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# Operations Management

## Operations and Productivity



## What Is Operations Management?

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- *Production* is the creation of goods and services
- *Operations management* is the set of activities that creates value in the form of goods and services by transforming inputs into outputs



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## ORGANIZING TO PRODUCE GOODS AND SERVICES



## Organizing to Produce Goods and Services

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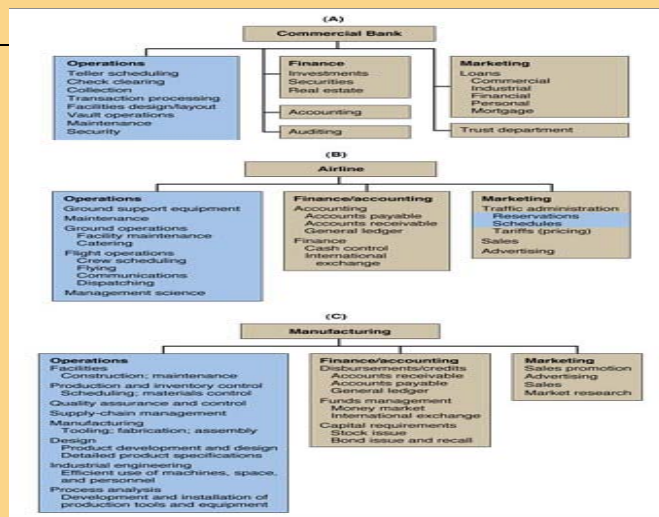
- **Essential functions:**
  - **Marketing – generates demand**
  - **Operations –creates the product**
  - **Finance/accounting – tracks organizational performance, pays bills, collects money**

# Organizational Functions

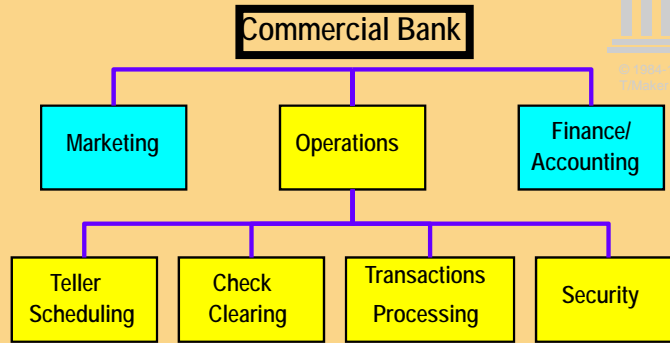
- **Marketing**
  - Gets customers
- **Operations**
  - creates product or service
- **Finance/Accounting**
  - Obtains funds
  - Tracks money



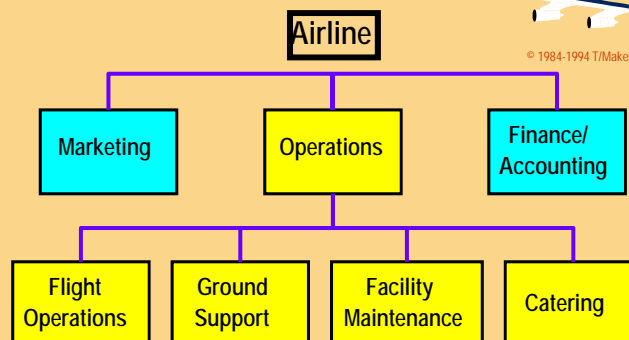
# Sample Organization Charts



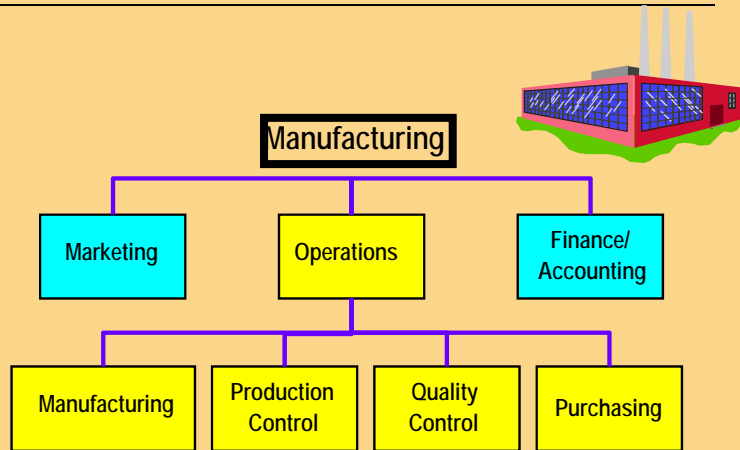
# Functions Bank



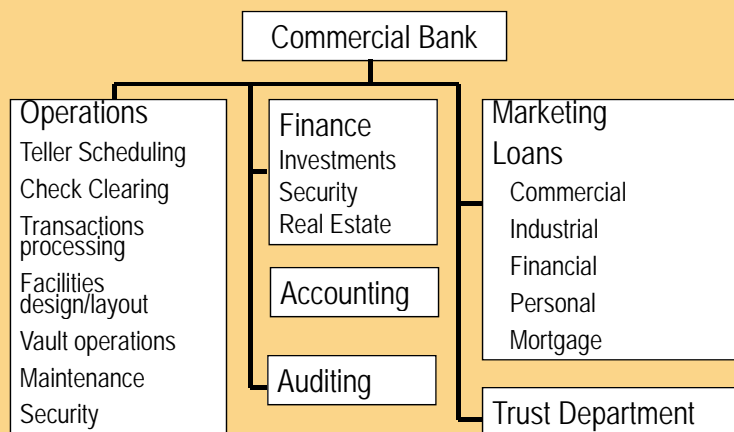
# Functions Airline



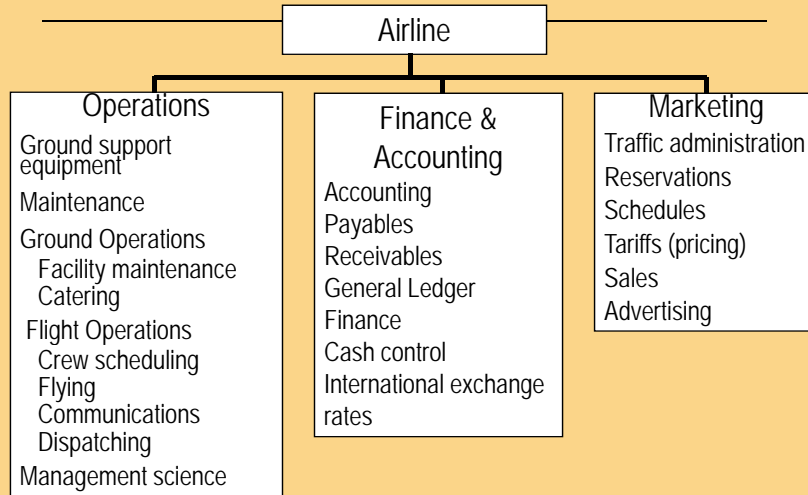
# Functions Manufacturer



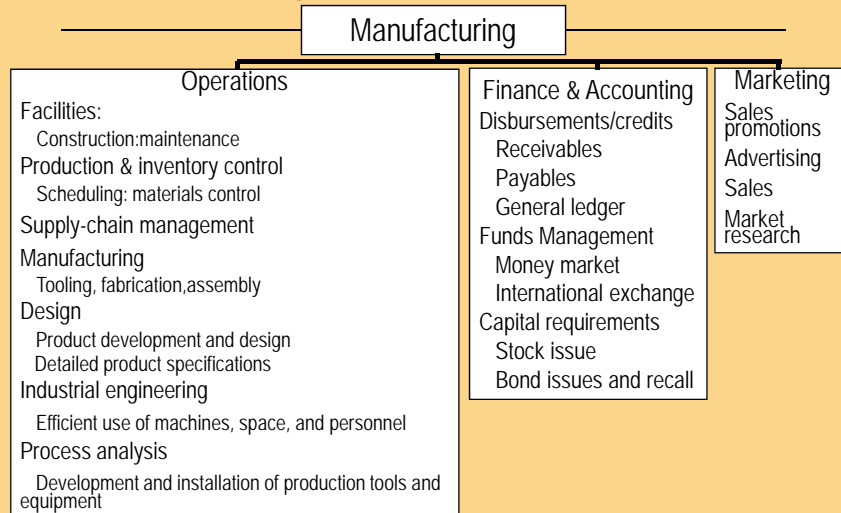
# Organizational Charts



# Organizational Charts



# Organizational Charts





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## Why Study OM?



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## Why Study OM?

- OM is one of three major functions (*marketing, finance, and operations*) of any organization.
- We want (*and need*) to know how goods and services are produced.
- We want to understand what operations managers do.
- OM is such a costly part of an organization.

## Options for Increasing Contribution

	Current	Marketing Option Sales Revenue : +50%	Finance & Accounting Option Finance Costs: -50%	OM Option Production Costs: -20%
Sales	\$100,000	\$150,000	\$100,000	\$100,000
Cost of Goods Sold	<u>-80,000</u>	<u>-120,000</u>	<u>-80,000</u>	<u>-64,000</u>
Gross Margin	20,000	30,000	20,000	36,000
Finance Costs	<u>-6,000</u>	<u>-6,000</u>	<u>-3,000</u>	<u>-6,000</u>
Net Margin	14,000	24,000	17,000	30,000
Taxes @ 25%	<u>-3,500</u>	<u>-6,000</u>	<u>-4,250</u>	<u>-7,500</u>
Contribution	10,500	18,000	12,750	22,500

Plan - Organize - Staff - Lead - Control

## WHAT OPERATIONS MANAGERS DO



## The Critical Decisions

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- *Quality management*
  - Who is responsible for quality?
  - How do we define quality?
- *Service and product design*
  - What product or service should we offer?
  - How should we design these products and services?



## The Critical Decisions Continued

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- *Process and capacity design*
  - What processes will these products require and in what order?
  - What equipment and technology is necessary for these processes?
- *Location*
  - Where should we put the facility
  - On what criteria should we base this location decision?



## The Critical Decisions Continued

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- *Layout design*
  - How should we arrange the facility?
  - How large a facility is required?
- *Human resources and job design*
  - How do we provide a reasonable work environment?
  - How much can we expect our employees to produce?



## The Critical Decisions Continued

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- *Supply chain management*
  - Should we make or buy this item?
  - Who are our good suppliers and how many should we have?
- *Inventory, material requirements planning,*
  - How much inventory of each item should we have?
  - When do we re-order?



## The Critical Decisions Continued

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- *Intermediate, short term, and project scheduling*
  - Is subcontracting production a good idea?
  - Are we better off keeping people on the payroll during slowdowns?
- *Maintenance*
  - Who is responsible for maintenance?
  - When do we do maintenance?



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WHERE ARE THE OM JOBS

## Where are the OM Jobs

### PLANT MANAGER

Division of Fortune 1000 company seeks plant manager for plant located in the upper Hudson Valley area. This plant manufactures loading dock equipment for commercial markets.

The Candidate must be experienced in plant management including expertise in production planning, purchasing and inventory management. Good written and oral communication skills are a must along with excellent understanding and application skills in managing people.

### Director of Purchasing

Well-established full line food distributor is seeking an experienced purchasing agent to support rapidly expanding food service sales. Must have thorough knowledge of day to day purchasing functions, ability to review vendor programs, establish operating par levels, and coordinate activities with operations. The candidate must be prepared to work with vendors to develop Internet catalogues. Must be well versed in all food categories, a team worker, and bottom line oriented. Salary commensurate with experience.

### Quality Manager

Several openings exist in our small package processing facilities in the Northeast, Florida, and Southern California for quality managers. These highly visible positions require extensive use of statistical tools to monitor all aspects of service timeliness and workload measurement. The work involves (1) a combination of hands-on applications and detailed analysis using databases and spreadsheets, (2) process audits to identify areas for improvement, and (3) manage implementation of changes. Positions involve night hours and weekends. Send resume.

### Process Improvement Consultants

An expanding consulting firm is seeking consultants to design and implement lean production and cycle time reduction plans in both service and manufacturing processes. Our firm is currently working with an international bank to improve its back office operations as well as several manufacturing firms. A business degree required, APICS certification a plus.

### Supply Chain Manager and Planner


Responsibilities entail negotiating contracts and establishing long-term relationships with suppliers. We will rely on the selected candidate to maintain accuracy in the purchasing system, invoices, and product returns. A bachelor's degree and up to 2 years related experience are required. Working knowledge of MRP, ability to use feedback to master scheduling and suppliers and consolidate orders for best price and delivery are necessary. Proficiency in all PC Windows applications, particularly Excel and Word, is essential. Knowledge of Oracle business system I is a plus. Effective verbal and written communication skills are essential.

## Where Are the OM Jobs?

- Technology/methods
- Facilities/space utilization
- Strategic issues
- Response time
- People/team development
- Customer service
- Quality
- Cost reduction
- Inventory reduction
- Productivity improvement

# The Heritage of Operations Management

# Significant Events in Operations Management



Cost Focus		Quality Focus	Customization Focus
<b>Early Concepts</b> <b>1776-1880</b> Labor Specialization (Smith, Babbage) Standardized Parts (Whitney)	<b>Mass Production Era</b> <b>1910-1980</b> Moving Assembly Line (Ford/Sorensen) Statistical Sampling (Shewhart) Economic Order Quantity (Harris)	<b>Lean Production Era</b> <b>1980-1995</b> Just-In-Time Computer Aided Design Electronic Data Interchange Total Quality Management Baldrige Award Empowerment Kanbans	<b>Mass Customization Era</b> <b>1995-2005</b> Globalization Internet Enterprise Resource Planning Learning Organization International Quality Standards Finite Scheduling Supply Chain Management Agile Manufacturing
<b>Scientific Management Era</b> <b>1880-1910</b> Gantt Charts (Gantt) Motion & Time Studies (Gilbreth) Process Analysis (Taylor) Queuing Theory (Erlang)	Linear Programming (Dantzig) PERT/CPM (DuPont) Material Requirements Planning		



## The Heritage of Operations Management

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Division of labor (Adam Smith 1776 and Charles Babbage 1852)

Standardized parts (Whitney 1800)

Scientific Management (Taylor 1881)

Coordinated assembly line (Ford/Sorenson/Avery 1913)

Gantt charts (Gantt 1916)

Motion study (Frank and Lillian Gilbreth 1922)

Quality control (Shewhart 1924; Deming 1950)

Computer (Atanasoff 1938)

CPM/PERT (DuPont 1957)



## The Heritage of Operations Management Continued

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Material requirements planning (Orlicky 1960)

Computer aided design (CAD 1970)

Flexible manufacturing system (FMS 1975)

Baldrige Quality Awards (1980)

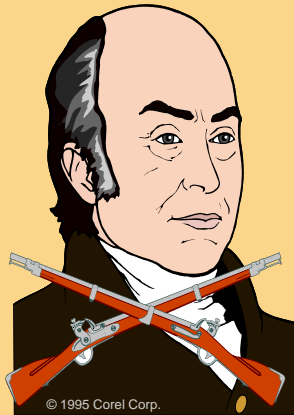
Computer integrated manufacturing (1990)

Globalization(1992)

Internet (1995)

## Eli Whitney

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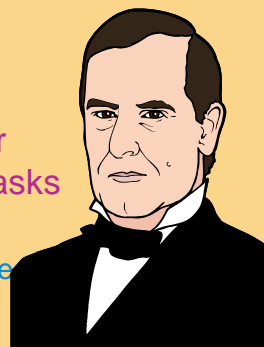


- Born 1765; died 1825
- In 1798, received government contract to make 10,000 muskets
- Showed that machine tools could make standardized parts to exact specifications
  - Musket parts could be used in any musket

## Frederick W. Taylor

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- Born 1856; died 1915
- Known as 'father of scientific management'
- In 1881, as chief engineer for Midvale Steel, studied how tasks were done
  - Began first motion & time studies
- Created efficiency principles





## Taylor: Management Should Take More Responsibility for

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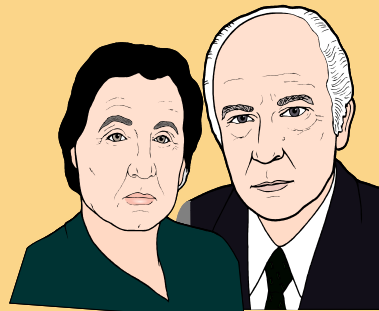
- Matching employees to right job
- Providing the proper training
- Providing proper work methods and tools
- Establishing legitimate incentives for work to be accomplished



## Frank & Lillian Gilbreth

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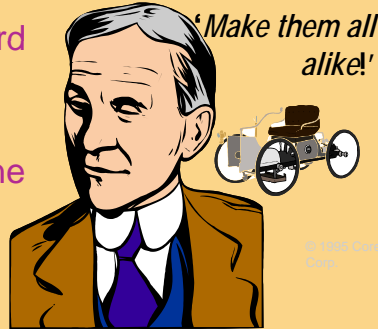
- Frank (1868-1924); Lillian (1878-1972)
- Husband-and-wife engineering team
- Further developed work measurement methods
- Applied efficiency methods to their home & 12 children!
- (Book & Movie: "Cheaper by the Dozen," book: "Bells on Their Toes")



© 1999, Gilbreth Foundation

## Henry Ford

- Born 1863; died 1947
- In 1903, created Ford Motor Company
- In 1913, first used moving assembly line to make Model T
  - Unfinished product moved by conveyor past work station
- Paid workers very well for 1911 (\$5/day!)



## W. Edwards Deming



- Born 1900; died 1993
- Engineer & physicist
- Credited with teaching Japan quality control methods in post-WW2
- Used statistics to analyze process
- His methods involve workers in decisions



## Contributions From

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- Human factors
- Industrial engineering
- Management science
- Biological science
- Physical sciences
- Information science



## Significant Events in OM


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- Division of labor (Smith, 1776)
- Standardized parts (Whitney, 1800)
- Scientific management (Taylor, 1881)
- Coordinated assembly line (Ford 1913)
- Gantt charts (Gantt, 1916)
- Motion study (the Gilbreths, 1922)
- Quality control (Shewhart, 1924)

## Significant Events Continued

- CPM/PERT (Dupont, 1957)
- MRP (Orlicky, 1960)
- CAD
- Flexible manufacturing systems (FMS)
- Manufacturing automation protocol (MAP)
- Computer integrated manufacturing (CIM)

## New Challenges in OM

- | <u>From</u>  |   | <u>To</u>   |
|--|---|---|
| <ul style="list-style-type: none"><li>• Local or national focus</li><li>• Batch shipments</li><li>• Low bid purchasing</li></ul> |  | <ul style="list-style-type: none"><li>• Global focus</li><li>• Just-in-time</li><li>• Supply chain partnering</li></ul> |
| <ul style="list-style-type: none"><li>• Lengthy product development</li></ul>  |   | <ul style="list-style-type: none"><li>• Rapid product development, alliances</li></ul>                                  |
| <ul style="list-style-type: none"><li>• Standard products</li><li>• Job specialization</li></ul>                                 |   | <ul style="list-style-type: none"><li>• Mass customization</li><li>• Empowered employees, teams</li></ul>               |

## Operations in the Service Sector

## Characteristics of Goods

- Tangible product
- Consistent product definition
- Production usually separate from consumption
- Can be inventoried
- Low customer interaction



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## Characteristics of Service

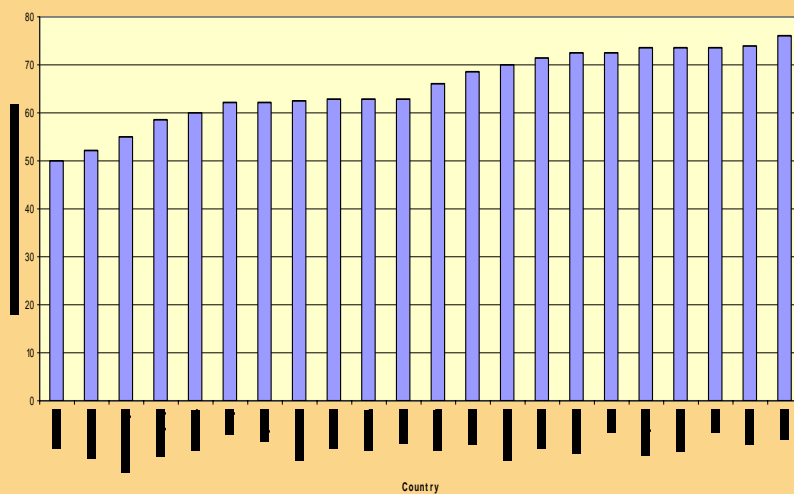


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- Intangible product
- Produced & consumed at same time
- Often unique
- High customer interaction
- Inconsistent product definition
- Often knowledge-based
- Frequently dispersed

## Service Economies

Proportion of Employment in the Service Sector





## Goods Versus Services

### Goods

- Can be resold
- Can be inventoried
- Some aspects of quality measurable
- Selling is distinct from production

### Service

- Reselling unusual
- Difficult to inventory
- Quality difficult to measure
- Selling is part of service



## Goods Versus Services Continued

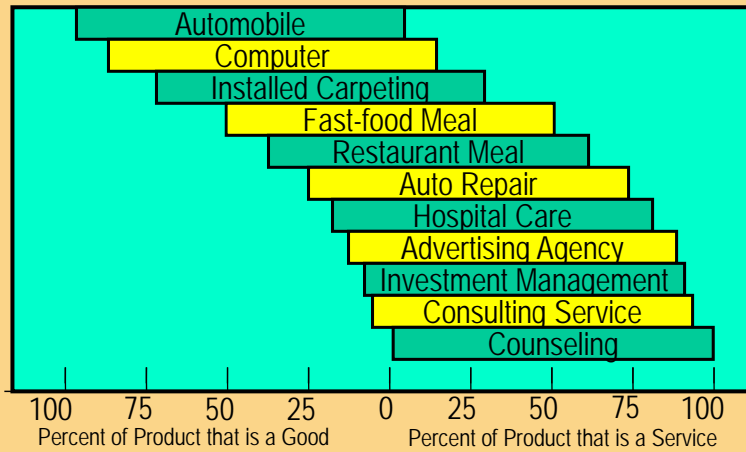
### Goods

- Product is transportable
- Site of facility important for cost
- Often easy to automate
- Revenue generated primarily from tangible product

### Service

- Provider, not product is transportable
- Site of facility important for customer contact
- Often difficult to automate
- Revenue generated primarily from intangible service.

## Goods Contain Services / Services Contain Goods



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## Organizations in Each Sector – *Table 1.4*

Service Sector	Example	% of all Jobs
Professional services, education, legal, medical	New York City PS108, Notre Dame University, San Diego Zoo	24.3
Trade (retail, wholesale)	Walgreen's, Wal-Mart, Nordstroms	20.6
Utilities, transportation	Pacific Gas & Electric, American Airlines, Santa Fe R.R, Roadway Express	7.2

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## Organizations in Each Sector – *Table 1.4*

Service Sector	Example	% of all Jobs
Business & Repair Services	Snelling & Snelling, Waste Management, Pitney-Bowes	7.1
Finance, Insurance, Real Estate	Citicorp, American Express, Prudential, Aetna, Trammel Crow	6.5
Food, Lodging, Entertainment	McDonald's, Hard Rock Café, Motel 6, Hilton Hotels, Walt Disney Paramount Pictures	5.2
Public Administration	U.S., State of Alabama, Cook County	4.5

## Organizations in Each Sector – *Table 1.4*

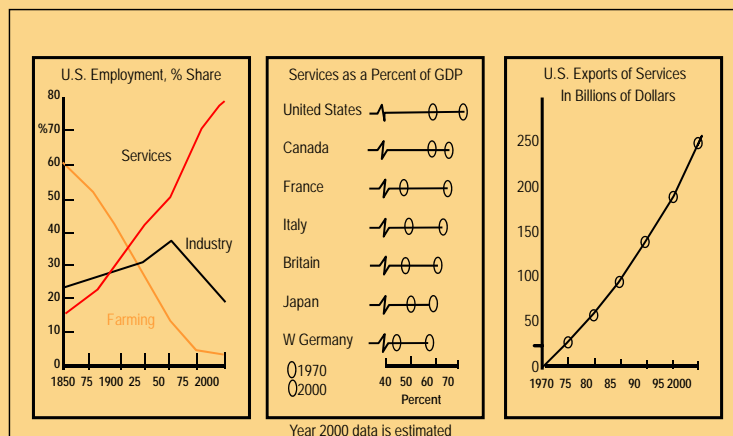
Manufacturing Sector	Example	% of all Jobs
General	General Electric, Ford, U.S. Steel, Intel	14.8
Construction	Bechtel, McDermott	7.0
Agriculture	King Ranch	2.4
Mining	Homestake Mining	0.4

## Organizations in Each Sector – *Table 1.4*

### Summary

Sector	% of all Jobs
Service	75.4%
Manufacturing	24.6%

## Development of the Service Economy



## EXCITING NEW CHALLENGES IN OPERATIONS MANAGEMENT

## Changing Challenges for the Operations Manager

Past	Causes	Future
Local or national focus	Low-cost, reliable worldwide communication and transportation networks	Global Focus
Batch (large) shipments	Cost of capital puts pressure on reducing investment in inventory	Just-in-time shipments
Low-bid purchasing	Quality emphasis requires that suppliers be engaged in product improvement	Supply-chain partners
Lengthy product development	Shorter life cycles, rapid international communication, computer-aided design, and international collaboration	Rapid product development, alliances, collaborative designs

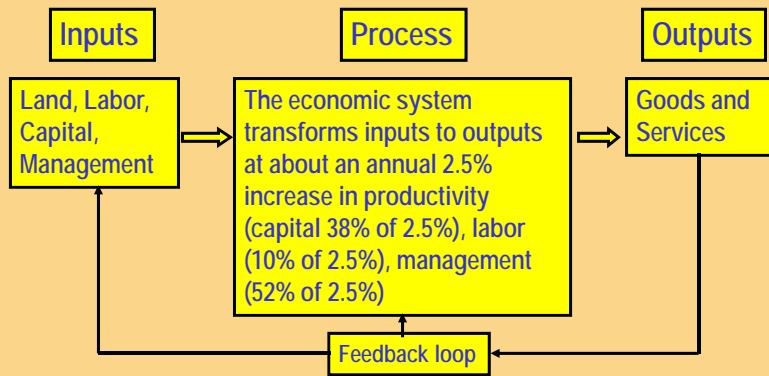
## Changing Challenges for the Operations Manager

Past	Causes	Future
Standardized products	Affluence and worldwide markets; increasingly flexible production processes	Mass customization
Job specialization	Changing sociocultural milieu. Increasingly a knowledge and information society.	Empowered employees, teams, and lean production
Low cost focus	Environmental issues, ISO 14000, increasing disposal costs	Environmentally sensitive production, Green manufacturing, recycled materials, remanufacturing

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## The Productivity Challenge

# The Economic System Transforms Inputs to Outputs

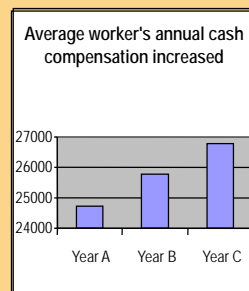
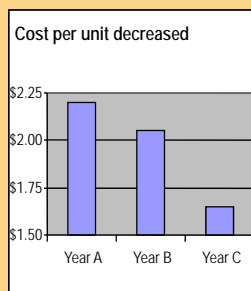
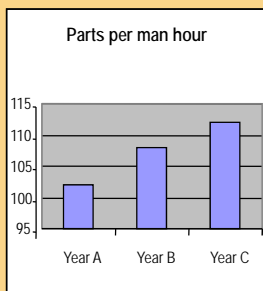


# Typical Impact of Quality Improvement

As productivity improved

Costs were pared

Wages increased



## Productivity

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- Measure of process improvement
- Represents output relative to input

$$\text{Productivity} = \frac{\text{Units produced}}{\text{Input used}}$$

- Only through productivity increases can our standard of living improve

## Multi Product Productivity

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Productivity =

$$\frac{\text{Output}}{\text{Labor + material + energy + capital + miscellaneous}}$$



## Measurement Problems

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- *Quality* may change while the quantity of inputs and outputs remains constant
- *External elements* may cause an increase or decrease in productivity
- *Precise units* of measure may be lacking



## Productivity Variables

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- *Labor* - contributes about 10% of the annual increase
- *Capital* - contributes about 32% of the annual increase
- *Management* - contributes about 52% of the annual increase

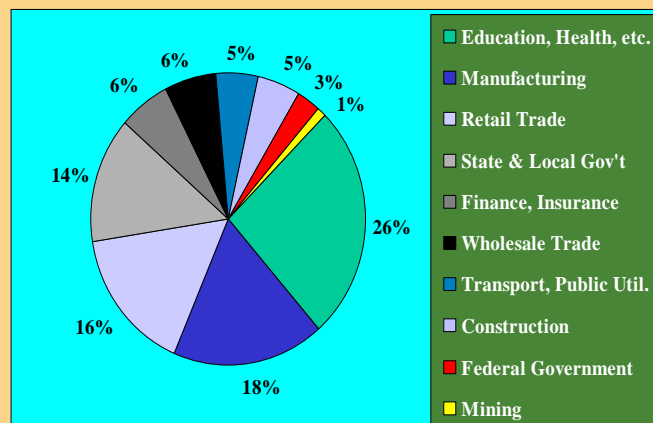


## Key Variables for Improved Labor Productivity

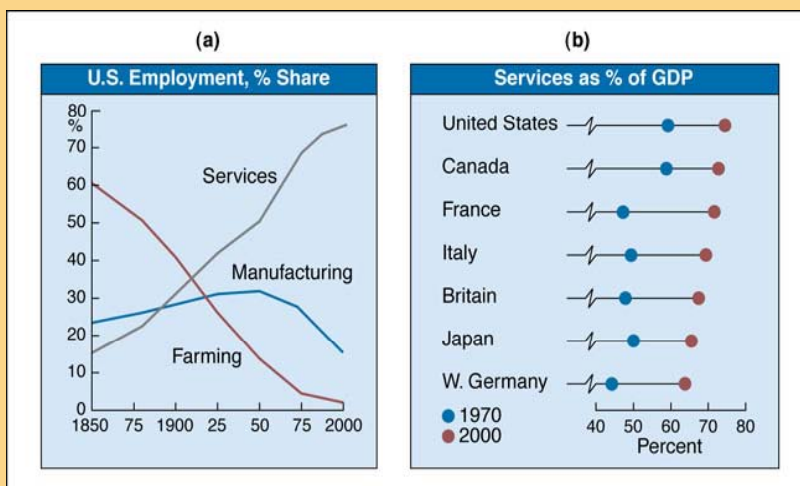
- Basic education appropriate for the labor force
- Diet of the labor force
- Social overhead that makes labor available
- Maintaining and enhancing skills in the midst of rapidly changing technology and knowledge



## Jobs in the U.S



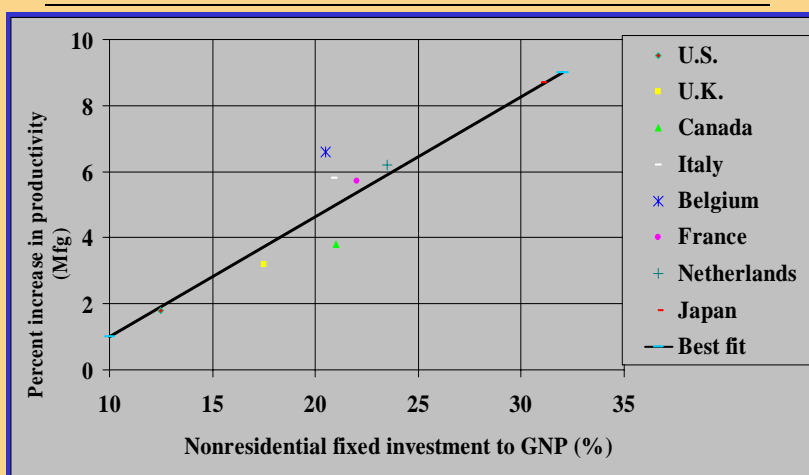
## Comparison of Productivity



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## Investment and Productivity in Selected Nations



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## Service Productivity

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- Typically labor intensive
- Frequently individually processed
- Often an intellectual task performed by professionals
- Often difficult to mechanize
- Often difficult to evaluate for quality