"We don't have to change, survival isn't mandatory"
W. Edwards Deming

58% of all small businesses and
82% of all large businesses
are implementing Lean
NIST

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"Teach them to fish."

ASQ Section 614 Dinner Meeting
Tuesday, March 11, 2008

Welcome to An Introduction to Lean Manufacturing

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Tonight's Objectives

- Learn to identify the 7 major wastes in any work
- Gain a High-Level Understanding of Lean
- Participate in the Star Exercise
  - and learn to complete two tools

  that you can take back to work and use immediately
- Questions and answers for how Lean supports every occupation and industry.

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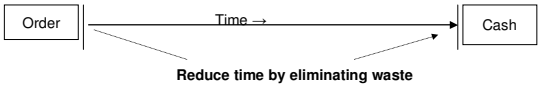
Lean… simply defined

- "All we are doing is looking at the timeline, from the moment the customer gives us an order to the point when we collect the cash. *And we are reducing that timeline by reducing the waste*."

Taiichi Ohno



Reduce time by eliminating waste

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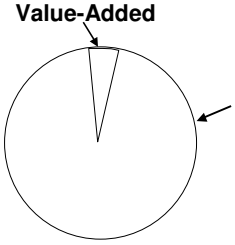
Lean = Eliminating The 7 Wastes

Value-Added



1. **Defects**- producing or reworking scrap
2. **Overproduction-** and early production producing over customer orders, producing unordered materials / goods.
3. **Waiting** - idle time
4. **Transportation**- handling more than once, delays in moving materials, unnecessary moving or handling
5. **Inventory** - unnecessary raw materials in stores, work in process (WIP), & finished stocks
6. **Motion** - movement of equipment or people that add no value to the product
7. **Excess Processing** - unnecessary processing or procedures (work carried out on the product which adds no value) [Over Processing]

These Seven wastes erode profit, take time and effect quality.

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Defects…

- Improper coding
- Paperwork that does not match
- Handwritten information incorrectly understood
- Making the Wrong part
- Making the right part but making it wrong

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Overproduction:

- Memos and E-Mail to everyone (or copying "extra" folks)
- Printing documents twice "just-in-case"
- Excessive logging of information
  - Keeping a list of callers or orders outside the system
  - Doing the work and then tracking what you did or when
- Making a draft before preparing formal document
  - Prepare monthly report early and updating it
  - Shipping documents, closing reports, sales reports
- Making 54 parts instead of the 50 ordered
  - planning for failures and scrap
  - because the system (dies/tooling/patterns) don't allow for a different amount

Inventory Waste Examples

- Buying items just-in-case or to save money
  - (bulk purchasing, quantity discounts, person ordering doesn't know you don't use it any more)
- Documents are waiting to be matched or signed
- No storage space because it is filled with other items we don't need

Waiting …

- Waiting for printer to warm-up, for some other print job to finish
- Waiting for host, lifts, or forklift, etc.
- Attendees not all on-time for meetings
- Waiting for the person or process before them to finish
- Mail or order delivery late to/within the organization
- Different work schedule of team members
- Signatures, unnecessary or excessive signatures
- Waiting when Printer or computer breaks down
- Waiting when Manufacturing machine breaks down

Transportation Waste…

- Long travel to common places
  - Copier is farthest away from people to use it
  - Paper, paper cutter and stapler kept away from printer and copier or work table
  - Commonly used File room
  - Printer is a long distance from desk
  - Co-worker is a long distance from others
- Treasure Hunts
  - Walking back and forth to find information or people
  - Returning to see if he/she is back yet
  - Returning to see if information has arrived
  - Looking for items because they do not have a defined place
  - Papers are not filed

Commonly caused by Poor office layout

Transportation Waste…

- Tools aren't where you need them when you need them
- Tools are shared
- Walking back and forth to do the job
- Walking back and forth to get instruction, product or looking for people
- Taking paperwork to the office
- Treasure Hunts
  - Searching for the tool that disappeared
  - Walking to a production book to find drawings or instructions
  - Walking back and forth to find information or people
  - Returning to see if he/she is back yet
  - Walking to see if needed parts have arrived

Commonly Caused by Poor production layout

Waste of Motion

- Keeping or storing forms out of reach of employee
- Saving files *forever* – mixed with current files
- Employee working by experience instead of standard method
- Not removing parts, dies or jigs no longer used or needed, or correct
- Setting up the saw each time because you are sharing it

Excess Processing Waste

- Printing or faxing and then mailing (sometimes overnight) and then also emailing the same document
- Keeping a copy for your *personal* file
- Repeating of same information in different forms
  - Re-entering data from screen to screen, or for different purposes
  - Using incompatible software in different departments creating rework, re-entry or even paper copies
- Over grinding, sanding or prepping that the customer hasn't required
- Adding bells-and-whistles the customer doesn't require

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Lean = Total Elimination of Waste

Typically 95% of Total Cycle Time is Non-Value Added!!!

PROCESSING TIME	Order Processing, Inspection, Documenting, Transport, Storage, Waiting, Rework, Inspection, etc...

Total Cycle Time

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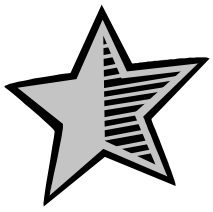
Recognizing Waste



The Star Exercise

Using 2 forms: Waste Analysis Sheet and Spaghetti chart

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Waste Analysis Sheet Example

Waste Analysis Sheet

Process: Pods face assy — Observer: Samantha
Area: Pods assy — Date: 1.31.06

#	Task Description	Defects	Overproduction	Inventory	Excess Processing	Motion	Waiting	Transportation	Value Added	Possible Solutions
1	Move case + grab box of faces					X		X		
2	Check face + Pull for Quality	X			X					
3	Install pull								✓	* Install pull w/ hands instead of hammer
4	Check face and pull for Quality	X			X					
5	Install pull								✓	
6	Check face + pull for quality	X			X					
7	Install pull								✓	
8	Sand + repaint face	X			X	X				
9	Install lock								✓	
10	Walk back place box on case					X		X		

10	Total Tasks	118	Estimated Total Time per cycle (seconds)
6	Non-Value Added Tasks	12	Estimated Value Adding time per cycle (seconds)
4	Value Added Tasks	12	% Value adding Time
40%	Value Adding Percentage		

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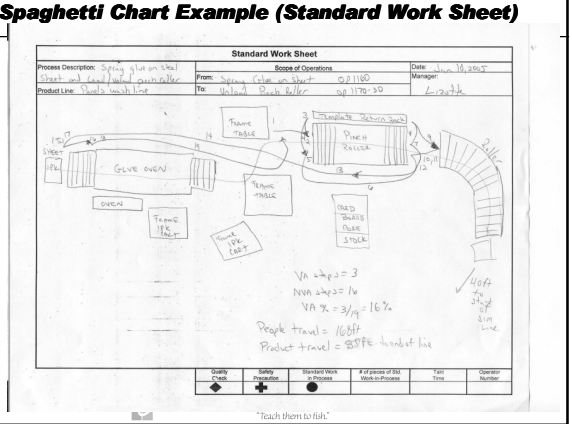
Spaghetti Chart Example (Standard Work Sheet)



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What are the issues in the Star production system?

Did you see any....

Defects-

Overproduction-

Waiting **–**

Transportation-

Inventory **–**

Motion **–**

Excess or Over Processing -

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The question now is…

Now I understand about Waste…
What is Lean?

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What is Lean?

"A systematic approach
to identifying
and eliminating waste
(non-value-added activities)
through continuous improvement"
Shingjiutsu Consulting

Lean is NOT about making people work harder or faster.

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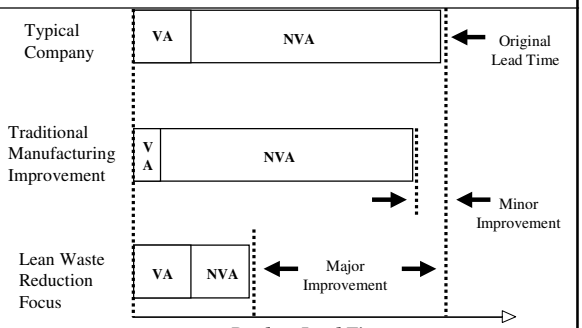
Continuous Improvement Focus



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LEAN PRODUCTION SYSTEM

Cost Reduction Through Standardization & Waste Elimination

Lean Production System

Just In Time
- Just what is needed.
- In just the amount needed.
- At just the moment needed.
- Utilizing the minimum; Material, Labor, Equipment and Space

People → Standard Work → Takt Time Production
Material → Standard Work in Process Kanban → One Piece Flow
Machine → Operational Availability → Pull System

Jidoka
- Separating human and machine work.
- Respond to machine abnormalities.
- Prevent the reoccurrence of abnormalities
- Immediate detection and correction of problems.

Leveled Production

5S – THE FOUNDATION OF LEAN PRODUCTION

SORT | *STRAIGHTEN* | *SHINE* | *STANDARDIZE* | *SUSTAIN*

Working together to Eliminate Waste

Value Stream Mapping

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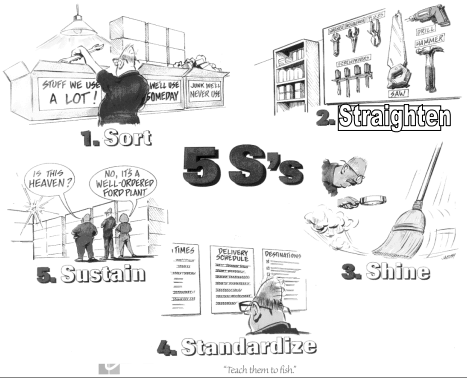
5S: The Foundation ①



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5S Levels of Excellence

		Sort	*Straighten*	*Shine*	*Standardize*	*Sustain*
Excellent	**LEVEL 5** *Focus on Prevention*	Employees are continually seeking improvement opportunities.	A dependable, documented method has been developed to provide continual evaluation, and a process is in place to implement improvements	Area employees have devised a dependable, documented method of preventive cleaning and maintenance.	Everyone is continually seeking the elimination of waste with changes documented and information shared	There is a general appearance of a confident understanding of, and adherence to the 5S principles.
	LEVEL 4 *Focus on Consistency*	A dependable, documented method has been established to keep the work area free of unnecessary items.	A dependable, documented method has been established to recognize in a visual sweep if items are out of place or exceed quantity limits.	5S agreements are understood and practiced continually.	Substantial process documentation is available and followed.	Follow-through with 5S agreements and safety practices is evident.
Levels of Improvement	**LEVEL 3** *Make it Visual*	Unnecessary items have been removed from the workplace.	Designated locations are marked to make organization more visible.	Work and break areas and machinery are cleaned on a daily basis. Visual controls have been established and marked.	Working environment changes are being documented. Visual control agreements for labeling and quantity levels have been established.	5S agreements and safety practices have been developed and are utilized.
	LEVEL 2 *Focus on Basics*	Necessary and unnecessary items are separated.	A designated location has been established for items.	Work and break areas are cleaned on a regular, scheduled basis. Key items to check have been identified.	Methods are being improved but changes haven't been documented.	A recognizable effort has been made to improve the condition of the workplace.
	LEVEL 1 *Just Beginning*	Needed and not needed items are mixed throughout the work place.	Items are randomly located throughout the workplace.	Work place areas are dirty, disorganized and key items not marked or identified.	Work place methods are not consistently followed and are undocumented.	Work place checks are randomly performed and there is no visual measurement of 5S performance.

Does Searching really matter?

If you are searching for tools/ equipment/people etc you are wasting valuable production time

If you can't find what you need, when you need it you can't produce anything

You can calculate the impact of your wasted time on business.

- **Average workdays per year = 250**
- **30 minutes per day searching = 250 / 0.5 (1/2 hr) = 125 hrs per year**
- **$15 per hour (wage/benefits): 125 hrs x $15 = $1875 per employee per year**
- **What about the total for all employees in an organization =**
  - **10 employees = $18,750 per year**
  - **50 employees = $93,750 per year**
  - **100 employees = $187,500 per year (6 people)**
  - **200 employees = $375,000 per year (12 people)**
  - **400 employees = $750,000 per year (24 people!)**

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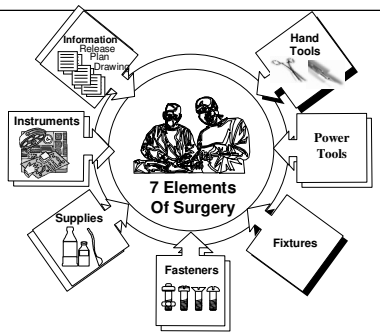
Point-of-Use Strategy as the 7 Elements of Surgery



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Visual Controls Aid in the work

- Tell us how we are doing
  - What is next and what is most important
- *Controls the behavior*
  - Tells what to do
  - Tells what not to do

➢ Need to be clear
➢ Are agreed upon by those in the process

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Defect Board

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Clear? Would you know what to do?

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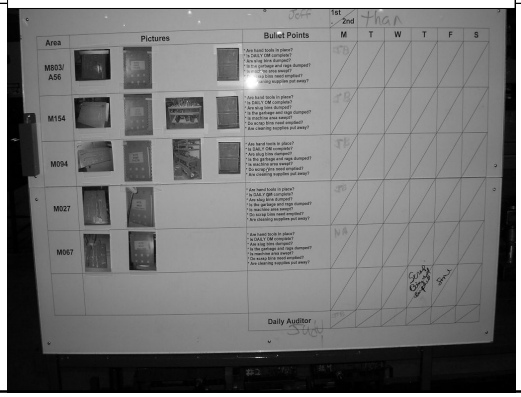
Does this communicate the right action?

Audit Boards are visual controls



4 Elements of Standard Work

Standard Work is comprised of these elements:

1. **Planned work sequence**
2. **Takt time – paced to the needs of the customer**
3. **Balanced Work**
4. **Standard work-in-process (SWIP)**

To use the right amount of people
In the right amount of time
With the right amount of work
And the right equipment
Just In Time.

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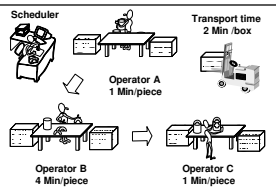
Traditional Batch Production



Lead Time for 100 piece Batch

Step	Process Time	Transport
1	100 Min	2 Min
2	400 Min	2 Min
3	100 Min	2 Min

***100 Item Lead Time*: 606 Minutes**

- **Layout is by process or department**
- **Separated by long distances**
- **Transported in batches**
- **Long lags between defect creation and detection at next process**
- **Long lead times from raw materials to finished product**
- **Waste of labor and equipment and moving batches**
- **Complex system for scheduling and accounting for inventory**

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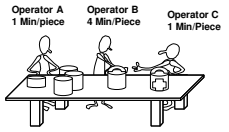
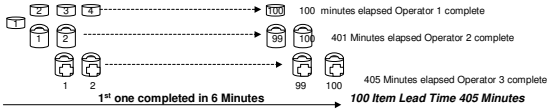
Continuous "Fake Flow" Production



- Product flows continuously through the processes- ideally *one-piece at a time.*
- Work-in-process inventory greatly reduced
- Lead-time greatly reduced
- Defect detection is immediate
- Flow of work is ***simple and visual***
- Easy to identify imbalance in operator work load.

Processing one at a Time



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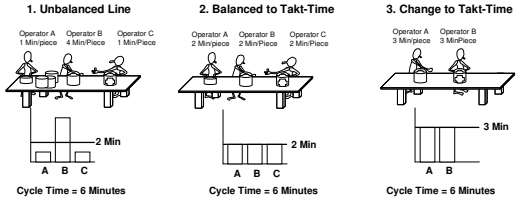
Takt-time, Standard Work and One-Piece Flow



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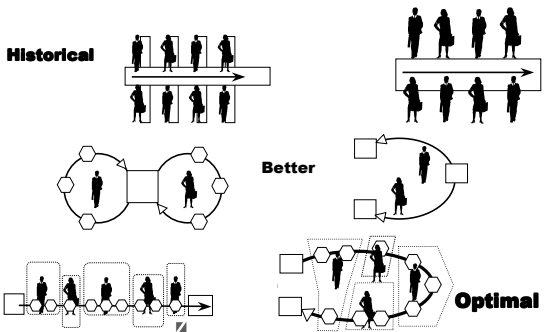
Flexible Layouts for Variable Work Cells



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Improved Layout

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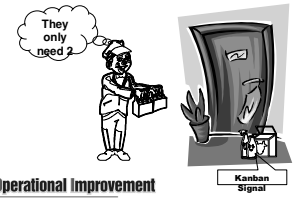
What is Kanban?

- It's the **"pull" signal** from the customer
- A **visual signal** that authorizes the production or movement of parts or material
- Usually it's a card, but can be a container, cart, etc.
- A tool for controlling inventory - A signal to deliver
- A calculated amount based on usage and time

$$k = \frac{\text{Expected demand} * (\text{Usage Frequency} + \text{Leadtime} + \text{Safety stock})}{\text{Size of the container}}$$



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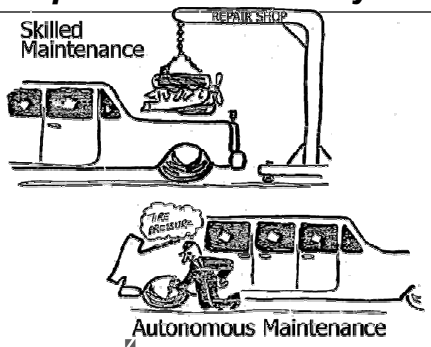
Operational Availability



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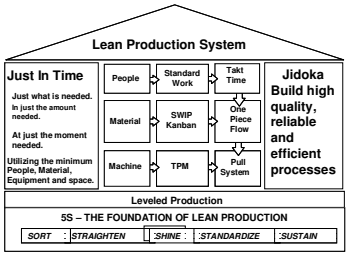
Build Quality into the Process



The principles of Jidoka:

- ***Separate human from machine work***
- ***Have equipment with the ability to detect abnormalities and stop automatically***
- ***Establish mistake-proofing methods***

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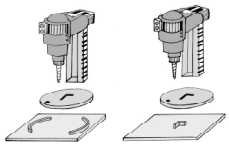
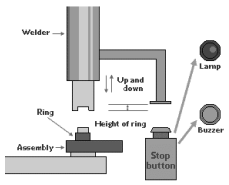
Mistake Proofing





Spell Check!!

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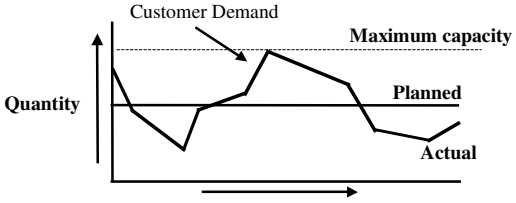
Production Leveling Is...

Smoothing the variability in Production Demand:



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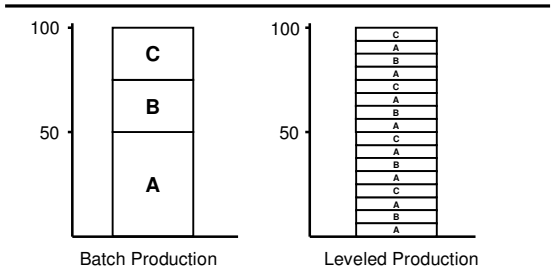
Batch Production vs Level Production



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Key things to Remember:

- Lean is about eliminating Waste
  - Waste is Evil (costs $$, hides defects, takes time)
  - Waste is at the root of all unprofitable activities.
  - Understanding what/where the waste is, is the first step to eliminating it
  - Eliminating waste always increases profit, improves employee morale, and takes both action and everyone's commitment
- Lean Production System
  - A set of principles and concepts that when applied to any process eliminates wastes by controlling overproduction to make production flow. (JIT)
  - Uses the talents of the folks that do the work to make improvements
  - Is the Key to making things Cheaper, faster and better.
- To be successful everyone must be engaged and committed through:
  - Lean education.
  - Learn by Doing through Kaizen Workshops
  - Using the tools and facts to guide improvements

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