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Manufacturing Waste and Environment

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Abstract: The purpose of this paper is to show the impact of manufacturing wastes on the environment. Now-a-days manufacturing wastes are very harmful to the society. Here I have tried to put the frame of lean manufacturing by using two methods kaizen and 5S and tried to show how can we create a sustainable environment for the society. By the way many industries are applying lean manufacturing concepts but their continuous involvement is necessary. This paper fist has shown the different wastes identified in manufacturing industries. The how can be these wastes eliminated of prevented by using kaizen and 5S. Finally few observations and relation have been shown between wastes and environment.

Keywords: Lean, Kaizen, 5S, Sustainability

INTRODUCTION

Lean involves a fundamental paradigm shift from conventional "batch and queue" mass production to product-aligned "one-piece flow" pull production. Whereas "batch and queue" involves mass production of large lots of products in advance based on potential or predicted customer demands, a "one-piece flow" system rearranges production activities in a way that processing steps of different types are conducted immediately adjacent to each other in a continuous flow.

This shift requires highly controlled processes operated in a well maintained, ordered, and clean environment that incorporates principles of employee-involved, system-wide, continual improvement.

While most of these methods are interrelated and can occur concurrently, most organizations begin by implementing lean techniques in a particular production area or at a "pilot" facility, and then expand use of the methods over time. Companies typically tailor these methods to address their own unique needs and circumstances. In doing so, they may develop their own terminology around the various methods. A summary of the environmental implications of each method is also available.

Lean Manufacturing

In the lean context, waste was viewed as any activity that does not lead directly to creating the product or service a customer wants when they want it. In many industrial processes, such “non-value added” activity can comprise more than 90 percent of the total activity as a result of time spent waiting, unnecessary “touches” of the product, overproduction, wasted movement, and inefficient use of raw materials, energy, and other factors.

When companies implement lean methods, several outcomes consistently result:

- Inventory level reduction (raw material, work-in-progress, finished product) helps environment by reducing damage, spoilage of materials.
- Decreased *material* usage (product inputs, including energy, water, metals, chemicals, etc.) by reducing material requirements and creating less material waste during manufacturing.
- Optimized *equipment* (capital equipment utilized for direct production and support purposes) using lower capital and resource-intensive machines to drive down costs.
- Reduced need for factory *facilities* (physical infrastructure primarily in the form of buildings and associated material demands) by driving down the space required for product production.
- Increased production *velocity* (the time required to process a product from initial raw material to delivery to a consumer) by eliminating process steps, movement, wait times, and downtime.
- Enhanced production *flexibility* (the ability to alter or reconfigure products and processes rapidly to adjust to customer needs and changing market circumstances) enabling the implementation of a pull production, just-in-time oriented system which lowers inventory and capital requirements.

Lean methods typically target eight types of waste.

Defects: Production of off-specification products, components or services that result in scrap, rework, replacement production, inspection, and/or defective materials

Waiting: Delays associated with stock-outs, lot processing delays, equipment downtime, and capacity bottlenecks

Unnecessary Processing: Process steps that are not required to produce the product

Overproduction: Manufacturing items for which there are no orders

Movement: Human motions that are unnecessary or straining, and work-in-process (WIP) transporting long distances

Inventory: Excess raw material, WIP, or finished goods.

Unused Employee Creativity: Failure to tap employees for process improvement suggestions

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Complexity: More parts, process steps, or time than necessary to meet customer needs.

Relation Between Lean and Environmental Improvement

Lean helps environment without intending to. "Environmental" wastes, such as excess energy or water use, hazardous waste, or solid waste, present largely untapped opportunities to the lean practitioner. This is obvious if one steps back to consider the overall goals of lean manufacturing continually improving production efficiency.

More efficient production means less energy used per unit produced. lean manufacturing means "producing exactly what the customer wants, exactly when (with no delay), at fair price and minimum waste." Therefore, lean thinking focuses on the optimization of production resources as relevant for the customer (i.e., time, people, machines, space, etc.) and reduces waste accordingly.

This paper indicates that environmental performance is almost never the objective of lean initiatives and that the financial contribution to the lean business case of environmental performance improvements (e.g., less material loss, lower waste management costs, lower liability, reduced regulatory burden) are often trivial.

The benefits associated with driving capital and time out of the production process are so potent, that other potential benefits such as environmental improvement are rarely necessary to justify action or even worth quantifying to make the business case. And yet, lean implementation produces very real environmental benefits.

Direct environmental benefits, including those experienced throughout the product life cycle, are rarely considered:

• Reduced demand for raw materials avoids environmental impacts from their extraction, processing, and transport;

• Higher quality products often have greater longevity, decreasing the frequency of product repair and replacement and the associated environmental impacts; and

• Lean design for manufacturability can reduce the number of parts and materials in a product, and therefore may make it easier to recycle products or product components.

Methods to Implement Lean in Organization

- Kaizen
- 5 S

Kaizen

Kaizen is drawn from two Japanese words Kai meaning **"change"** and Zen meaning **"good".** Translated as **"to change for better".**

'Kaizen' or rapid improvement processses is a well proven model used by industry to deliver sustainable lean manufacturing processes that eliminate waste, improve productivity, achieving sustained continual improvement and improve operational efficiency.

Lean production is founded on the idea of *kaizen* – or continual improvement. This philosophy implies that small, incremental changes routinely applied and sustained over a long period result in significant improvements. The *kaizen* strategy aims to involve workers from multiple functions and levels in the organization in working together to address a problem or improve a process. The team uses analytical techniques, such as value stream mapping and "the 5 whys", to identify opportunities quickly to eliminate waste in a targeted process or production area. The team works to implement chosen improvements rapidly (often within 72 hours of initiating the *kaizen* event), typically focusing on solutions that do not involve large capital outlays.

Method and Implementation Approach

Phase 1: Planning and Preparation. The first challenge is to identify an appropriate target area for a rapid improvement event.

Phase 2: Implementation. **Five Whys.** Toyota developed the practice of asking "why" five times and answering it each time to uncover the root cause of a problem.

Phase 3: Follow-up. A key part of a *kaizen* event is the follow-up activity that aims to ensure that improvements are sustained, and not just temporary.

Implications for Environmental Performance

Advantages

- Kaizen involves workers from multiple functions who may have a role in a given process, and strongly encourages them to participate in waste reduction activities.
- *Kaizen* may provide a vehicle for engaging broad-based organizational participation in continual improvement activities that target, in part, physical wastes and environmental impacts.
- *Kaizen* can be a powerful tool for uncovering hidden wastes or waste-generating activities and eliminating them.
- *Kaizen* focuses on waste elimination activities that optimize existing processes and that can be accomplished quickly without significant capital investment. This creates a higher likelihood of quick, sustained results.

Disadvantages

- Care should be taken to consult with environmental staff regarding changes made to environmentally sensitive processes.
- Failure to incorporate environmental considerations into *kaizen* can potentially result in solutions that do not consider inherent environmental risk associated with new processes.

5S

5S is a system to reduce waste and optimize productivity through maintaining an orderly workplace and using visual cues to achieve more consistent operational results. It

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derives from the belief that, in the daily work of a company, routines that maintain organization and orderliness are essential to a smooth and efficient flow of activities. Implementation of this method "cleans up" and organizes the workplace basically in its existing configuration, and it is typically the starting point for shop-floor transformation.

Method and Implementation Approach

Seiri – "Sort"

Seiri means "to sort" or organize. It is the first stage of the **5S** method.

The goals of ***Seiri*** are:

- Remove unnecessary objects
- Reduce waste

Seiton – "Set in Order"

The principle here is to keep things in their proper places. One guide to proper placement is to keep frequently-used items handy, and store other things where they can be found.

Seiton uses the same concept, expressed for a workplace:

- Keep tools near the place they are used
- Don't make workers bend or stretch frequently
- Store rarely-used items where they won't get in the way, but where they can be found easily

Seiso – "Shiny Clean"

This is the exception – the only one-time activity in the **5S** method.

This stage has two goals:

- Determine and gain agreement on the desired level of cleanliness
- Learn how to make new routines so this will become standardized (in the ***Seiketsu*** stage)

Seiketsu – "Standardized Cleanup"

This phase draws on the notes from the ***Seiso*** stage. Consider the sources of dirt: air-borne dust; sawdust or other dry powder from cutting operations; splatter from wet processes; or simple trash because there is no proper container.

The results include:

- Maintenance for buildings or equipment, if these are sources of dirt
- Improvements to processes – for example, adding a dust hood over a cutting area
- A binder with instructions for cleaning each work area
- A checklist for each cleanup period (daily, biweekly, or less frequently)
- A list matching the people with their responsibilities

Shitsuke – ">Sustain"

Shitsuke is a complex Japanese concept that includes instilled discipline, self-discipline, common cultural values, and self-motivated practice to improve. A Westerner might think of: parents training their children to brush their teeth after each meal; children then brushing regularly; expecting everyone to brush after meals; and (for a non-dental example) golfers continuing to practice putting, even though the stroke may seem easy to a beginner.

This step requires continued management support and communication.

Implications for Environmental Performance

Advantages

- Painting the machines and the equipment light colors and cleaning the windows, often done under the Shine pillar, decreases energy needs associated with lighting.
- Painting and cleaning makes it easier for workers to notice spills or leaks quickly, thereby decreasing spill response. This can significantly reduce waste generation from spills and clean-up.
- The removal of obstacles and the marking of main thoroughfares decreases the potential of accidents that could lead to spills and associated hazardous waste generation (e.g., spilled material, absorbent pads and clean up materials).
- Regular cleaning, as part of the Shine pillar, decreases the accumulation of cuttings, shavings, dirt, and other substances that can contaminate production processes and result in defects. Reduction in defects has significant environmental benefits (e.g., avoided materials, wastes, and energy needed to produce the defective output; avoided need to dispose of defective output).

Disadvantages

- Regularly painting and cleaning machines and equipment could lead to increased use of paints and cleaning supplies.
- Disposing of unneeded equipment and supplies creates a short-term surge in waste generation.

Observations

- Lean produces an operational and cultural environment highly conducive to waste minimization and pollution prevention
- Lean can be leveraged to produce more environmental improvement, filling key "blind spots" that can arise during lean implementation
- Lean experiences regulatory friction around environmentally sensitive Processes
- Environmental agencies have a window of opportunity to enhance the environmental benefits associated with lean

Relation between Manufacturing waste to the Environment

Defects

- Raw materials consumed in making defective products
- Defective components require recycling or disposal

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- More space required for rework and repair, increasing energy use for heating, cooling, and lighting

Waiting

- Potential material spoilage or component damage causing waste
- Wasted energy from heating, cooling, and lighting during production downtime

Overproduction

- More raw materials consumed in making the unneeded products
- Extra products may spoil or become obsolete requiring disposal

Movement

- More energy use for transport
- Emissions from transport
- More space required for WIP movement, increasing lighting, heating, and cooling demand and energy consumption
- More packaging required to protect components during movement

Inventory

- More packaging to store work-in-process
- Waste from deterioration or damage to stored WIP
- More materials needed to replace damaged WIP More energy used to heat, cool, and light inventory space

Complexity

- More parts and raw materials consumed per unit of production
- Unnecessary processing increases wastes, energy use, and emissions

Unused Creativity

- Fewer suggestions of P2 and waste minimization opportunities

CONCLUSION

By this paper we can say that by minimizing or eliminating the manufacturing wastes, we can save our environment by reducing the effect of wastes on environment.

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