



# Just-in-Time

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# Just-in-Time

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- JIT philosophy means getting the right quantity of goods at the right place and the right time
- JIT exceeds the concept of inventory reduction
- JIT is an all-encompassing philosophy found on eliminating waste
- Waste is anything that does not add value
- A broad JIT view is one that encompasses the entire organization



# Philosophy of Just-in-Time

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- JIT originated in Japan, post WWII
- Driven by a need survive after the devastation caused by the war
- JIT gained worldwide prominence in the 1970s
- Toyota Motor Co. developed JIT

# The Philosophy of JIT - continued



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- Often termed “Lean Systems”
- All waste must be eliminated- non value items
- Broad view that entire organization must focus on the same goal - serving customers
- JIT is built on simplicity- the simpler the better
- Focuses on improving every operation- Continuous improvement - Kaizen
- Visibility – all problems must be visible to be identified and solved
- Flexibility to produce different models/features



# JIT means Good Industrial Housekeeping!

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- [http://www.mlive.com/business/west-michigan/index.ssf/2011/02/do\\_our\\_messy\\_desks\\_really\\_cost.html#incart\\_hbx](http://www.mlive.com/business/west-michigan/index.ssf/2011/02/do_our_messy_desks_really_cost.html#incart_hbx)



# Three Elements of JIT

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# Toyota

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[http://www.businessweek.com/smallbiz/content/oct2007/sb20071019\\_981292.htm?chan=search](http://www.businessweek.com/smallbiz/content/oct2007/sb20071019_981292.htm?chan=search)

**Toyota's performance...has been stunning.** The company has not lost money in a single quarter since 1951. As U.S. automotive powerhouses are drowning in red ink, Toyota earned its highest ever net profit in 2006—\$17 billion.

So what keeps Toyota growing and improving year after year? In his book, Magee suggests the driver is a handful of principles embedded deeply in the company, including a respect for people, a willingness to take a long-term view, and the determination to improve the business a little bit every day.

# Three Elements of JIT - continued



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- JIT manufacturing focuses on production system to achieve value-added manufacturing
- TQM is an integrated effort designed to improve quality performance at every level
- Respect for people rests on the philosophy that human resources are an essential part of JIT philosophy





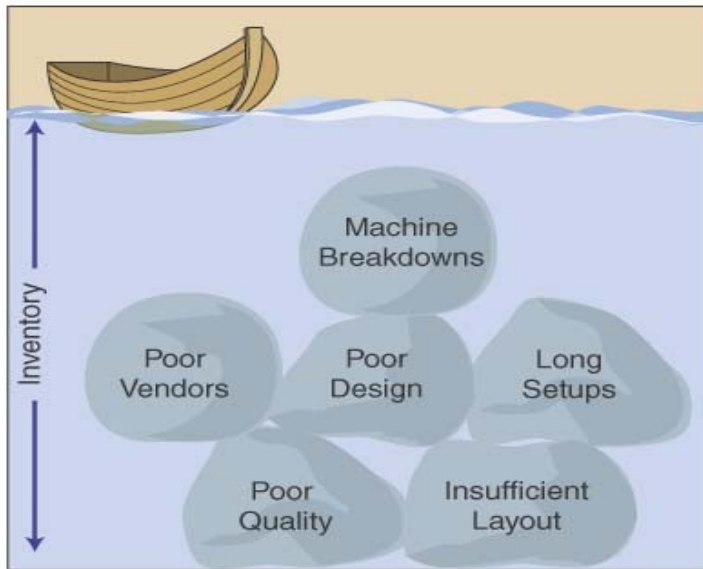
# Elements of JIT Manufacturing

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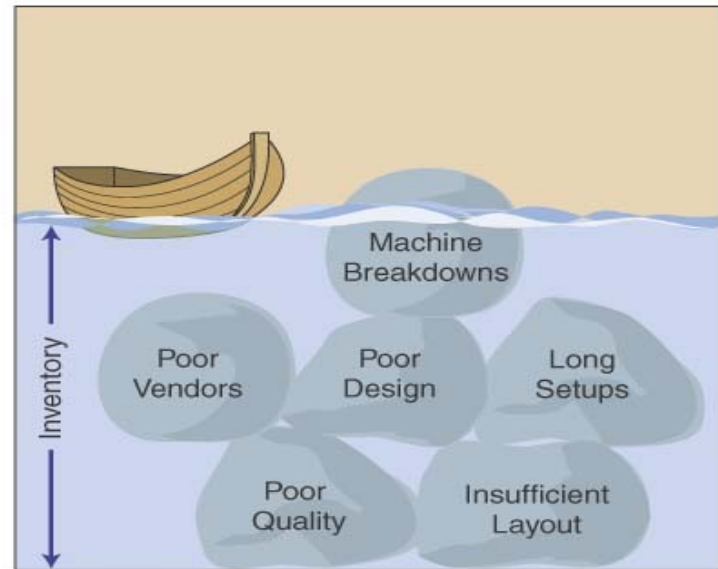
- JIT Manufacturing is a philosophy of *value-added* manufacturing
- Achieved by
  - Inventory reduction - exposes problems
  - Kanbans & pull production systems
  - Small lots & quick setups
  - Uniform plant loading
  - Flexible resources
  - Efficient facility layouts

# Role of Inventory Reduction

- Inventory = Lead Time (less is better)
- Inventory hides problems



(a) Inventory Hides Problems



(b) Reducing Inventory Exposes Problems



# Push Production Systems

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- make to stock
- production decisions are based on forecasts of demand
- appropriate when uncertainty about demand is low
- generally not compatible with JIT



# Pull Production Systems

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- Make to order
- work is triggered by order from external customer, or “internal” customer (e.g. last station in line)
- generally compatible with JIT

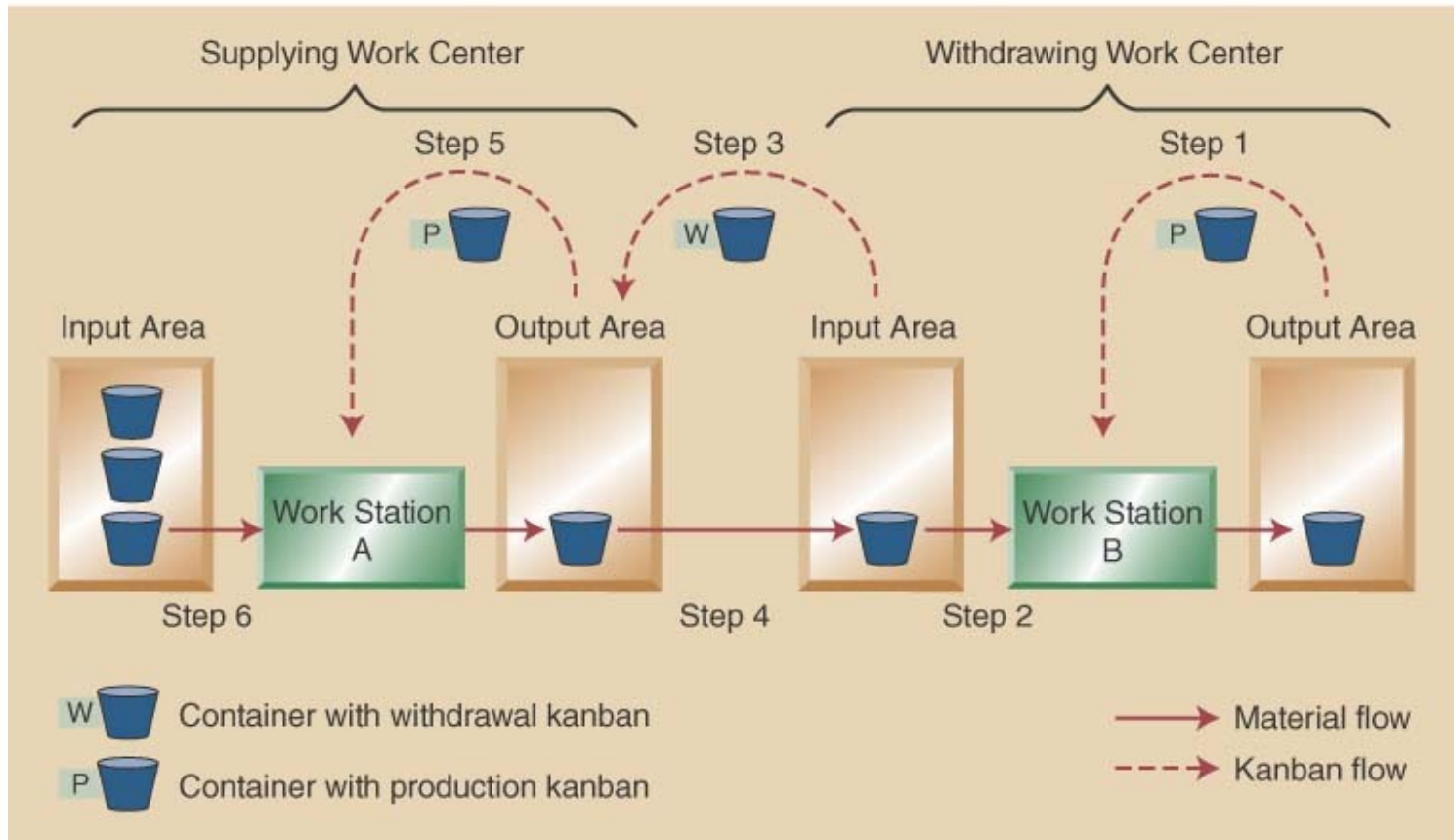


# Push & Pull Supply Chains

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- Just as individual firms can implement push or pull operations, entire supply chains can be
  - Push
  - Pull
  - Push-Pull Hybrid
    - Some components are push, others pull

# The Pull System





# Steps of Kanban Production

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- 1) Worker at B receives empty container tagged with production kanban from "customer" -> worker B must fill container
- 2) Worker at B withdraws required full container of material from B input area and uses it to produce enough to fill empty container in step (1)
- 3) To replenish the empty container in input area, worker at B sends withdrawal kanban to output area of A



# Steps of Kanban Production

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- 4) Worker at A attaches withdrawal kanban to a full container in output (A) and sends to B
- 5) Worker at B takes production kanban from full container and places it on an empty container  
-> worker A must fill container
- 6) Worker at A removes container of materials from its input area, and then uses a withdrawal kanban to generate a request for more material from upstream station





# Small Lot Sizes & Quick Setups

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- Small lots mean less average inventory and shorten manufacturing lead time
- Small lots with shorter setup times increase flexibility to respond to demand changes
- Strive for single digit setups- < 10 minutes
- Setup reduction process is well-documented
  - **External tasks-** do as much preparation while present job is still running
  - **Internal tasks-** simplify, eliminate, shorten steps involved with location, clamping, & adjustments
- Ultimate goal is single unit lot sizes



# Flexible Resources

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- **Moveable, general purpose equipment:**
  - Portable equipment with plug in power/air
  - *E.g.:* drills, lathes, printer-fax-copiers, etc.
  - Capable of being setup to do many different things with minimal setup time
- **Multifunctional workers:**
  - Workers assume considerable responsibility
  - Cross-trained to perform several different duties
  - Trained to also be problem solvers



# Effective Facility Layouts

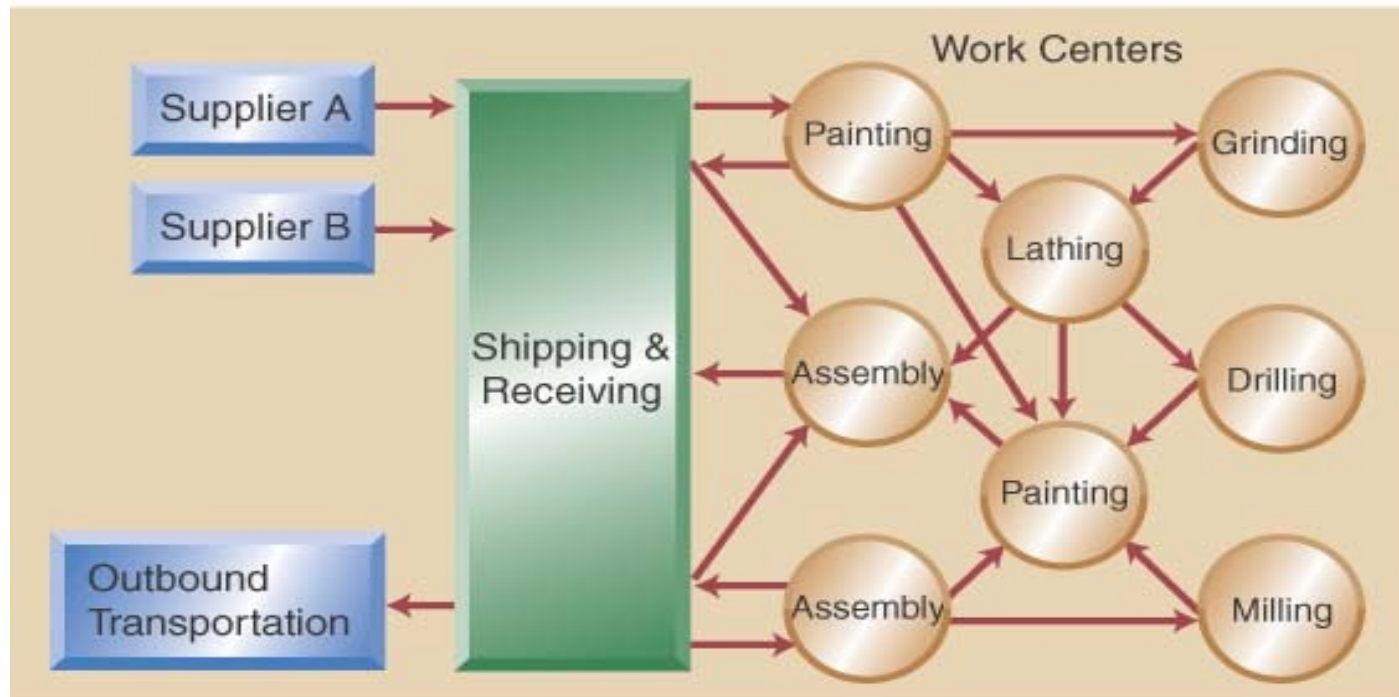
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- Workstations in close physical proximity to reduce transport & movement
- Streamlined flow of material
- Often use:
  - **Cellular Manufacturing** (instead of process focus)
  - **U-shaped lines:** (allows material handler to quickly drop off materials & pick up finished work)

# Traditional Process Focused Layout

- Jumbled flows, long cycles, difficult to schedule

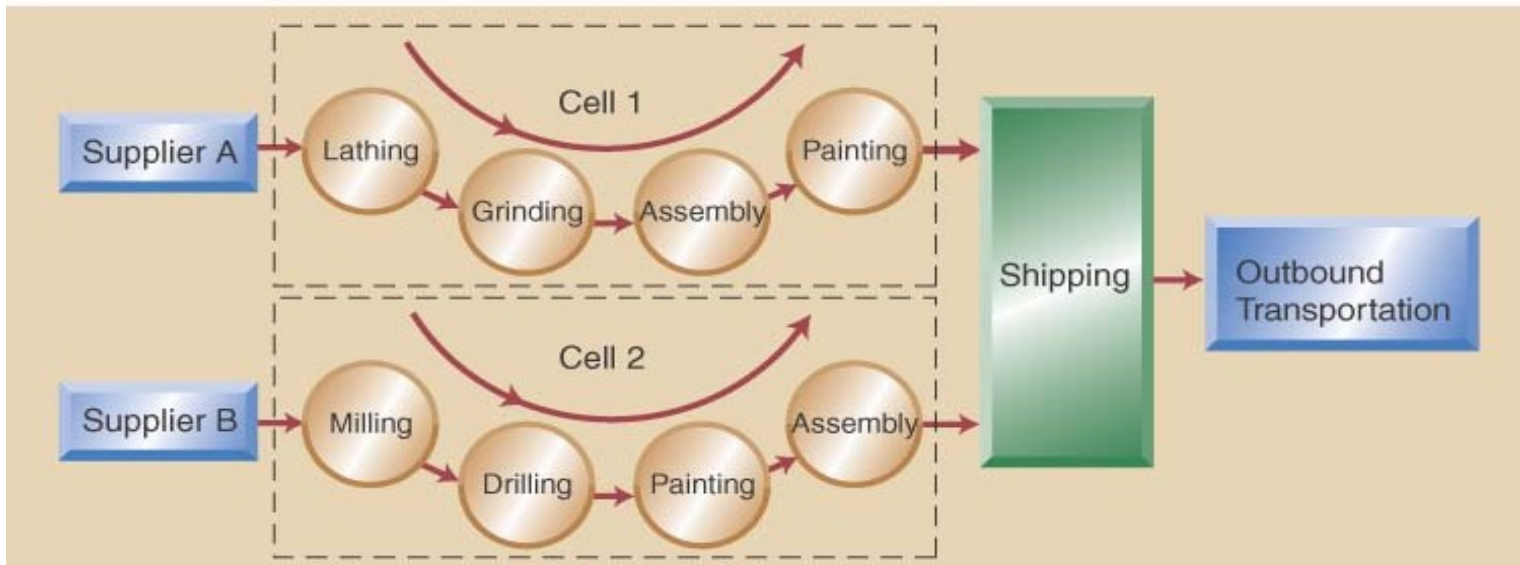
(a) Traditional Layout



# JIT Cellular Manufacturing

- Product focused cells, flexible equipment, high visibility, easy to schedule, short cycles

(b) JIT with Cell Manufacturing





# JIT and TQM- Partners

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- Build quality into all processes
- Focus on continuous improvement - Kaizen
- Quality at the source- sequential inspection
- Jidoka (authority to stop line)
- Poka-yoke (fail-safe all processes)
- Preventive maintenance- scheduled
- Work environment- everything in its place, a place for everything



# Respect for People: The Role of Employees

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- Genuine and meaningful respect for associates
- Willingness to develop cross-functional skills
- JIT uses bottom-round management – consensus management by committees or teams
- Actively engage in problem-solving (quality circles)
- Everyone is empowered
- Everyone is responsible for quality: understand both internal and external customer needs



# Respect for People: The Role of Employees

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- Associates gather performance data
- Team approaches used for problem-solving
- Decisions made from bottom-up
- Everyone is responsible for preventive maintenance





# The Role of Management

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- Responsible for culture of mutual trust
- Serve as coaches & facilitators
- Support culture with appropriate incentive system including non-monetary
- Responsible for developing workers
- Provide multi-functional training
- Facilitate teamwork



# Supplier Relationships and JIT

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- Use single-source suppliers when possible
- Build long-term relationships
- Work together to certify processes
- Co-locate facilities to reduce transport if possible
- Stabilize delivery schedules
- Share cost & other information
- Early involvement during new product designs



# Benefits of JIT

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- Reduction in inventories
- Improved quality
- Shorter lead times
- Lower production costs
- Increased productivity
- Increased machine utilization
- Greater flexibility



# Implementing JIT

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- Starts with a company shared vision of where it is and where it wants to go
- Management needs to create the right atmosphere
- Implementation needs a designated “Champion”
- Implement the sequence of following steps
  - Make quality improvements
  - Reorganize workplace
  - Reduce setup times



# Implementing JIT - continued

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- Reduce lot sizes & lead times
- Implement layout changes
  - Cellular manufacturing & close proximity
- Switch to **pull** production
- Develop relationship with suppliers



# JIT in Services

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- Most of the JIT concepts apply equally to Service companies
  - Improved quality such as timeliness, service consistency, and courtesy
  - Uniform facility loading to provide better service responsiveness
  - Use of multifunction workers
  - Reduction in cycle time
  - Minimizing setup times and parallel processing
  - Workplace organization



# JIT across the organization

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- JIT eliminates organizational barriers and improves communications
  - Accounting changes or relies on activity-based costing
  - Marketing by interfacing with the customers
  - Finance approves and evaluates financial investments
  - Information systems create the network of information necessary for JIT to function

The logo graphic consists of a vertical black line on the left, a horizontal black line at the bottom, and three overlapping squares: a yellow one at the top left, a red one at the middle left, and a blue one at the bottom left. The word "Emerson" is written in a blue, sans-serif font to the right of the vertical line.

# Emerson

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[http://www.businessweek.com/bwdaily/dnflash/mar2005/nf20050316\\_3927\\_db008.htm?chan=search](http://www.businessweek.com/bwdaily/dnflash/mar2005/nf20050316_3927_db008.htm?chan=search)

The company, which makes everything from electric motors and air-conditioner compressors to computerized equipment that can run an oil refinery, reported improved results in fiscal 2004 for the third consecutive year, with sales up 12% to an all-time high of \$15.62 billion. Emerson is benefiting hugely from the rebound in the U.S. industrial economy and China's economic boom. But that's only half the story. James Berge, Emerson's president, is a disciple of Toyota Motor (TM ) and its "lean manufacturing" practices. Emerson has closed or sold 140 factories and cut its payroll by 13% since 2000.





# Matsushita

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[http://www.businessweek.com/magazine/content/06\\_28/b3992071.htm?chan=search](http://www.businessweek.com/magazine/content/06_28/b3992071.htm?chan=search)

**No One Does Lean Like The Japanese.** Take Matsushita. To counter low-cost rivals, it's taking efficiency to new heights. Two years ago, Matsushita Electric Industrial Co.'s factory in Saga, on Japan's southern island of Kyushu, was looking mighty lean. The plant had doubled efficiency over the previous four years, and machinery stretching the length of the spotless facility could churn out cordless phones, fax machines, and security cameras in record time.



# Parker-Hannifin

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[http://www.businessweek.com/bwdaily/dnflash/jul2004/nf200407193427\\_db049.htm?chan=search](http://www.businessweek.com/bwdaily/dnflash/jul2004/nf200407193427_db049.htm?chan=search)

Donald E. Washkewicz...was promoted to president of Parker Hannifin (PH ), the world's No. 1 maker of motion-control products -- hydraulic and pneumatic components for aircraft, construction equipment, and even theme-park robots.

Q: How has lean manufacturing changed work on the factory floor?

A: In the past, you had to justify your machine tool by the setup time: It takes me 25 hours to set this thing up, at \$50 an hour, so I've got to run a batch of 1 million widgets to justify that setup time. What you ended up doing was using all your capacity to make inventory that nobody needed. In the meantime, your customer service suffered because you didn't want to break in on that machine run to fill new orders. Nobody wins.



# Parker-Hannifin

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We found that we freed up 25% or 30% of the square footage of our plants just doing just lean and getting rid of all of this waste. Now when the orders come in, you start the process, and you ship it out the door. Nothing sits on shelves anymore. Nothing is queued up. That's what's really driving efficiency and inventory reduction throughout the company. That's basically the concept of lean.



# Parker-Hannifin

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Q: But don't you lose efficiency by going to this build-to-order approach?

A: No. Instead of buying that big \$1 million machine tool that'll make 1 million products at lightning speed, you tend to buy lower-cost and smaller capital equipment that you can change over quickly and is more efficient. So, in fact, you don't suffer in the end. You can maintain low setup costs in cellular manufacturing.

Workers like this, too. This tends to make their jobs easier. Each worker is the inventory-control manager for raw materials. When he needs materials, he orders them himself. In the prior process, you had to staff a whole purchasing department, and you'd have to send a requisition in to them, and you'd bring in too much invariably because you had to stock up on materials. Now, we have the raw materials delivered only whenever we need them.



# Chapter 7 Highlights

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- JIT is a philosophy that was developed by the Toyota Motor Company in the mid-1970s. It has since become the standard of operation for many industries. It focuses on simplicity, eliminating waste, taking a broad view of operations, visibility, and flexibility. Three key elements of this philosophy are JIT manufacturing, total quality management, and respect for people.
- JIT views waste as anything that does not add value.



# Chapter 7 Highlights

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- Traditional manufacturing systems use “push” production, whereas JIT uses “pull” production. Push systems anticipate future demand and produce in advance in order to have products in place when demand occurs. This system usually results in excess inventory. Pull systems work backwards. The last workstation in the production line requests the precise amounts of materials required.



## Chapter 7 Highlights (Continued)

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- JIT manufacturing is a coordinated production system that enables the right quantities or parts to arrive when they are needed precisely where they are needed. Key elements of JIT manufacturing are the pull system and kanban production, small lot sizes and quick setups, uniform plant loading, flexible resources, and streamlined layout.



## Chapter 7 Highlights (Continued)

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- TQM creates an organizational culture that defines quality as seen by the customer. The concepts of continuous improvement and quality at the source are integral to allowing for continual growth and the goal of identifying the causes of quality problems.





## Chapter 7 Highlights (Continued)

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- JIT considers people to be the organization's most important resource.
- JIT is equally applicable in service organizations, particularly with the push toward time-based competition and the need to cut costs.
- JIT success is dependent on interfunctional coordination and effort.