



Lean Production



Learning Objectives



- Explain Lean or Just-in-Time (JIT) Production
- Understand Elements of A Lean System



What is Lean Production?



- Lean Production is an integrated set of activities designed to achieve high-volume production using minimal inventories
- Based on the JIT logic: nothing is produced until it is needed (Items arrive at the next stage of production "just in time")
- A philosophy (big JIT) and a production scheduling system (little JIT) first adopted by the Toyota Production System
- Major goal: Elimination of all wastes



Lean Manufacturing at Boeing



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What is JIT ?



WHAT IT IS	WHAT IT DOES
<ul style="list-style-type: none"> • Management philosophy • Pull system through the plant 	<ul style="list-style-type: none"> • Attacks waste • Exposes problems and bottlenecks • Achieves streamlined production
WHAT IT REQUIRES	WHAT IT ASSUMES
<ul style="list-style-type: none"> • Employee participation • Industrial engineering/basics • Continuing improvement • Total quality control • Small lot sizes 	<ul style="list-style-type: none"> • Stable environment

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JIT Focus: Eliminate Wastes



- Waste from overproduction
- Waste of waiting time
- Unnecessary transportation waste
- Storing inventory
- Processing waste
- Waste from machine breakdown
- Waste from rework

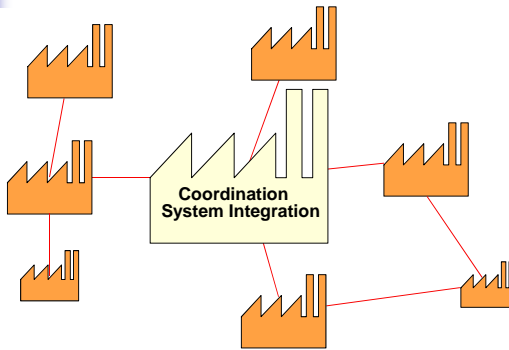
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Basic Elements of Lean Production

1. Focused factory networks
2. Group technology
3. Quality at the source
4. Pull production system
5. Uniform plant loading
6. Kanban production control
7. Small-Lot production
8. Quick setup
9. Preventive maintenance
10. Supplier networks

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Lean Element Focused Factory Networks

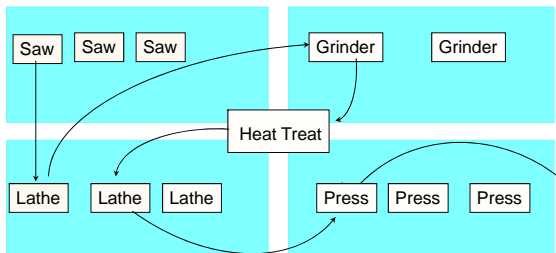


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Lean Element Group Technology



- Departmental Specialization — **Old Layout**



- Using *Departmental Specialization* for plant layout can cause a lot of unnecessary material movement.

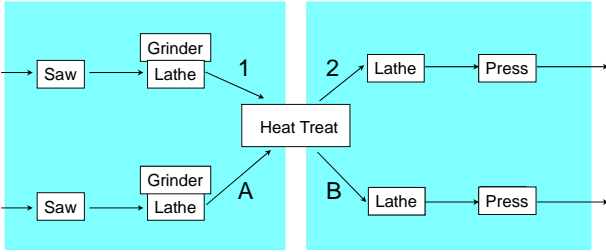
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Group Technology (cont.)



■ Group Technology Cells – **New Layout**



■ Using *Group Technology Cells* can reduce movement and improve product flow.

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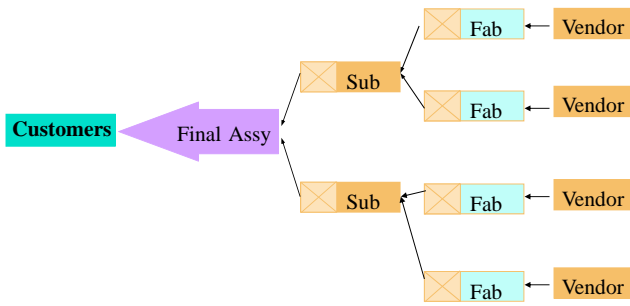
Quality at the Source



- Do it right the first time
 - Self-inspection
 - Line-stopping empowerment
 - Defects prevention
 - *Poka-yoke*
 - *Quality circle*

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Pull Production System



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Uniform Plant Loading

Suppose we operate a production plant that produces a single product. The schedule of production for this product could be accomplished using either of the two plant loading schedules below.

Non-uniform	Jan. Units	Feb. Units	Mar. Units	Total
	1,200	3,500	4,300	9,000

Uniform	Jan. Units	Feb. Units	Mar. Units	Total
	3,000	3,000	3,000	9,000

How does the uniform loading help save labor costs?

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Uniform Plant Loading


- Maintain a **stable mix** of products, and **firm monthly schedules**.

Model	Monthly demand	Daily demand
Small	1200	40
Midsize	2400	80
Luxury	2400	80

⊗ The sequence of L-M-S-M-L repeated 40 times per day maintains the proper mix of models.

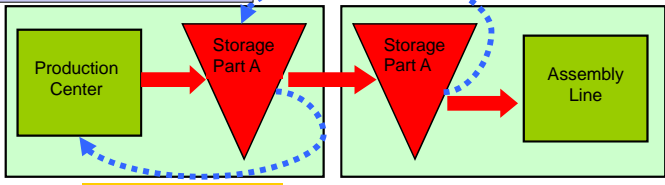
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Kanban Production Control System



2.) Once the Production kanban is received, the Production Center produces a unit to replace the one taken by the Assembly

1.) The process begins by the Assembly Line pulling Part A from Storage



Withdrawal kanban

Production kanban

Material Flow (Red arrow)

Card (signal) Flow (Blue dashed arrow)

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Small-Lot Production



- Requires less space & capital investment
- Reduces inventory
- Moves processes closer together
- Makes quality problems easier to detect

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Quick Setup



- A requirement for small-lot-size, mixed-model production.
- What are the consequences of long setup times?

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Preventive Maintenance




- Proactive approach that uses periodic inspection & maintenance to keep machines operating
- The goal is to achieve zero breakdown

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Supplier Networks



- Reliable suppliers are critical to JIT or lean production
 - Supplier selection
 - Small number of suppliers; single sourcing
 - Long-term agreements
 - Geographical proximity
 - Frequent information sharing
 - Benefits
 - Reduced lead times
 - Quality expectations
 - Small but frequent deliveries

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Lean Applications in Services

- Lean principles can help improve service processes to be more efficient and effective by removing waste and streamlining operations
- Examples of Healthcare Waste:
 - o Redundant capture of information on admission
 - o Multiple recording of patient information
 - o Excess supplies stored in multiple locations
 - o Excess time spent looking for charts, waiting for equipment, lab results, X-ray etc.
 - o Excess setup time in operating rooms
 - o Patient waiting rooms
 - o Excess time spent dealing with service complaints

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Lean Applications in Services

- lean retailing: retail stores order smaller quantity more frequently to reduce inventory.
- lean banking: banks make the process for routine transactions standardized so that services can be provided more smoothly.
- lean health care: heal care providers use the concept of quality circles, mistake-proofing, and quick setups to reduce wastes and costs.

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Benefits of Lean Production

1. Reduced inventory
2. Improved quality
3. Lower costs
4. Reduced space requirements
5. Shorter lead time
6. Increased productivity
7. Greater flexibility
8. Better relations with suppliers
9. Simplified scheduling and control activities
10. Increased capacity
11. Better use of human resources
12. More product variety

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Limitations of Lean Production

- Lean production isn't for everyone and is difficult to implement for
 - products with high variability in demand
 - high variety of low-volume products
- Risks with unexpected changes in supply and demand

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Reading: "A key strategy of Japan's car makers backfires"



- 1.) What are the downsides of lean manufacturing? Should Toyota change its practice of single sourcing?
- 2.) Compare and contrast inventory levels and stocking points in a lean supply chain and a traditional supply chain (push system).
- 3.) What would you suggest to Toyota to minimize the impact of a similar disaster in the future?

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