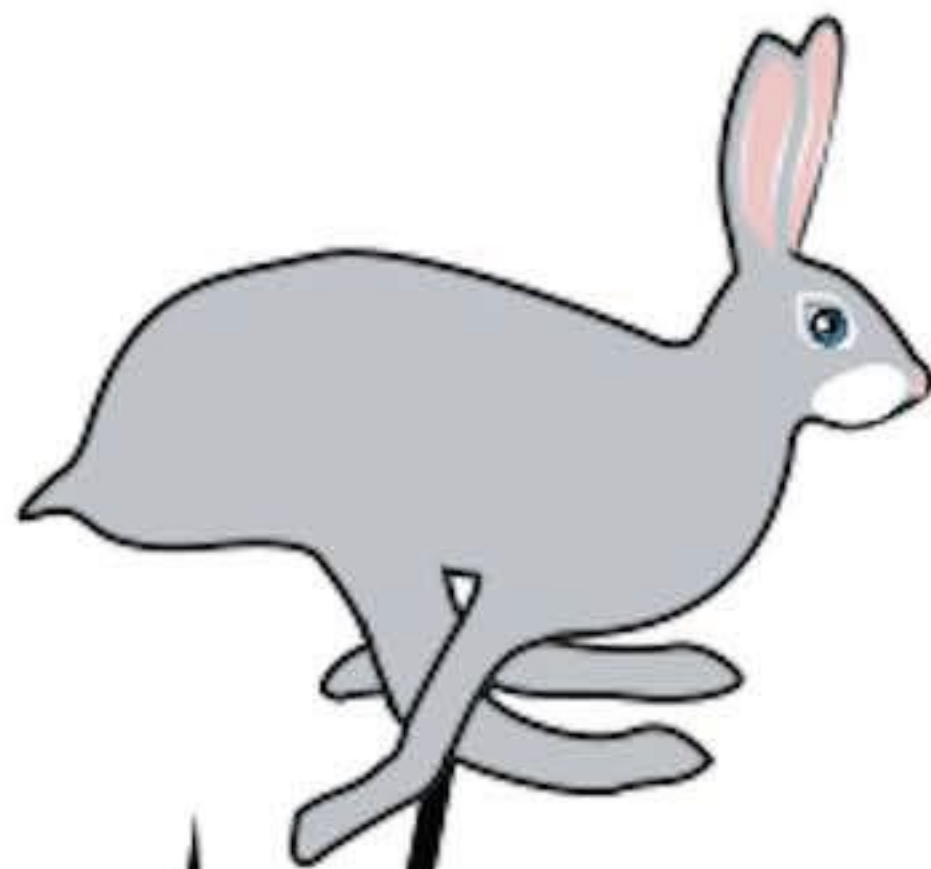
WHAT IT IS

Heijunka is a form of production scheduling that encourages a **steady, predictable flow of small-batch manufacturing**, rather than less frequent, larger production processes for goods and components.

Toyota® uses Heijunka to help schedule manufacturing, with each step reflecting a different model's consumer demand.

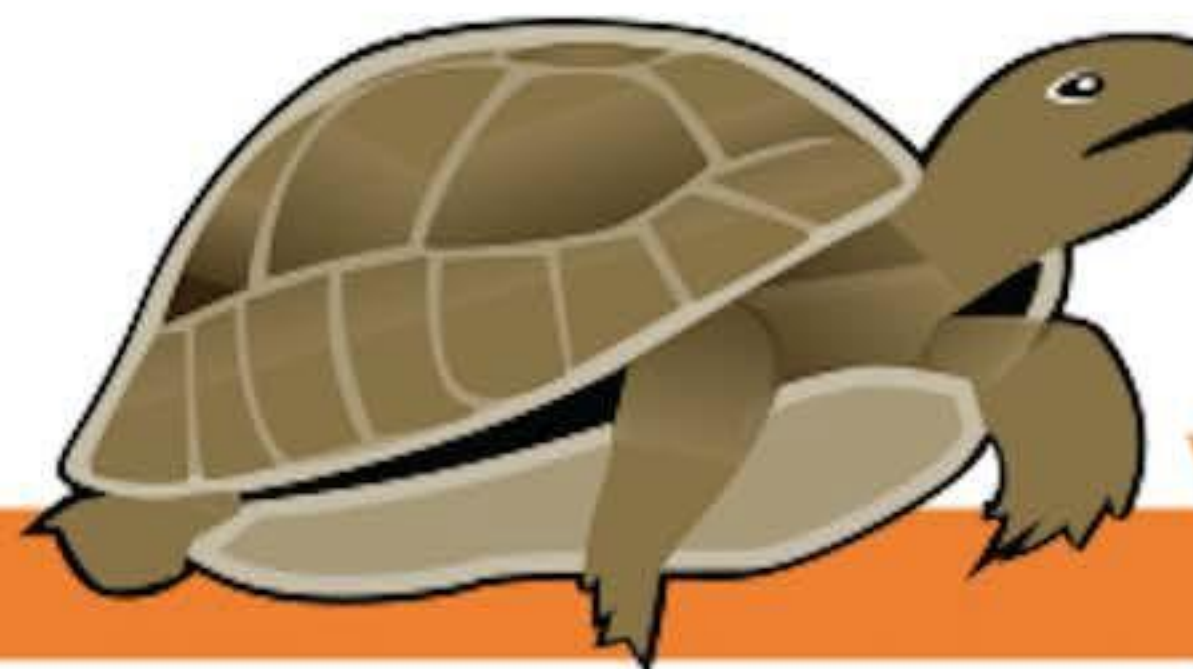
HOW IT HELPS

The smaller-scale focus on production improves efficiency at all levels of the manufacturing process. Certain items won't become obsolete before they're needed at later stages of the manufacturing process, and those later steps won't be slowed down by manufacturing delays earlier in the production cycle. Meanwhile, employers won't have to find room for excess inventory and can account for productivity as demand for a product fluctuates.



Heijunka =

STEADY PRODUCTION



8. Hoshin Kanri



WHAT IT IS

Rather than focus on the day-to-day actions within an organization, **Hoshin Kanri takes a big-picture look at a company's direction** by ensuring its goals align with the strategies outlined by middle management and the everyday work being done within a facility.

The top-down approach emphasizes steady communication for explaining visions, developing and implementing policy, and receiving feedback.

Printer manufacturer Hewlett-Packard began using Hoshin Kanri in the 1970s to ensure workers performed tasks that contributed directly to the company's broader mission and established goals.

HOW IT HELPS

Without Hoshin Kanri, it becomes exponentially more difficult to implement other lean tools. The practice helps ensure that all employees within a company understand the organization's vision and march in lockstep toward a common goal. In doing so, organizations may eliminate wasteful processes and tasks that don't contribute toward the larger vision.



9. Ishikawa



WHAT IT IS

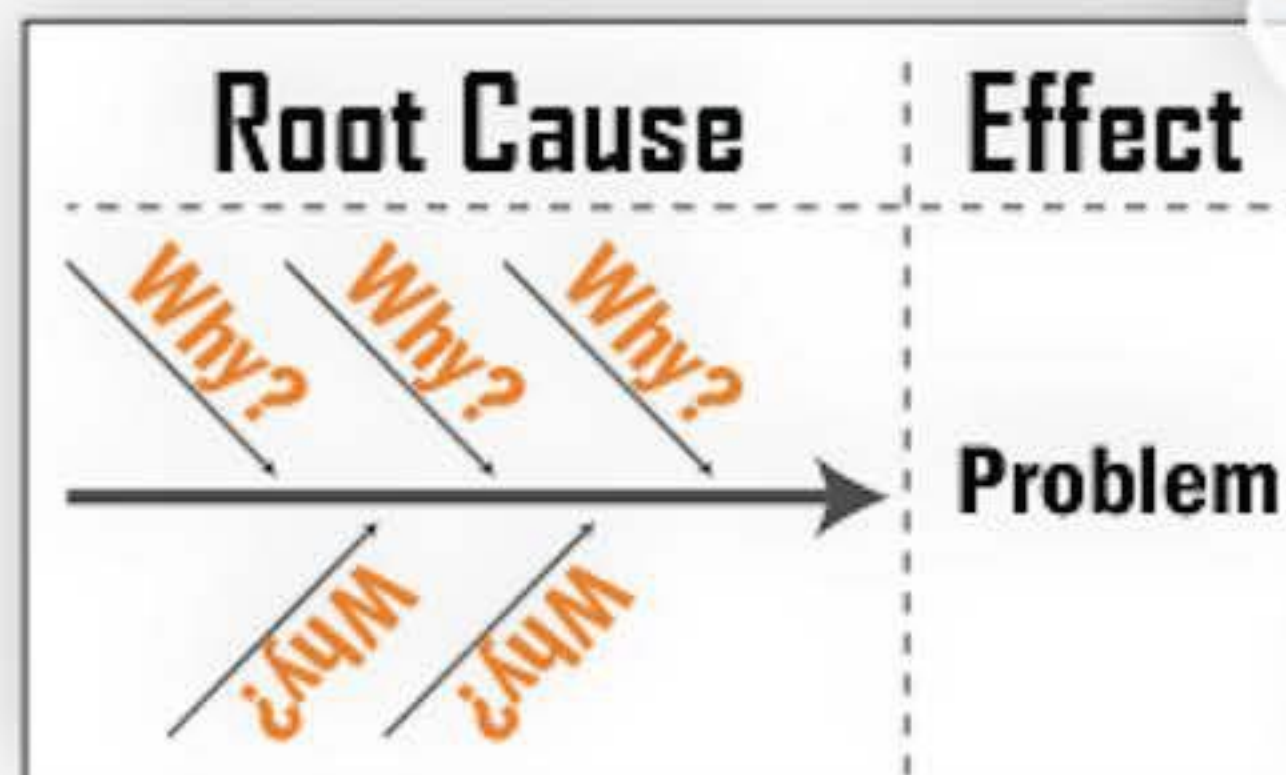
Ishikawa Diagrams (also called Cause-and-Effect Diagrams) help identify the root cause of an inefficiency or problem within a facility.

The easiest, most common way to create an Ishikawa Diagram is to be guided by asking the question, “Why?” to better understand the heart of an issue. Each answer lays the foundation for the next iteration of “Why?” This is commonly referred to as the **5 Whys**, so named because it has been observed to take roughly five instances of asking “Why?” to find the root cause of an issue.

HOW IT HELPS

Ishikawa Diagrams help uncover potential problems within a system and can help administrators understand how a broader system works, as well as its impact on other parts of the system.

5 WHYS



WHY?
WHY? WHY?
WHY? WHY?

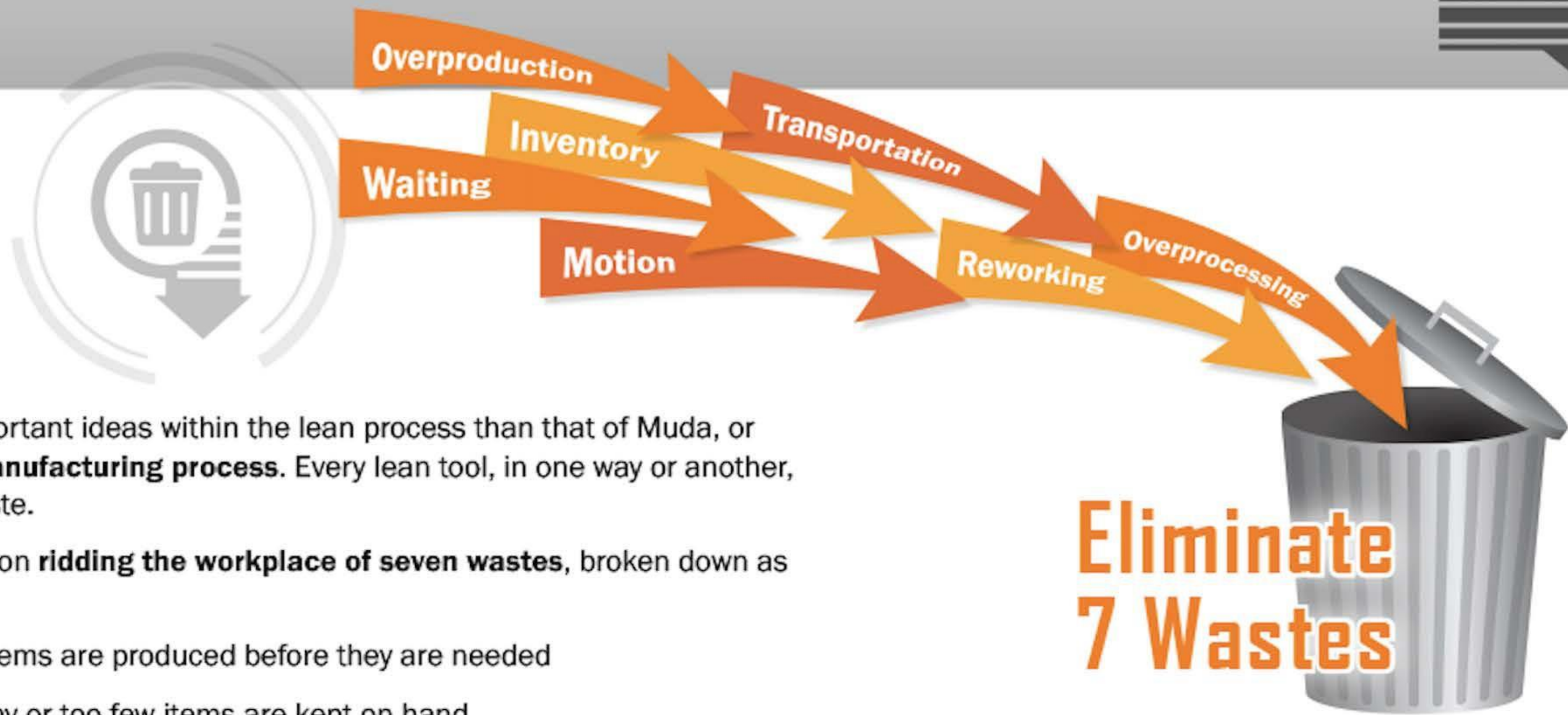
10. Muda

WHAT IT IS

There may be few more important ideas within the lean process than that of Muda, or **wastefulness within the manufacturing process**. Every lean tool, in one way or another, is designed to eliminate waste.

Specifically, lean is focused on **ridding the workplace of seven wastes**, broken down as follows:

1. **Overproduction:** When items are produced before they are needed
2. **Inventory:** When too many or too few items are kept on hand
3. **Waiting:** When people and machines wait for another part of the process to complete
4. **Motion:** When people and machines engage in unnecessary, wasteful movements
5. **Transportation:** When items or parts are moved unnecessarily or inefficiently throughout the process
6. **Reworking:** When human error causes processes to be repeated
7. **Overprocessing:** When more work goes into a product or process than is required by the customer



HOW IT HELPS

Eliminating muda is the heart of lean. With less waste, employees can be more productive, thrive in a safer work environment, and quickly understand standardized procedures and policies. In all, eliminating waste improves a company's bottom line, reduces downtime, and improves efficiency.

11. Overall Equipment Effectiveness (OEE)



WHAT IT IS

Overall Equipment Effectiveness (OEE) provides a measuring stick for understanding the efficiency of each step in the manufacturing process. A machine or processes' **efficiency is calculated by analyzing downtime, performance, and output quality.**

The OEE is then represented as a percentage, with 0 being the most inefficient score possible and 100 representing perfect production.

$$\text{AVAILABILITY \%} \times \text{PERFORMANCE \%} \times \text{QUALITY \%} = \text{OEE}$$

HOW IT HELPS

Knowing a machine or processes' OEE helps employers find inefficiencies in the production cycle, set goals for improvement, and track progress as changes are made.

12. Plan, Do, Check, Act (PDCA)



WHAT IT IS

Plan, Do, Check, Act (PDCA) offers a **standardized framework for problem-solving and improving efficiency.**

The **FOUR STEPS** in the PDCA cycle are:

1. Plan

A problem or inefficiency is identified, and all impacted employees work together to develop a plan for making improvements.

2. Do

The plan is implemented as a pilot program to study its efficacy and impacts on the broader production process.

PDCA

4. Act

The plan is incorporated on a wider level if it has successfully addressed the initial problem; if not, the cycle starts over at the Plan phase to account for other factors.

3. Check

The plan's changes and impacts are reviewed to see if further improvements can be made—and to see if any unintended consequences arose.

The Pearl River School District in New York uses PDCA to guide its decision-making and work processes.

HOW IT HELPS

PDCA reduces confusion about how to approach, implement, analyze, and review solutions to problems—and helps facilities incorporate improvements in an efficient manner.

13. Standardized Work



WHAT IT IS

Standardized Work focuses on finding **best practices for an organization or process**, documenting those procedures, implementing them on a wider scale, and communicating those tasks or methods to employees.

That communication is usually accomplished through visual cues that break down the best practice, the sequences for following it, where the work is done, and the specific procedures for accomplishing certain tasks.



DOCUMENT AND
IMPLEMENT
BEST PRACTICES

HOW IT HELPS

Standardized Work is designed specifically to improve efficiency. The more a company develops, implements, and communicates best practices, the more efficient—and the less wasteful—its employees will be.

14. Visual Factory



WHAT IT IS

A Visual Factory relies on **visual communication to clearly share key information with workers.**

The communication will vary among work areas within an organization, not to mention among disparate companies, depending on the needs of a specific work area or organization.

Organizations may use electronic display boards, color-coded floor marking, signs, labels, and other tools to efficiently communicate important information, such as how to operate machinery, the status of a process, where to find storage areas, and how to move throughout a facility.

HOW IT HELPS

Employees can increase productivity and efficiency when communication is clear, direct, and simple to understand.

CRUSHER LOCKOUT PROCEDURE

1. Notify crew of crusher shutdown
2. Remove all
3. Lockout all
4. Disengage
5. Visually ins
6. Visually inspect external p
7. Tag area to notify work
8. Commence mainten
9. Notify workers of s
10. Visually inspect h
11. Visually inspect
12. Remove lockou
13. Startup crusher



SHIPPING



15. ABC Inventory

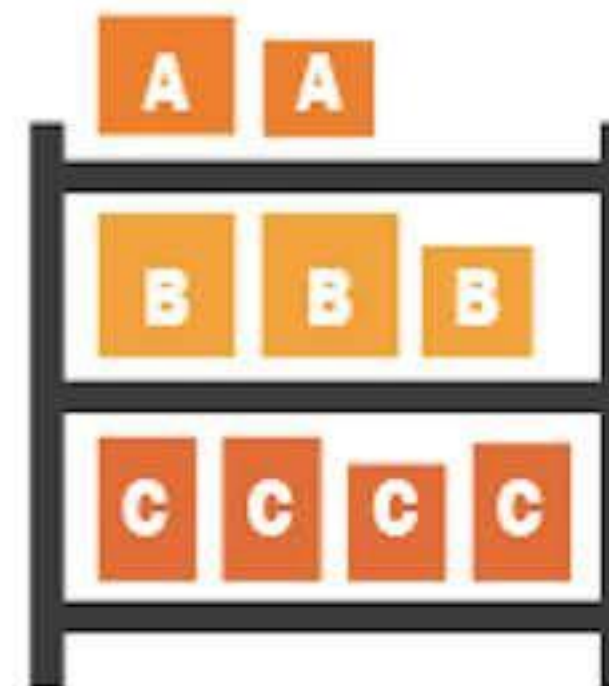


WHAT IT IS

ABC Inventory helps a company understand the relative importance of various items throughout a production process, prioritize those items, and track inventory costs.

In short, **ABC Inventory ranks items into three categories:**

- **“A” items** are the most important for an organization, each requiring more time and economic investment to ensure maximum efficiency.
- **“B” items** are less important and, accordingly, require less of an investment. By separating “A” and “B” items, organizations can allocate resources and make strategic decisions accordingly.
- **“C” items** are the least important items in a manufacturing process.



HOW IT HELPS

ABC Inventory helps companies track and prioritize their inventory more efficiently, which guides decisions around resource investment and cost-benefit analyses.

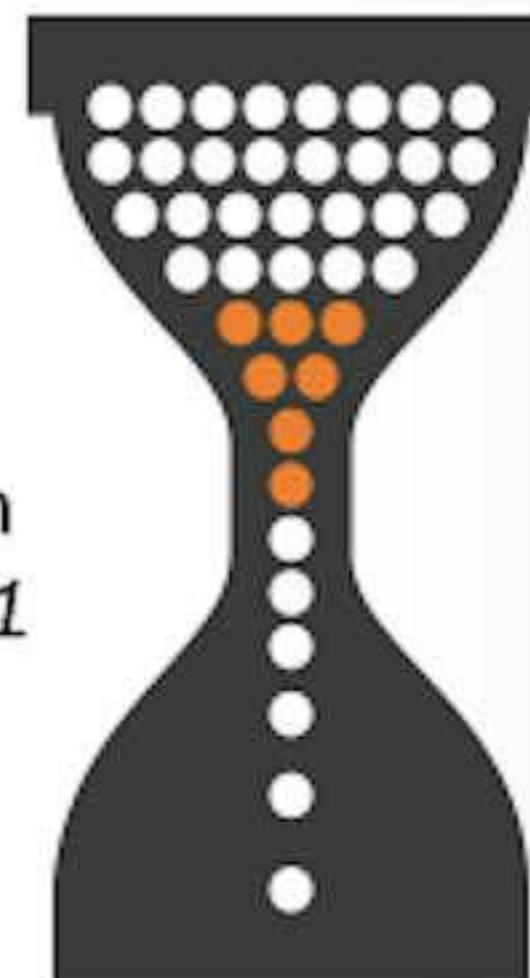
16. Bottleneck Analysis



WHAT IT IS

As the name implies, a **Bottleneck Analysis** looks for constraints and barriers that slow down a larger production process—and develops methods that account for, remove, or otherwise mitigate that particular slowdown.

There is no single established method for conducting a full-fledged Bottleneck Analysis; rather, a company may use other lean tools (such as the **5S System**—see #1 or **Plan-Do-Check-Act cycle**—see #12) for developing a workable framework.



HOW IT HELPS

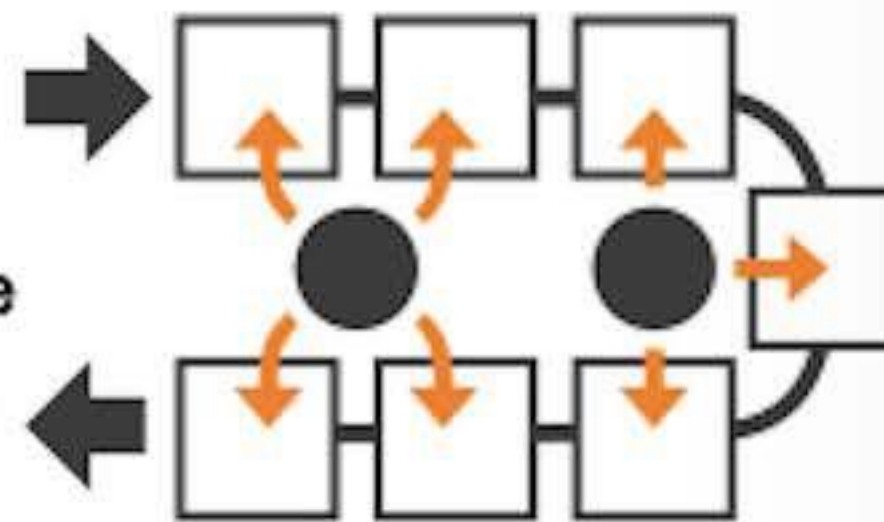
A Bottleneck Analysis improves efficiency and productivity by locating the biggest obstacle in a process and giving employers the tools to remove that barrier.

17. Cellular Manufacturing

WHAT IT IS

Cellular Manufacturing focuses on creating flow by **breaking various steps in a process down into smaller “cells.”** Each cell, in turn, uses the necessary combination of machines, people, and processes to focus on distinct, yet related tasks that fit into the larger manufacturing process.

Medical equipment manufacturer Smiths Medical replaced its conveyor system with several cells to **cut down on manufacturing floor space, increase output, and improve productivity.**



HOW IT HELPS

Cellular Manufacturing offers greater flexibility than standard assembly line production. Companies can adjust components of cells without disrupting the larger production process and can make quicker decisions that impact specific cells, without having to worry about ripple effects elsewhere in the operation.

18. Continuous Flow



WHAT IT IS

Practicing Continuous Flow allows companies to run manufacturing processes with minimal interruption. In developing a Continuous Flow system, **companies account for potential shutdowns and find workarounds that don't stop production.** For instance, an organization may invest in backup machines that turn on when a primary machine is taken offline for maintenance.

HOW IT HELPS

With little downtime, a company can increase profitability, eliminate wasted inventory, and improve production.

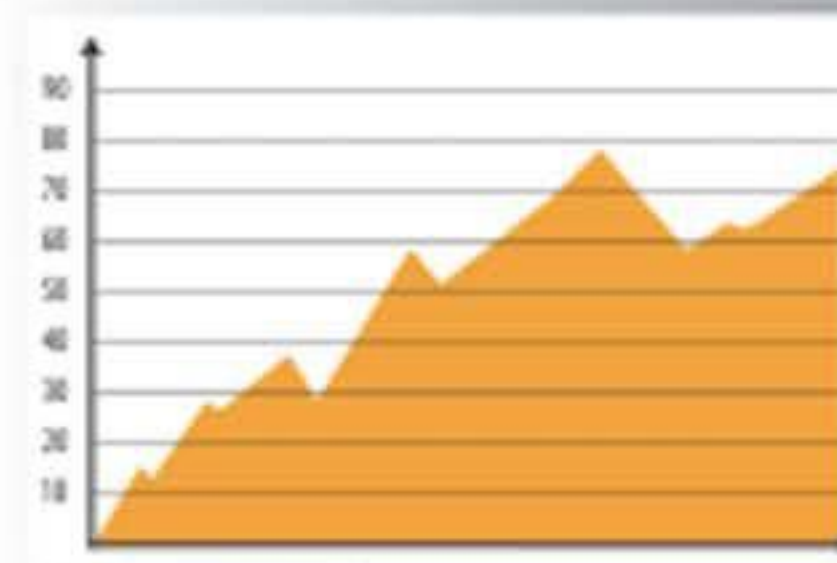


19. ERP



WHAT IT IS

Enterprise Resource Planning (ERP) systems are **large computer systems that aid companies in decision-making**. ERP systems do this by mining data, recording output, sharing information, and measuring progress—all information that **companies can use to track efficiency and implement new processes**.



HOW IT HELPS

With an ERP system, facilities can save time that might otherwise be devoted to data collecting and analysis—and with the additional data, companies can use ERP systems to test possible solutions to slowdowns and other inefficiencies.



20. Jidoka



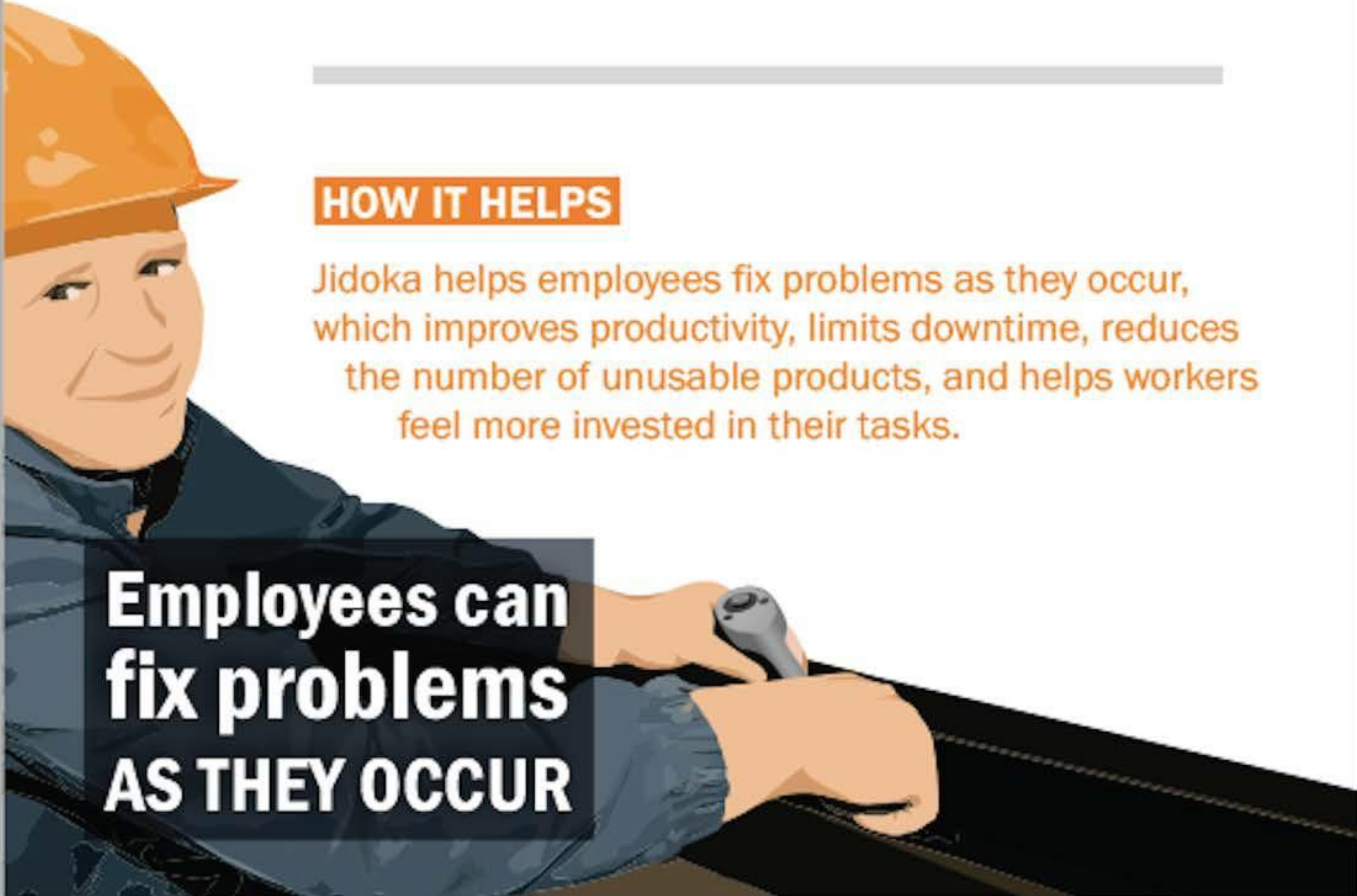
WHAT IT IS

Jidoka empowers machines and employees to **detect inefficiencies, slowdowns, breakdowns, and other abnormalities—and immediately stop work to course-correct.** With Jidoka, employees don't have to wait for a manager's approval to stop production and fix a problem.

Highway truck trailer manufacturer Doepker Industries implemented Jidoka in the early 2000s to maximize productivity, address ongoing manufacturing issues, and keep up with customer demand.

HOW IT HELPS

Jidoka helps employees fix problems as they occur, which improves productivity, limits downtime, reduces the number of unusable products, and helps workers feel more invested in their tasks.



**Employees can
fix problems
AS THEY OCCUR**

21. Just-In-Time (JIT)

WHAT IT IS

Just-In-Time casts aside traditional thinking for a new approach to manufacturing: Rather than produce items to meet potential demand, **items are made in response to actual, concrete customer demand.**

HOW IT HELPS

Just-In-Time cuts down on excess inventory, minimizes storage needs, and gives companies greater flexibility in their manufacturing processes.



22. Key Performance Indicator (KPI)

WHAT IT IS

Key Performance Indicators (KPI) are important for **measuring efficiency, waste, and productivity**—and, in turn, tracking progress toward top-line goals within a facility.

HOW IT HELPS

Clearly-defined KPIs quickly and easily communicate goals and progress to employees at all levels within an organization, thereby improving productivity and striving for greater efficiency.



**EFFICIENCY
WASTE
PRODUCTIVITY**

23. Level Loading



WHAT IT IS

Level Loading is a technique that balances the manufacturing process, so **goods are produced at a steady, stable rate**. This, in turn, ensures that other stages of the production process can happen at a constant, steady pace that doesn't rise or fall with swings in demand.

HOW IT HELPS

Level loading cuts the need for excess inventory, and its steady schedule improves efficiency by allowing companies to plan and budget for the steady, predictable rate of production.



24. Mind Maps

WHAT IT IS

Mind Maps are visual tools designed to **organize and showcase connected ideas revolving around a certain task**. Mind Maps can be organized to offer both high-level and granular looks at problems, all while breaking down complex challenges into easy-to-follow diagrams.



HOW IT HELPS

Use Mind Maps to brainstorm, develop, and implement solutions to problems large and small. The diagrams can unlock new approaches to problem-solving, as well as unusual solutions—and their potential consequences.



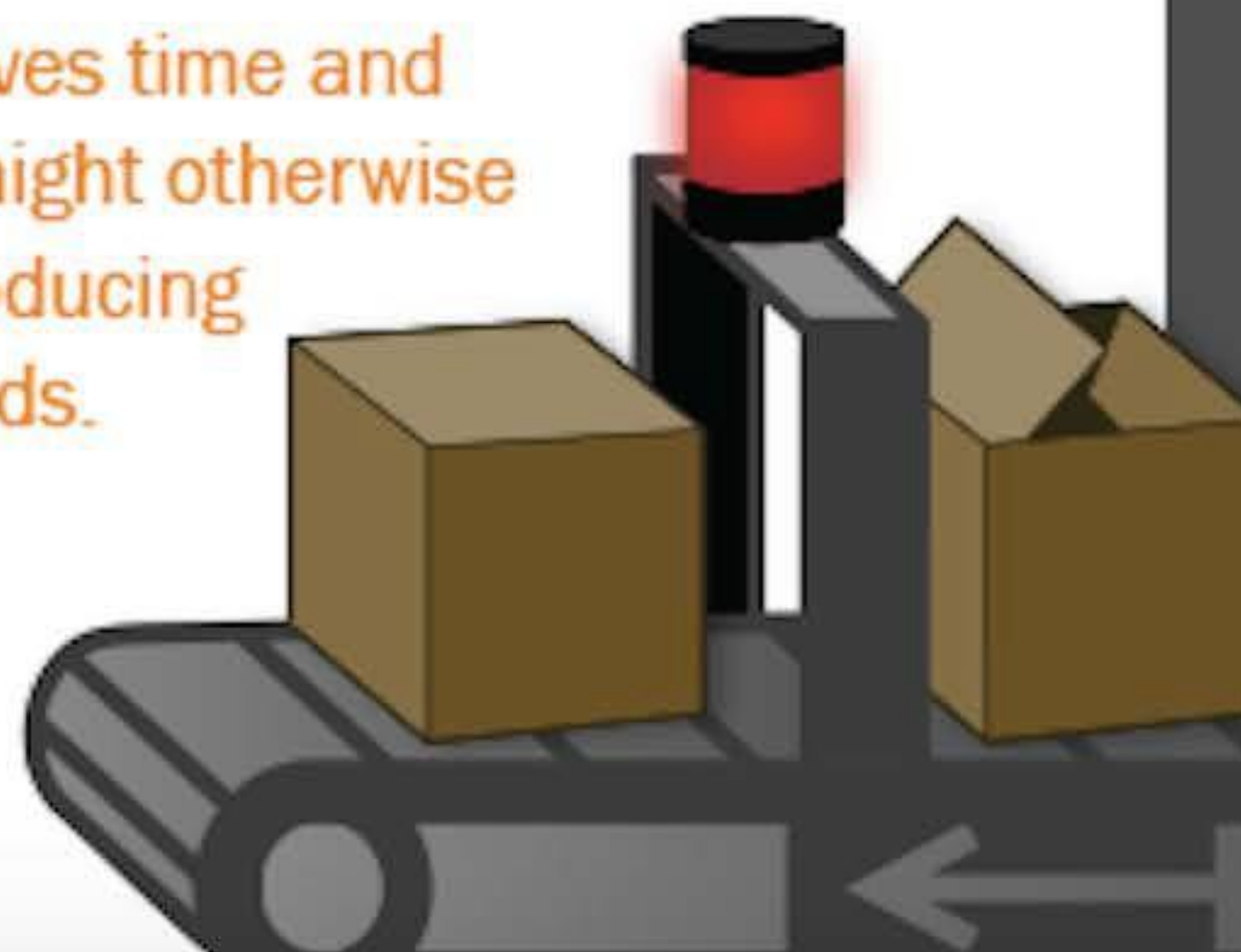
25. Poka-Yoke

WHAT IT IS

Roughly translated as “inadvertent error prevention,” Poka-Yoke is a process designed to protect against errors and mistakes as items are manufactured. Employers use Poka-Yoke to **detect errors and prevent defects throughout the production process**, rather than after an item has been manufactured or a process completed.

HOW IT HELPS

Poka-Yoke saves time and money that might otherwise go toward producing defective goods.



26. Root Cause Analysis



WHAT IT IS

As the name implies, a Root Cause Analysis is a **problem-solving method that works to find the underlying cause of a problem**, rather than treat subsequent problems as they arise.

Some companies use the **5 Whys (Ishikawa)**—see #9—to diagnose a problem, while others trace the steps that led to a defect to find out where the problem began.



HOW IT HELPS

A Root Cause Analysis can save companies money as they address problems with long-lasting fixes, rather than treat symptoms as they appear.

27. Single Minute Exchange of Die (SMED)

WHAT IT IS

Single-Minute Exchange of Die (SMED) offers a method for **reducing setup or changeover time in a manufacturing process to less than 10 minutes**. When implemented, SMED bridges the time gaps between production steps by altering and **simplifying setup processes, eliminating wasteful steps, and developing standardized procedures**.

Auto maker Toyota® uses SMED to plan for changing the dies on transfer-stamping machines that create body parts for the company's various automobiles. The company managed to cut the process, which had once taken as long as three days, down to 10 minutes.

HOW IT HELPS

SMED improves efficiency and saves time by cutting down on inessential processes, procedures, and steps; in turn, it enables a higher rate of production and reduces on-hand inventory.



28. Six Big Losses



WHAT IT IS

Six Big Losses helps organizations **identify and plan for the six most common categories of productivity loss**:

1. **Unplanned Stops** occur when machines go offline due to unplanned events, such as a breakdown or when employees are not available to operate the equipment.
2. **Planned Stops** occur when machines are offline due to planned events, such as planned maintenance, safety inspections, or employee breaks.
3. **Small Stops** are when machines stop for a short duration of time to correct settings, unclog jams, and routine cleaning.
4. **Slow Cycles** occur when machines run slower than designed, usually because a piece of equipment is worn out, uses substandard parts, or when its operator is new and learning the system.
5. **Production Rejects** are defective parts produced in the routine course of production, usually due to operator error or incorrect settings.
6. **Startup Rejects** are defective parts produced as a machine turns on and starts up. These typically occur due to normal processes related to equipment startup and process changeovers.



HOW IT HELPS

Knowing the Six Big Losses helps companies understand, study, and plan for some of the most common causes of manufacturing waste.

29. Smart Goals



WHAT IT IS

SMART Goals give companies a **criteria for developing useful, clear, and attainable goals.**

SMART is an acronym that stands for:

- **Specific:** Goals should clearly outline what you hope to accomplish.
- **Measurable:** You should be able to track success with tangible, concrete measurements.
- **Attainable:** The goal should be realistic and achievable.
- **Results-Focused:** The goal should outline desired results.
- **Time-Specific:** Goals should have time spans or deadlines for tracking or measuring success.



30. Takt Time



WHAT IT IS

Takt Time invites manufacturers to **develop a rate of production that reflects consumer demand**. Takt time doesn't measure how long it takes to produce an item, but rather the pace at which items must be produced to meet consumer needs.



HOW IT HELPS

Employers can appropriately allocate resources, enjoy increased flexibility, and eliminate wasted inventory by basing the production schedule around customer demand.

31. Value Stream Mapping (VSM)



WHAT IT IS

Value Stream Mapping (VSM) outlines the production process, from when an item's ingredients leave the supplier until the finished product reaches the consumer. The process utilizes a **flow diagram to examine each step to find areas of waste and point out inefficiencies.**

Dalco Metals, Inc. used VSM to reconfigure its office space to better reflect the company's typical workflow. The change cut processing time in half and inspired Dalco Metals to implement lean elsewhere on their manufacturing floor.

HOW IT HELPS

VSM helps organizations locate waste and inefficiencies, so they can take steps to improve and address underlying issues.



32. Zero Quality Control

WHAT IT IS

Zero Quality Control (ZQC) is a method for eliminating all defects from a particular process. Rather than focus on the employee, **ZQC aims to control a process' performance and make it impossible to produce defects**, no matter the operator or conditions.

HOW IT HELPS

ZQC leads to a proactive approach for finding and addressing defects, which increases uptime, improves productivity, and boosts efficiency.

