Just-In-Time Systems

History and Philosophy of Just-In-Time

- A philosophy that seeks to eliminate all types of waste, including carrying excessive levels of inventory and long lead times.
- Takes its name from the idea of replenishing material buffers just when they are needed and not before or after.
- Developed by Toyota Motor Company in mid-1970s
- Best applied to a production system, such as automobile assembly, that would be considered repetitive, such as a flow shop

History and Philosophy of Just-In-Time

- Three Tenets
  - minimize waste in all forms: avoid waste of materials, space, and labor. They pay significant attention to identifying and correcting problems that could potentially lead to such waste. Operation and procedures are constantly being improved and fine-tuned to increase productivity and yield, further eliminating waste (*Overproduction, waiting time, unnecessary transportation, processing waste, inefficient work methods, product defects, waste of motion*).
  - continually improve processes and systems: JIT is considered not simply a means of converting the transformation system from a sloppy, wasteful form to an efficient, competitive form, but also as producing continuing improvements throughout the system to keep the firm competitive and profitable in the future
  - maintain respect for all workers: equal respect is paid to

Characteristics of Lean Systems: Just-in-Time

- Pull method of materials flow
- Consistently high quality
- Small lot sizes
- Uniform workstation loads
- Standardized components and work methods
- Close supplier ties
- Flexible workforce
- Line flows
- Automated production
- Preventive maintenance

JIT Means …

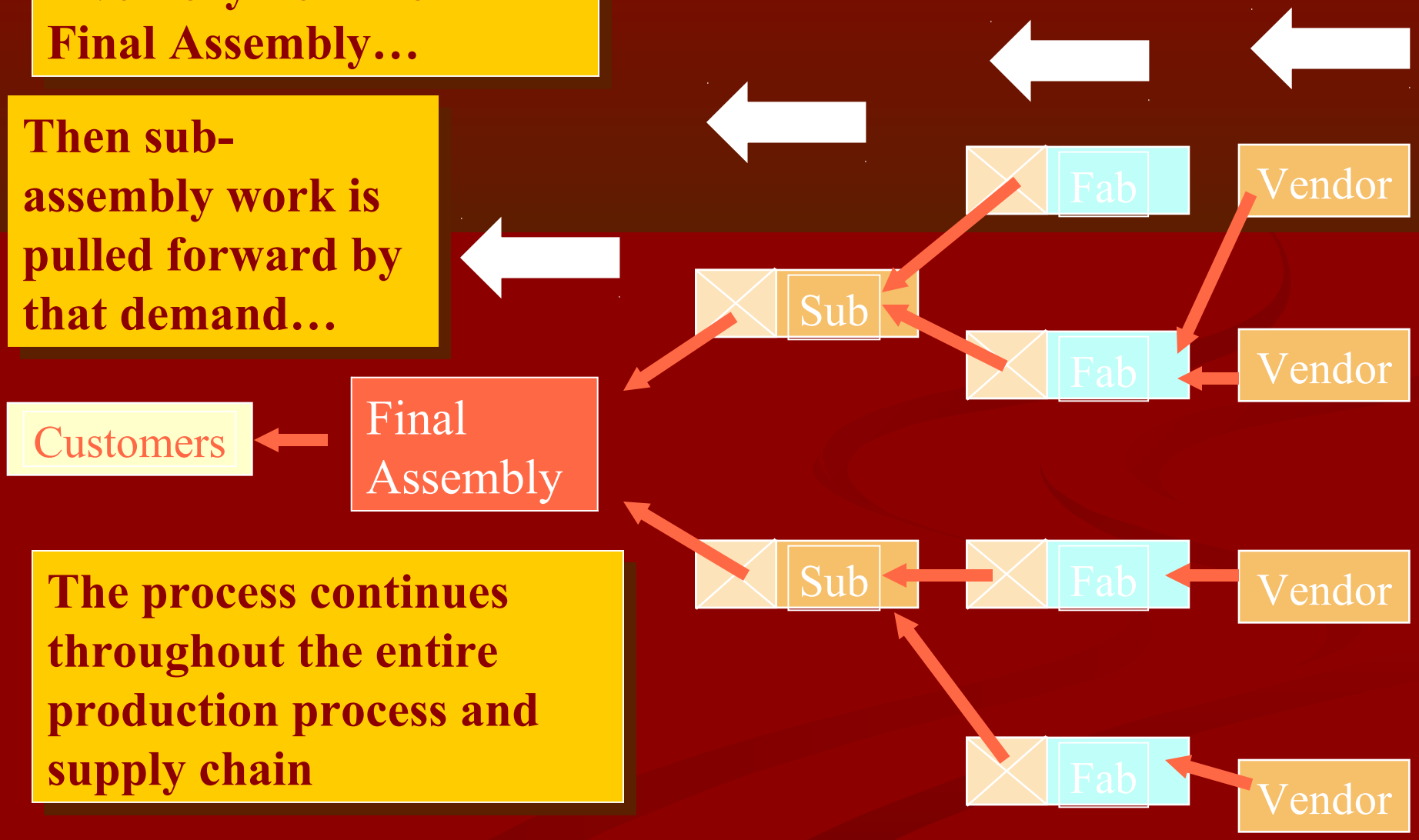
- Keeping work flows moving
- Eliminating inventories
- Reducing travel distances
- Eliminating defects and scrap
- Maximizing usage of space

JIT Demand-Pull Logic

Here the customer starts the process, pulling an inventory item from Final Assembly…

Then sub-assembly work is pulled forward by that demand…

The process continues throughout the entire production process and supply chain



Just-In-Time Production

WHAT IT IS

- Management philosophy
- “Pull” system though the plant

WHAT IT DOES

- Attacks waste
- Exposes problems and bottlenecks
- Achieves streamlined production

WHAT IT REQUIRES

- Employee participation
- Industrial engineering/basics
- Continuing improvement
- Total quality control
- Small lot sizes

WHAT IT ASSUMES

- Stable environment

Traditional Systems Compared to JIT

Priorities

- Traditionally
  - Accept all customer orders
  - Provide a large number of options from which customers may order
- JIT
  - low cost/high quality within limited market

Engineering

- Traditional
  - design custom outputs
- JIT
  - design standard outputs
  - incremental improvements
  - design for manufacturability (DFM)

Capacity

- Traditional
  - excess capacity designed into system ***just-in-case*** problem arises
  - highly utilized
  - inflexible
- JIT
  - minimize waste of having extra capacity
  - flexible capacity
  - moderately utilized

Transformation System

- Traditional
  - job shop
  - materials handling equipment
  - lots of space to store inventory
- JIT
  - mostly used in repetitive production situations
  - job shops often converted to cellular manufacturing

Transformation System *continued*

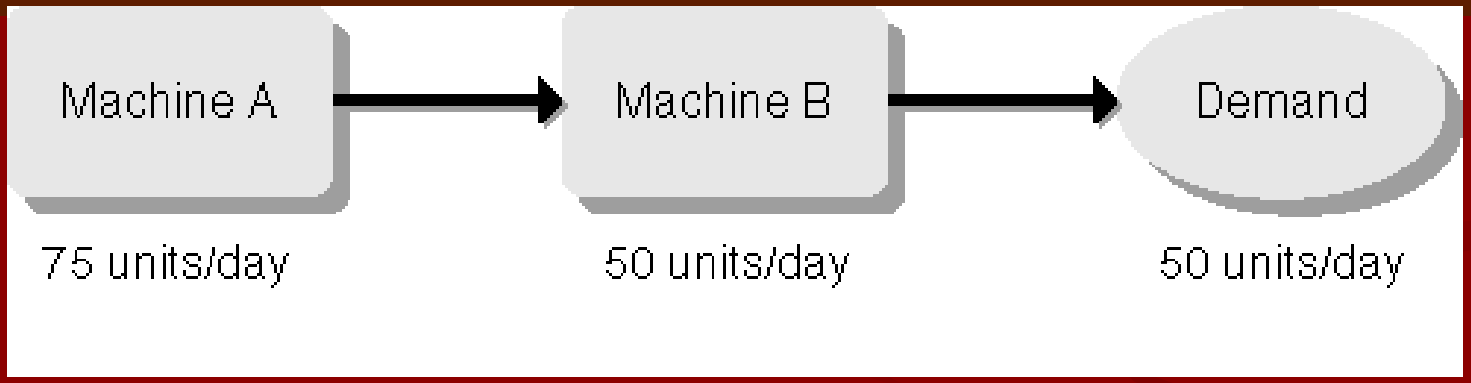
- Traditional-long lead times are often thought to allow more time to make decisions and get work performed.

- JIT
  - short lead times mean easier, more accurate forecasting and planning.
  - If lead times are reduced, there is less time for things go awry, to get lost, or to be changed
  - “Don’t let the parts touch the floor” (the parts have to be kept on the machines and thus be worked on until completed)
  - Smaller batches result in shorter lead times and less inventory, at the same time. With smaller batches, engineering changes get to the customer sooner, problems with quality are corrected more quickly

Transformation System *continued*

- JIT
  - Employing Kanban (*Toyota's materials management system*)
  - *Pull system:* System for moving work where a workstation pulls output from the preceding station as needed (*control-based systems* that signals the requirement for parts as they are needed in reality).
  - *Push system*: System for moving work where output is pushed to the next station as it is completed (*planning-based systems* that determine when workstations will probably

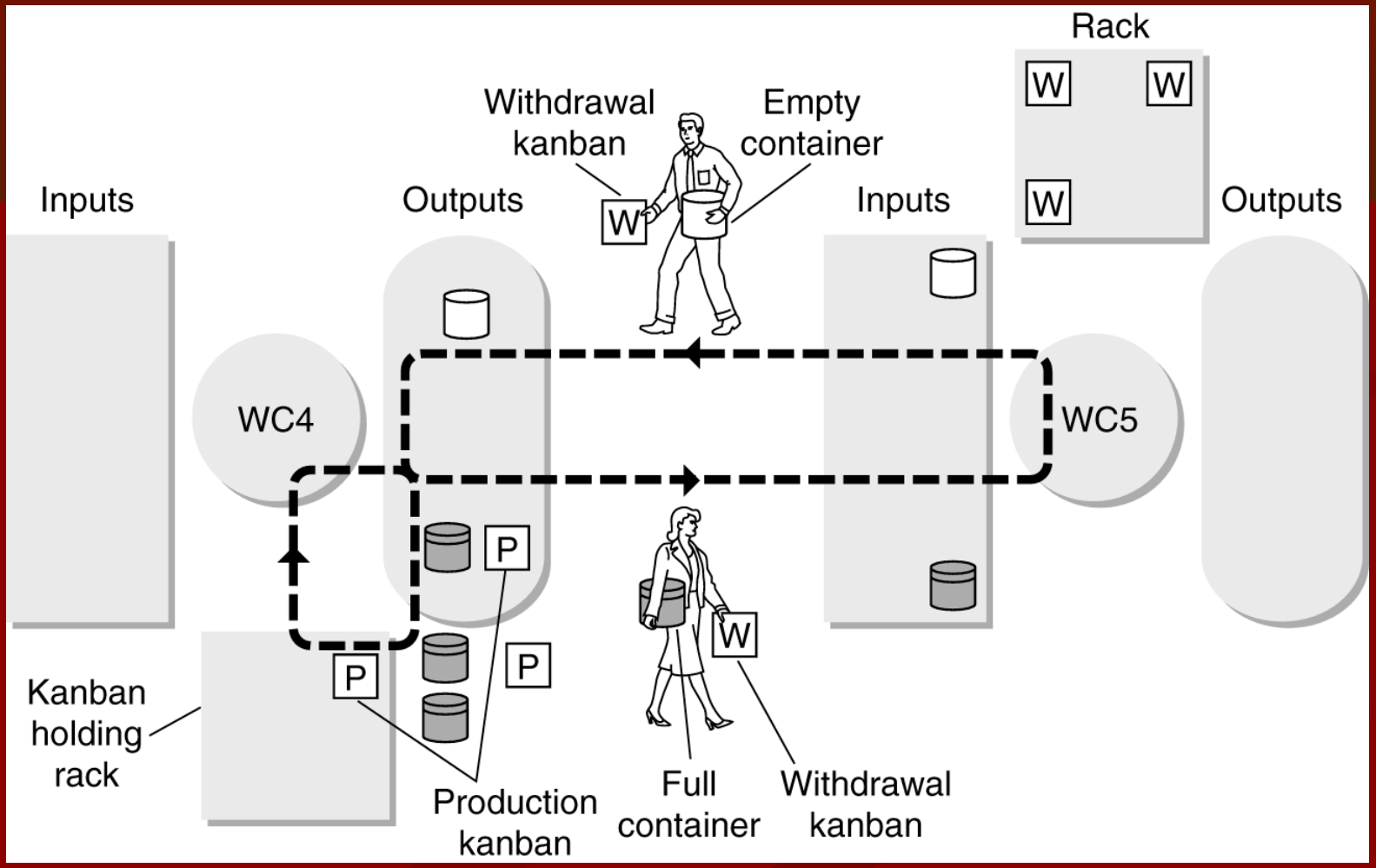
Sequential Production System with Two Machines



Kanban

- *Kanban*: Card or other device that communicates demand for work or materials from the preceding station
- Kanban is the Japanese word meaning “signal” or “visible record”
- Paperless production control system
- The idea behind this system is to authorize materials for production only if there is a need for them.
- Through the use of Kanban authorization cards, production is “pulled” through the system, instead of pushed out before it is needed and then stored.

Kanban Process



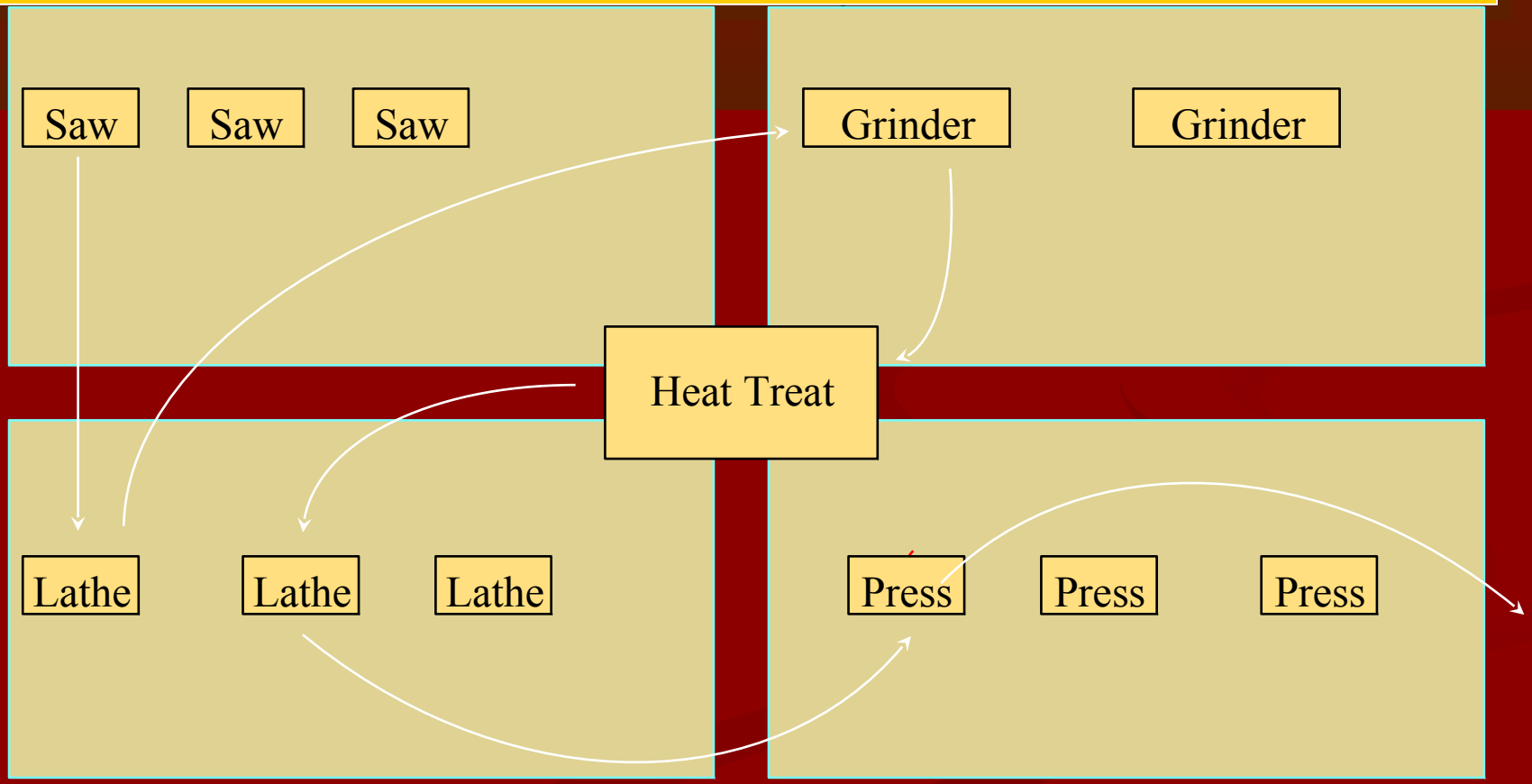
Layout

- Traditional
  - job shop approach of using widely spread-out equipment with space for stockrooms, tool cribs, and work-in-process inventories between the equipment
  - To handle and move all this inventory, automated or semi automated materials handling equipment (conveyors, forklifts) is required, which takes even more space.
- JIT
  - Equipment is moved as close together as possible so that parts can be actually handed from one worker or machine to the next.
  - Use of cells, and flow lines dictates small lots of parts with minimal work-in-process and material-moving equipment.
  - manual transfer

Group Technology (Part 1)

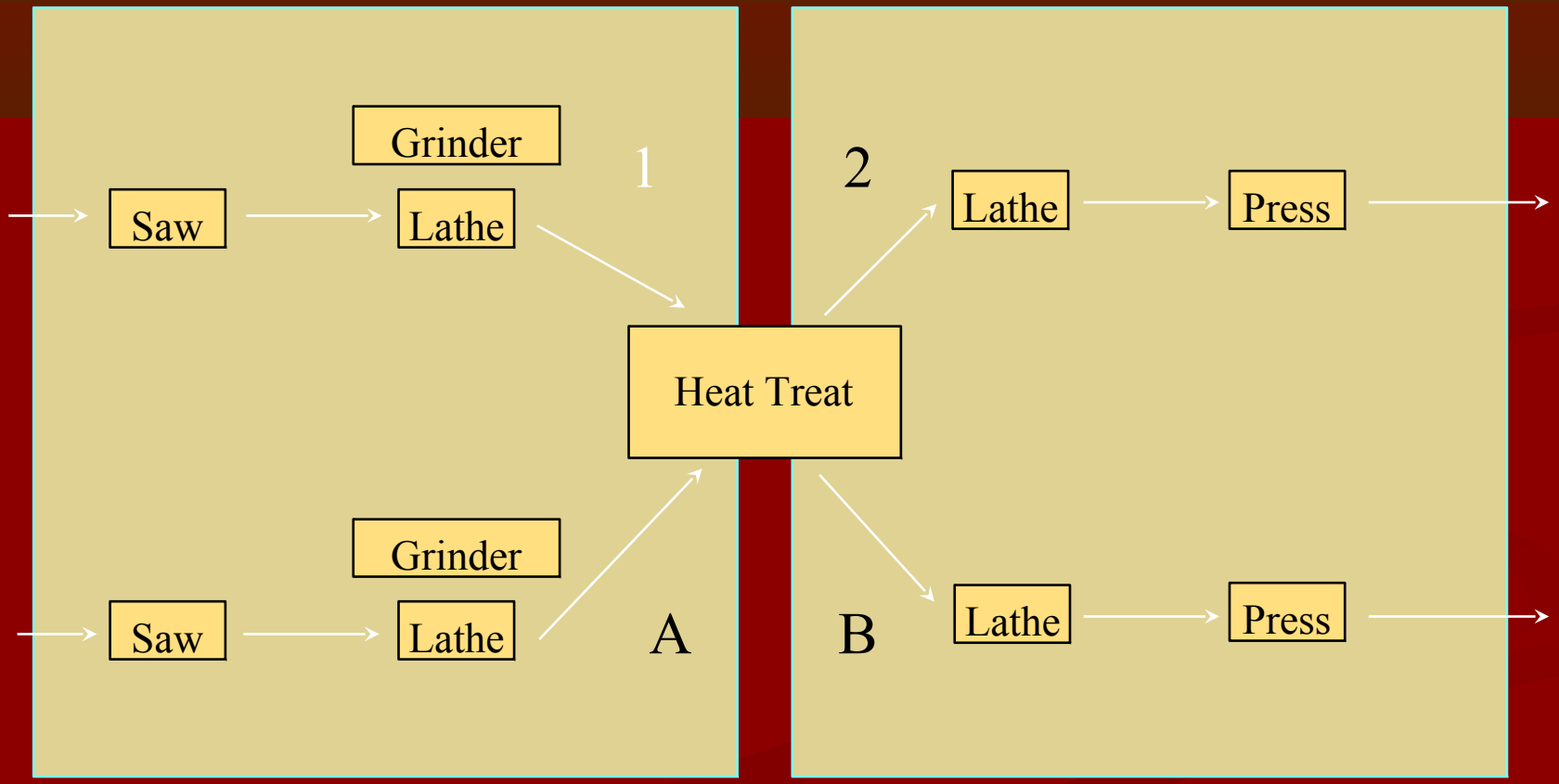
Note how the flow lines are going back and forth

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



Group Technology (Part 2)

- **Revising by using *Group Technology Cells* can reduce movement and improve product flow**



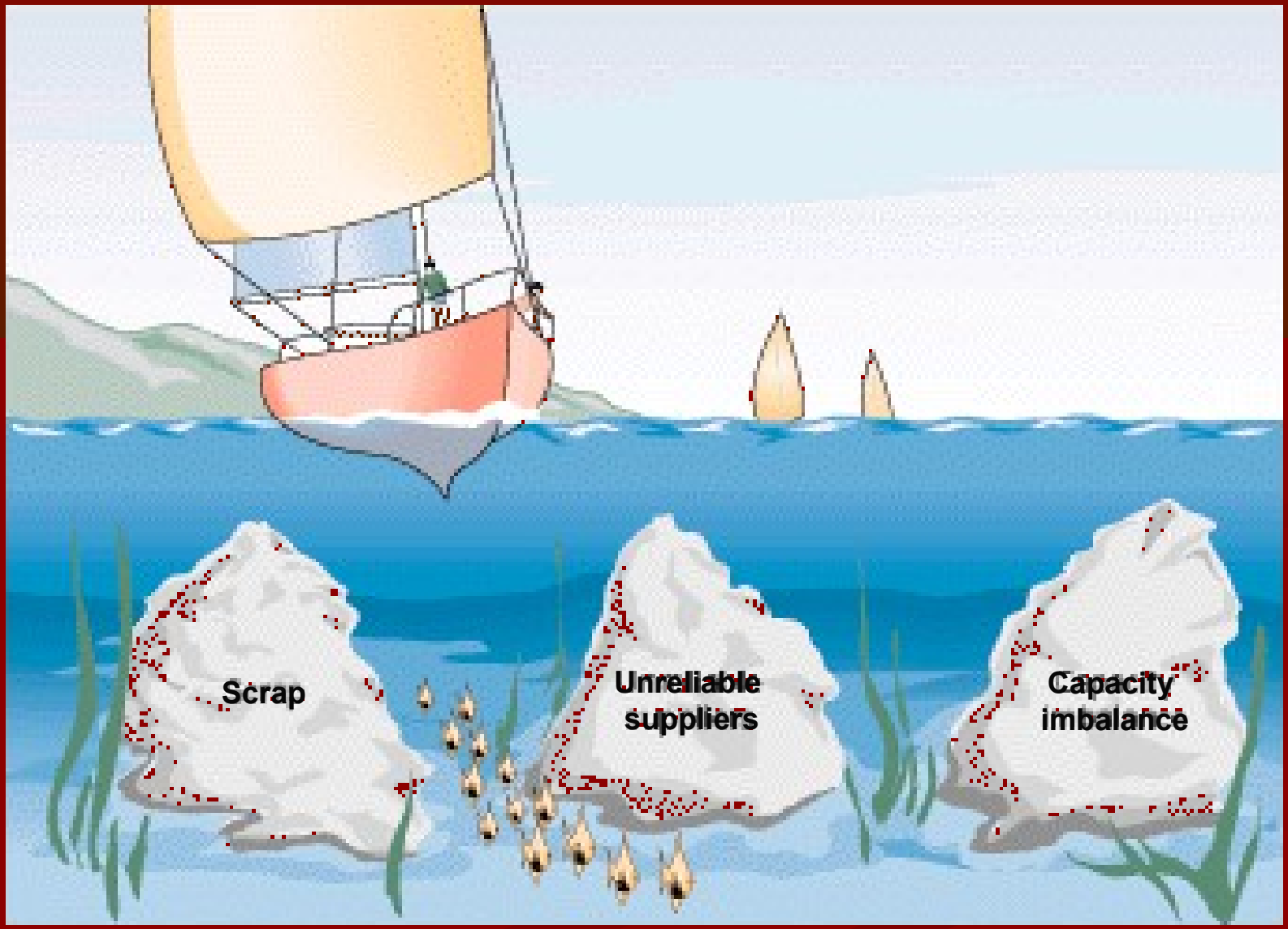
Workforce

- Traditional
  - competitive attitude between workers and managers
  - status symbols and privileges
  - much of the employees' time is nonworking time: looking for parts, moving materials, setting up machines, getting instructions, and so on. When actually working, they tend to work fast.
- JIT
  - broadly skilled flexible workers who can uncover and solve problems
  - workteams
  - cooperative attitudes

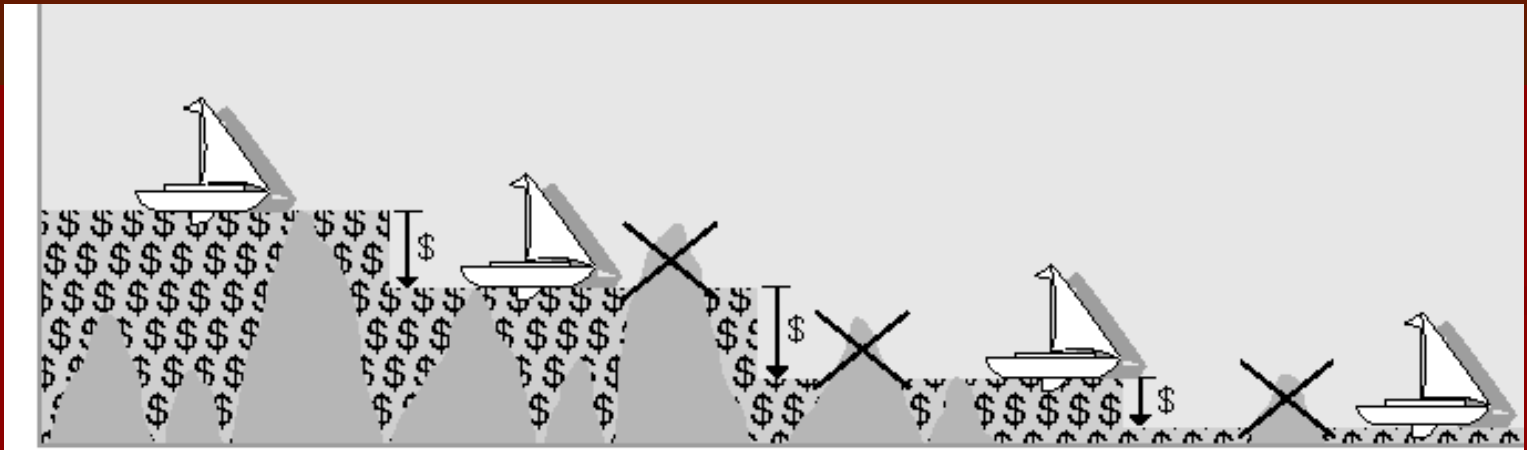
Inventories

- Traditional
  - used to buffer operations
  - large WIP buffers
- JIT
  - inventory is seen as an evil
  - small WIP buffers

Inventory Hides Problems

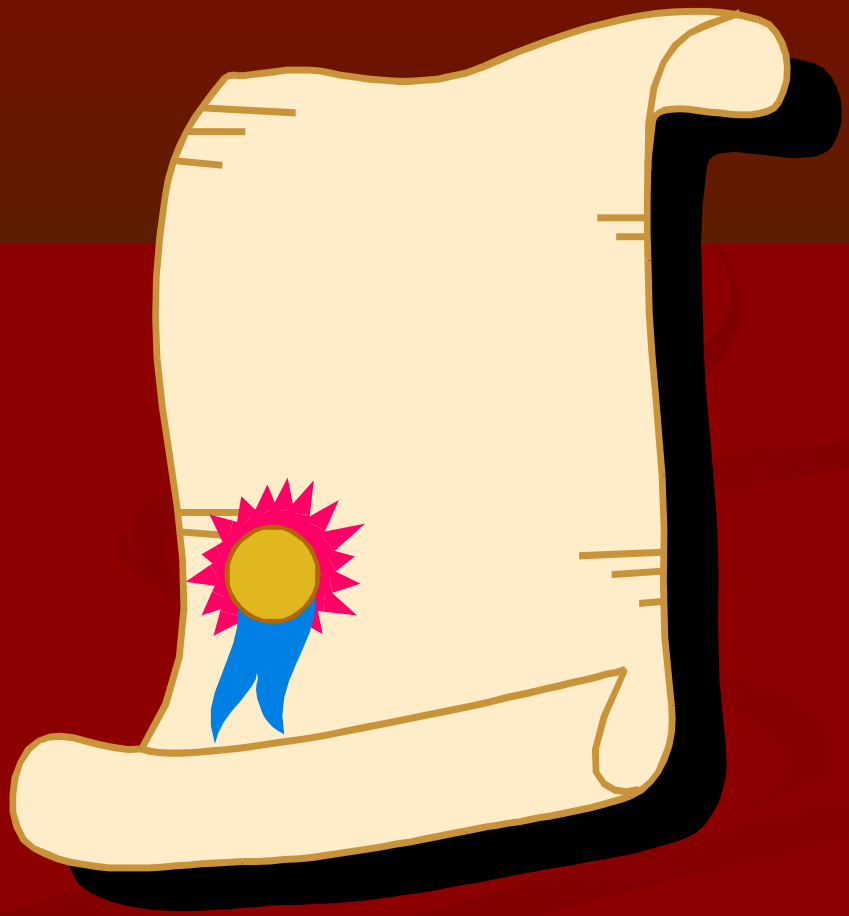


Lowering Inventory Investment to Expose Problems



Suppliers

- Traditional
  - suppliers treated as adversaries
  - multiple sourcing
- JIT
  - supplier considered part of team
  - single-sourcing agreements
  - supplier certification programs



Planning and Control

- Traditional
  - focus is on planning
  - planning complex and computerized
- JIT
  - focus is on control
  - procedures kept simple and visual
  - rather than planning and forecasting for an uncertain future, the firm attempts to respond to what actually happens in real time with flexible, quick operations.

Quality

- Traditional
  - inspect goods at critical points
  - scrap rates tracked
- JIT
  - goal is zero defects
  - workers themselves inspect parts

Maintenance

- Traditional
  - corrective maintenance, repairing a machine when it breaks down
  - done by experts who do nothing but repair broken equipment
  - equipment run fast
- JIT
  - preventive maintenance, conducting maintenance before the machine is expected to fail, or at regular intervals.
  - done by equipment operators
  - equipment run slow (minimizes their chance of breakdown while maximizing their output)

Value Stream Mapping

- A qualitative lean tool for eliminating waste that involves a current state drawing, a future state drawing, and an implementation plan.

Typical Benefits of JIT

- Cost savings: inventory reductions, reduced scrap, fewer defects, fewer changes due to both customers and engineering, less space, decreased labor hours, les rework.
- Revenue increases: better service and quality to the customer.
- Investment savings: less space, reduced inventory, increased the volume of work produced in the same facility.
- Workforce improvements: more satisfied, better trained employees.
- Uncovering problems: greater visibility to problems that JIT allows, if management is willing to capitalize on the opportunity to fix these problems.

Potential Problems Implementing JIT

- Applicable primarily to repetitive operations
- Requires discipline
- Based on cooperation and trust
- Requires change of philosophy

Interaction of JIT Elements