Production and Operations Management

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Course Materials

- **教材：** Lee J. Krajewski, Larry P. Ritzman, Manoj K. Malhotra，*Operations Management : Processes and Supply Chains* (*10/*e). Harlow : Pearson, 2013 (electronic resource，清华图书馆)
- **参考教材：** 陈荣秋, 马士华，生产与运作管理（第三版），高等教育出版社， 2011
- **指定阅读：**（以）高德拉特，（美）科克斯著，齐若兰译，目标(第3版)，电子工业出版社，2012

  （原著： Eliyahu M. Goldratt and Jeff Cox , *The Goal (3/e)*，North River Press)
- PPT files, case and readings

Grading

- **Class participation** **15%** ***individual***
- **Assignments** **20%** ***individual***
- **Game and report** **15%** **in *group***
- **Final examination** **50%**

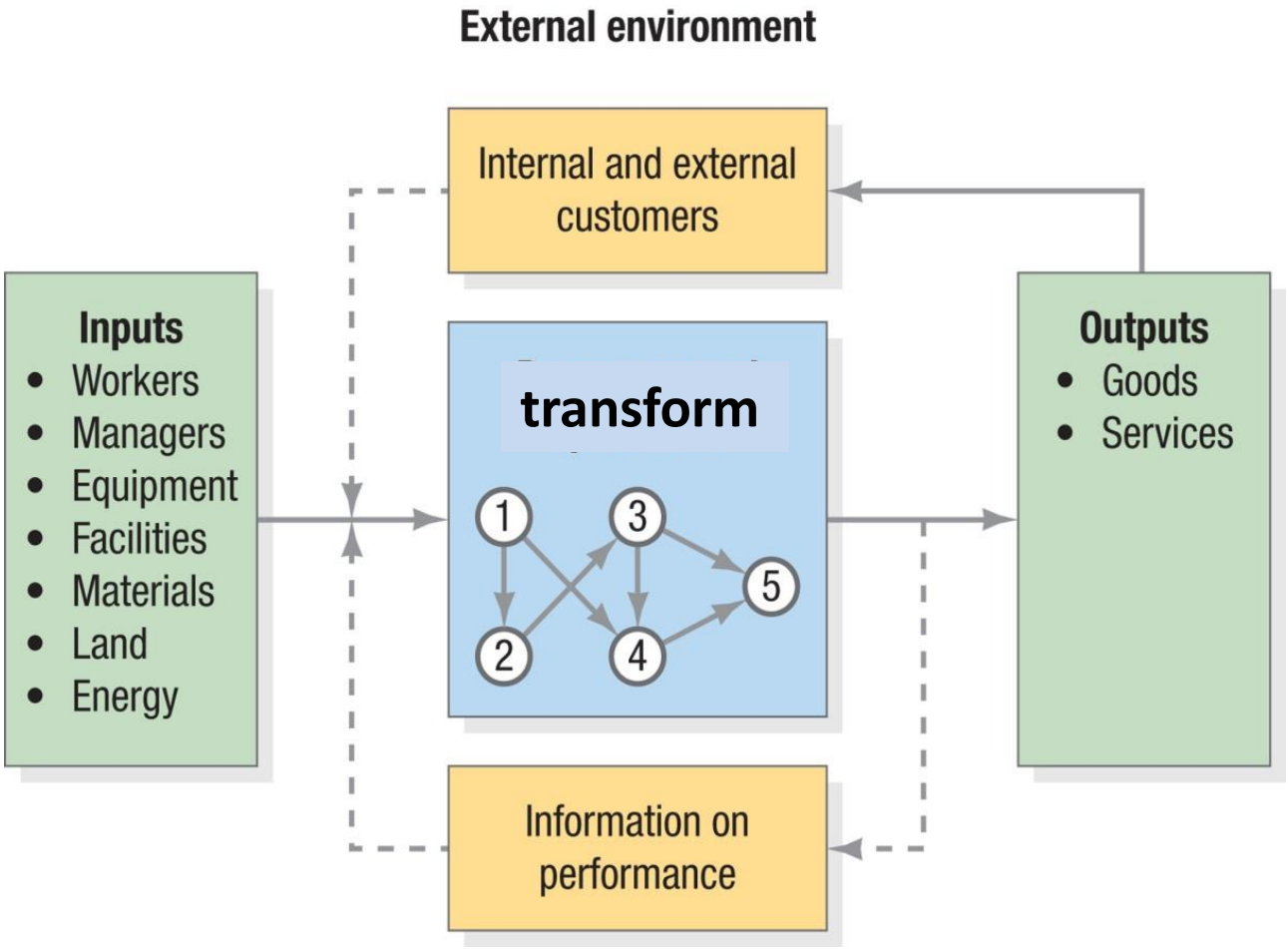
Chapter 1 Introduction

- What is OM?
- Manufacturing and Service Processes
- Major Decisions in OM
- Impact of Three IT waves on OM
- Why Study OM?

What is OM?

What is Operations?

Any activity or group of activities that takes one or more inputs, transforms them, and provides one or more outputs for its customers.



Types of Transformation

Operations	Examples
Goods Producing	Farming, mining, construction, manufacturing, power generation
Storage/Transportation	Warehousing, trucking, mail service, taxis, buses, hotels, airlines
Exchange	Retailing, wholesaling, banking, renting, leasing, library, loans
Entertainment	Films, radio and television, concerts, recording
Communication	Newspapers, radio and television newscasts, telephone, satellites

What is Operations Management?

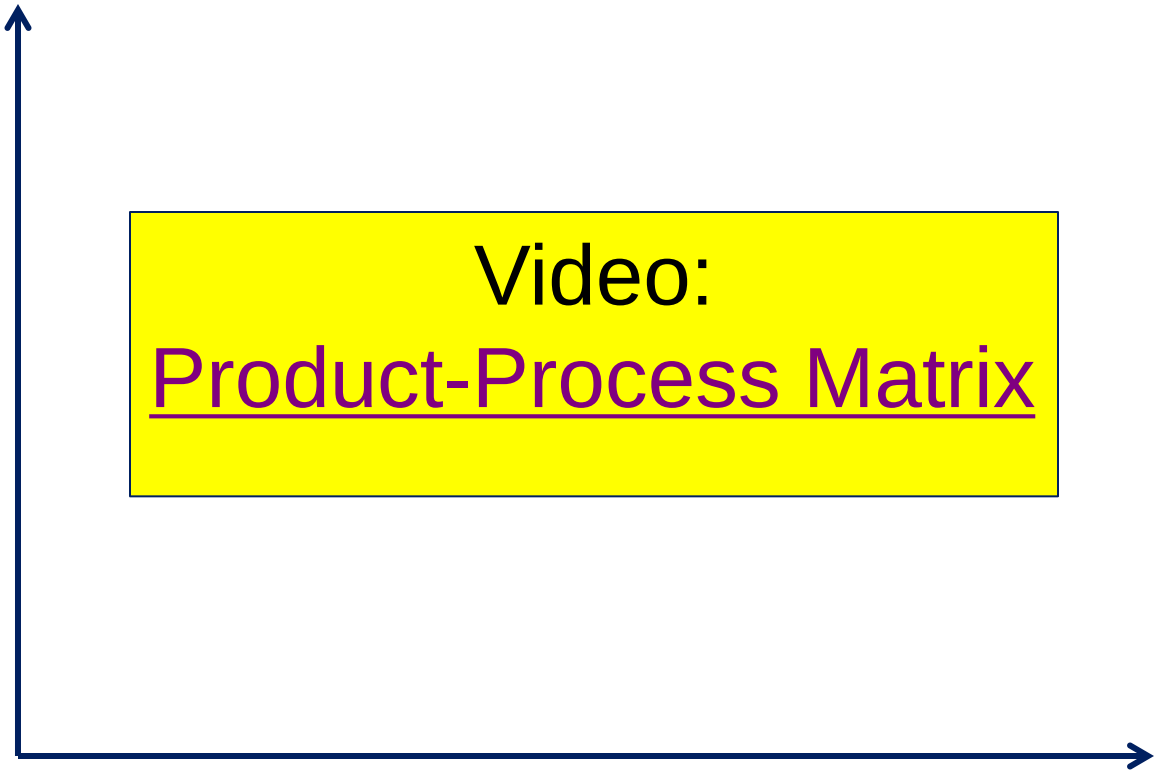
The systematic design, planning and control of processes that transform inputs into services and products

Process Structure in Manufacturing

- **Job Process**
  - Airplane, ship building
- **Batch Process**
  - Bread，Clothing
- **Line Process**
  - Car，PC
- **Continuous Flow Process**
  - Oil Refinery，Pharmacy

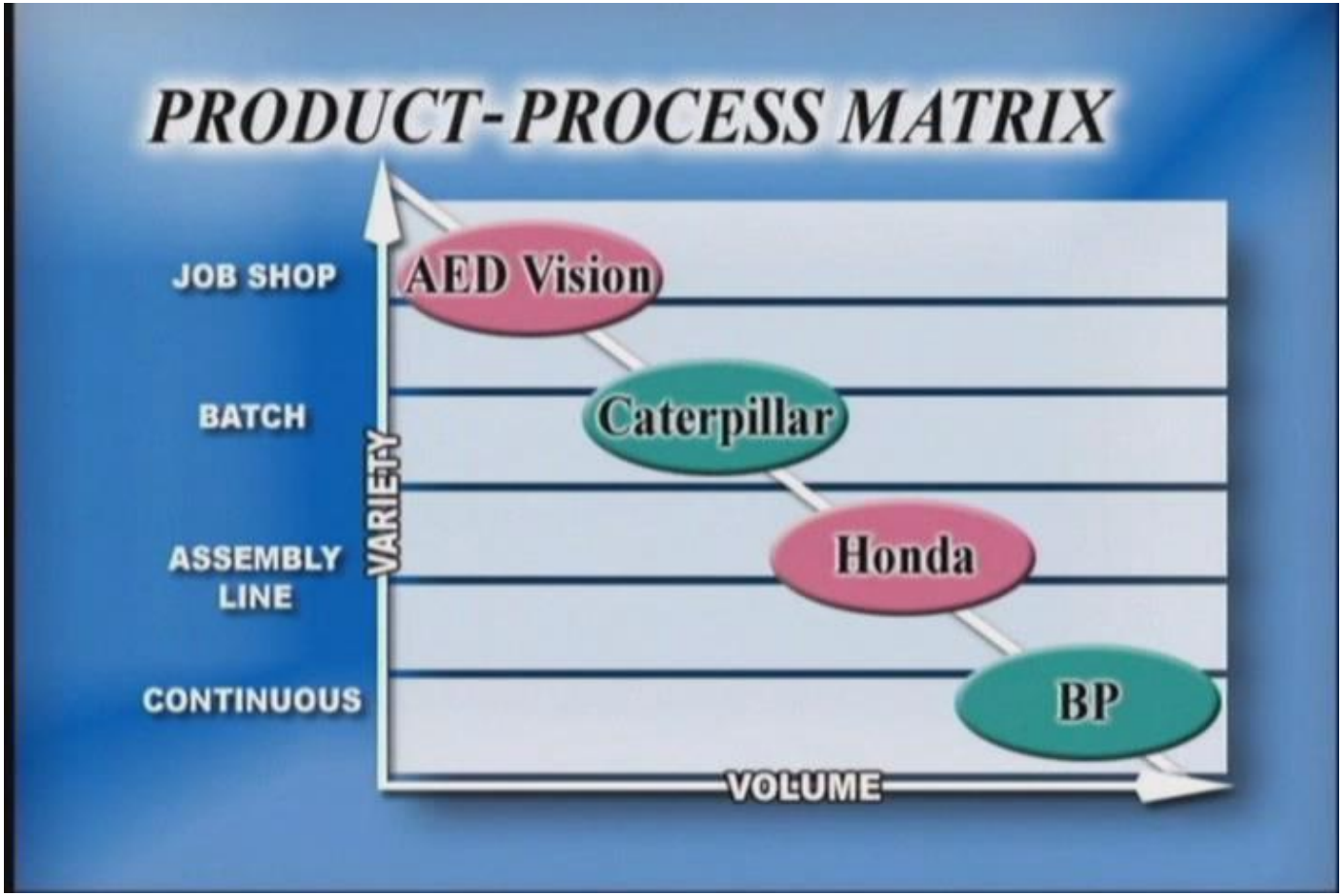
What is the relation between process and products?

Process Structure in Manufacturing

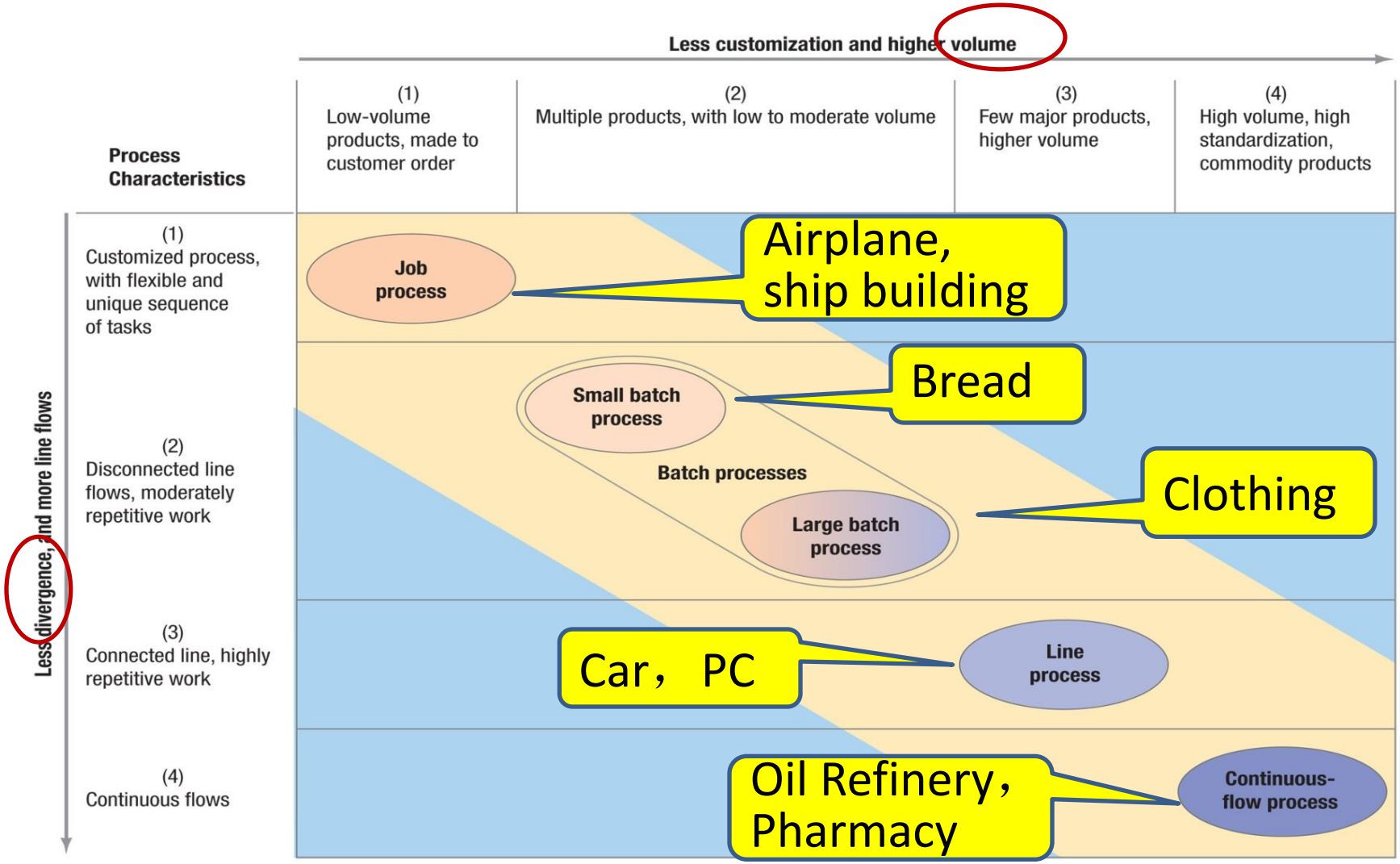


Video:
Product-Process Matrix

Video: Product-Process Matrix



Product-Process Matrix —Source: P.115, textbook 1



Example:
The Process of Airplane Building

Example:
The Process of Airplane Transportation

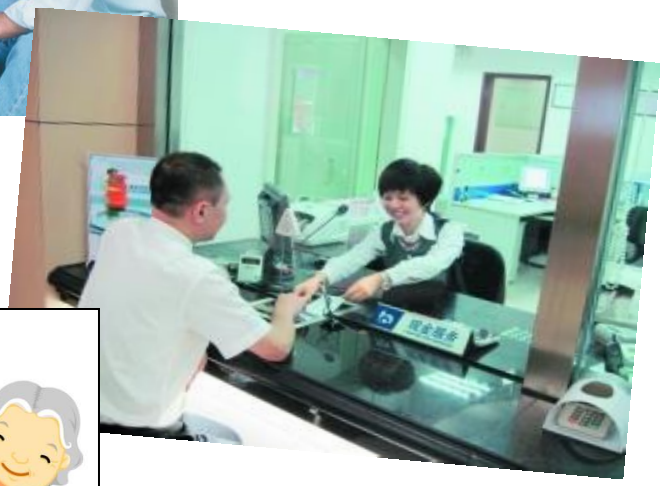
Process Characteristics in Services

Customer Contact

- **Customization**

Process Divergence

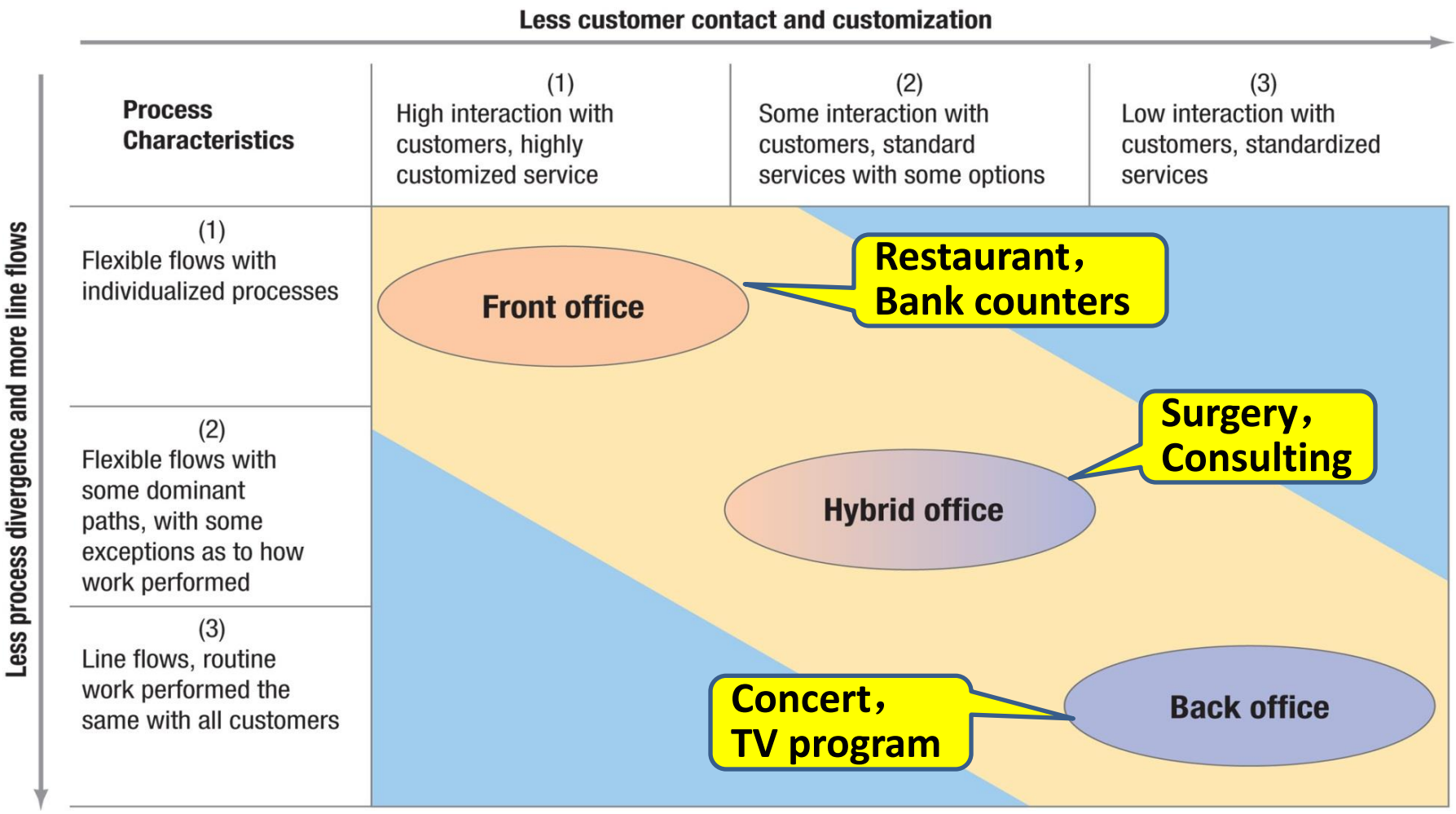
- **Flexible Flow**



Customer Contact in Services

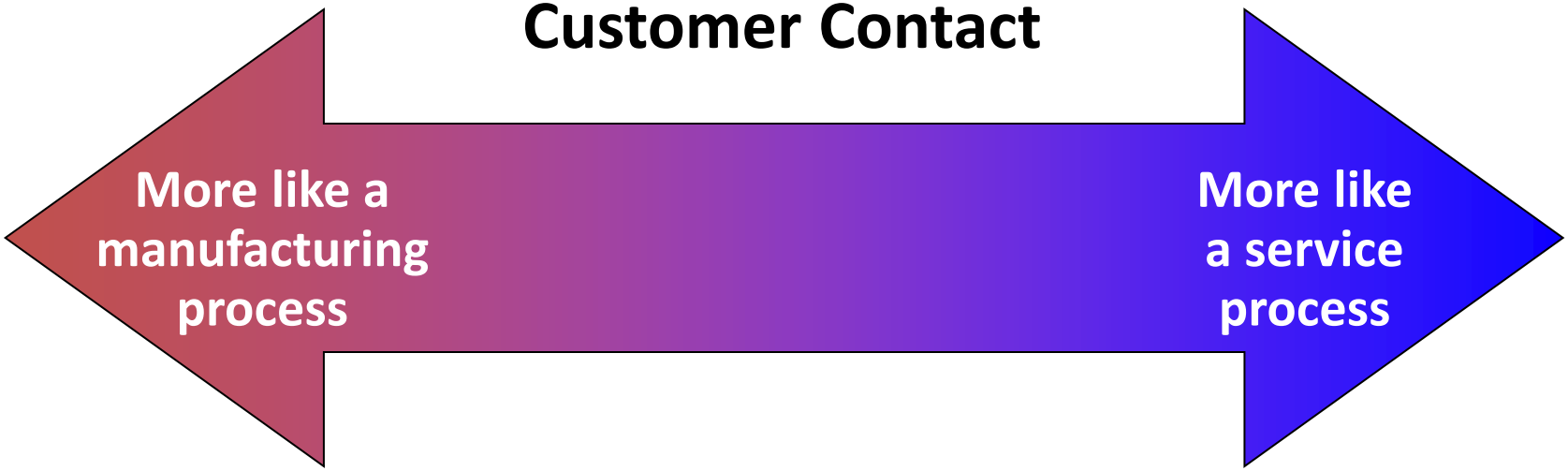
DIMENSIONS OF CUSTOMER CONTACT IN SERVICE PROCESSES		
Dimension	**High Contact**	**Low Contact**
Physical presence	Present	Absent
What is processed	People	Possessions or information
Contact intensity	Active, visible	Passive, out of sight
Personal attention	Personal	Impersonal
Method of delivery	Face-to-face	Regular mail or e-mail

Customer Contact - Process Matrix



Service and Manufacturing Processes

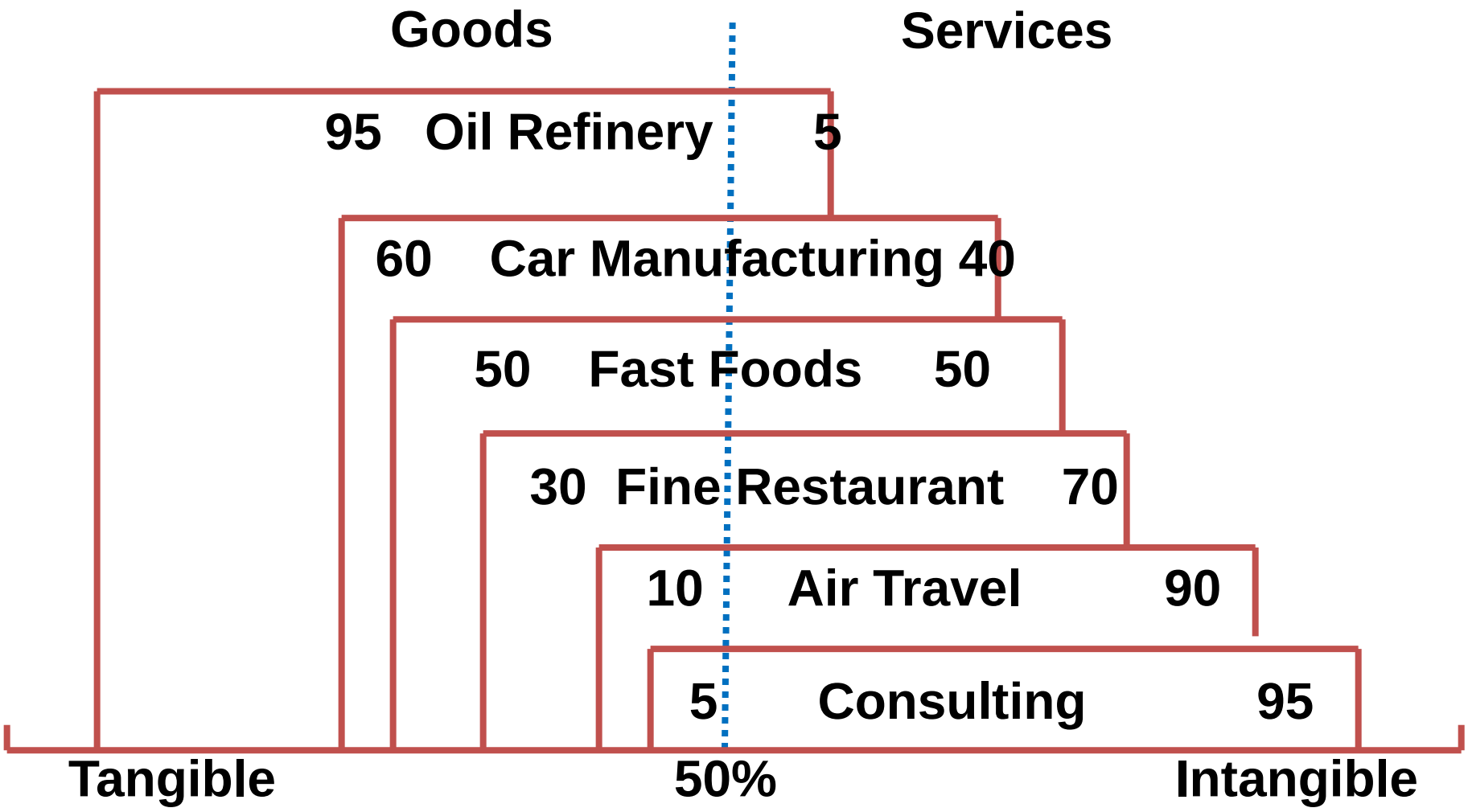
Differ Across Nature of Output and Degree of Customer Contact



- Physical, durable output
- Output can be inventoried
- Low customer contact
- Long response time
- Capital intensive
- Quality easily measured

- Intangible, perishable output
- Output cannot be inventoried
- High customer contact
- Short response time
- Labor intensive
- Quality not easily measured

Nature of Output: Mixture of Goods and Services



Major Decisions in OM

Goal of Operations Management

Provide products and service to customers on time with lower price, reasonable quality and diversity

The main performance index of OM:

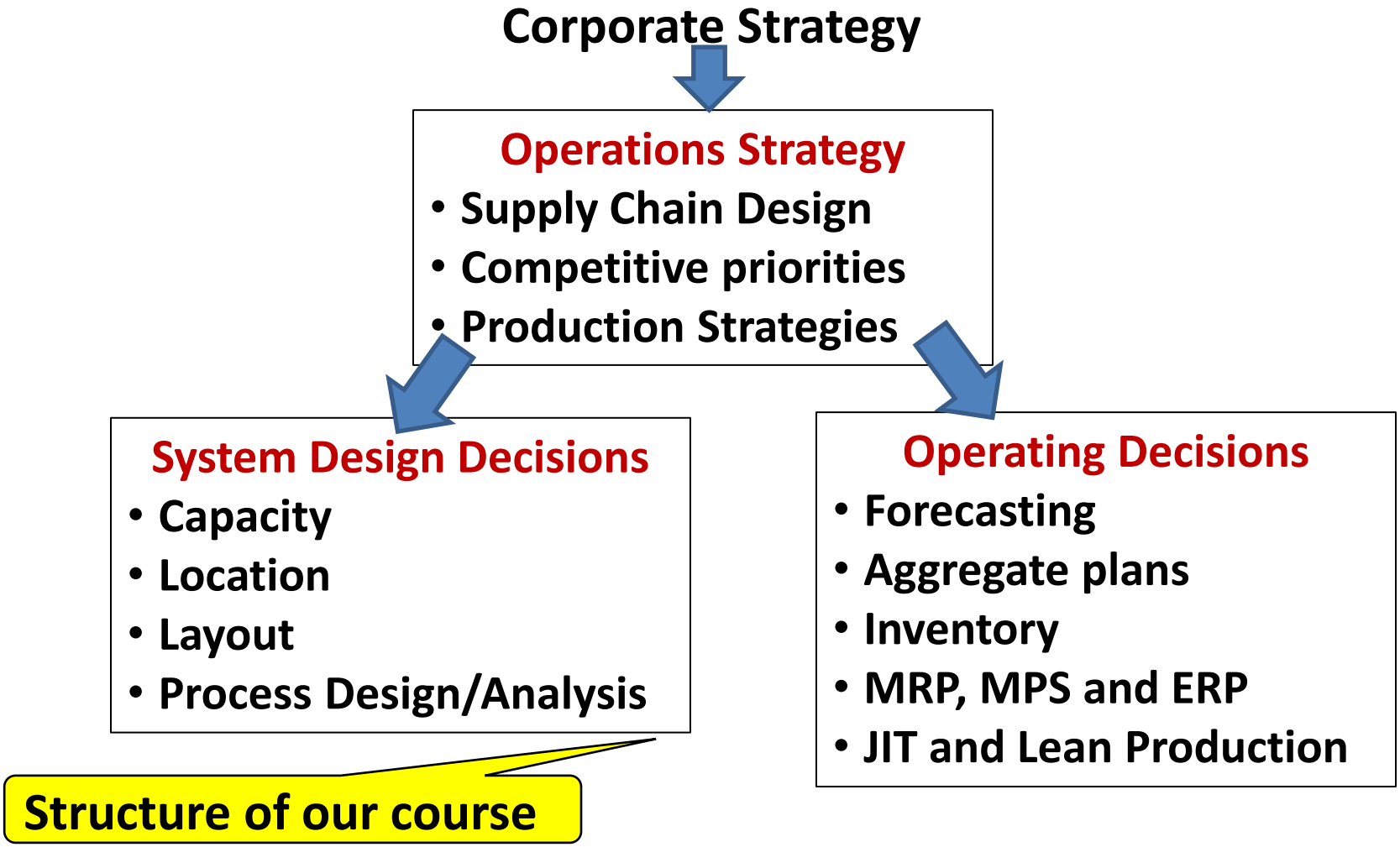
quality, time, cost, flexibility

(Note: ***flexibility means diversities of products' volume, color, model and so on)***

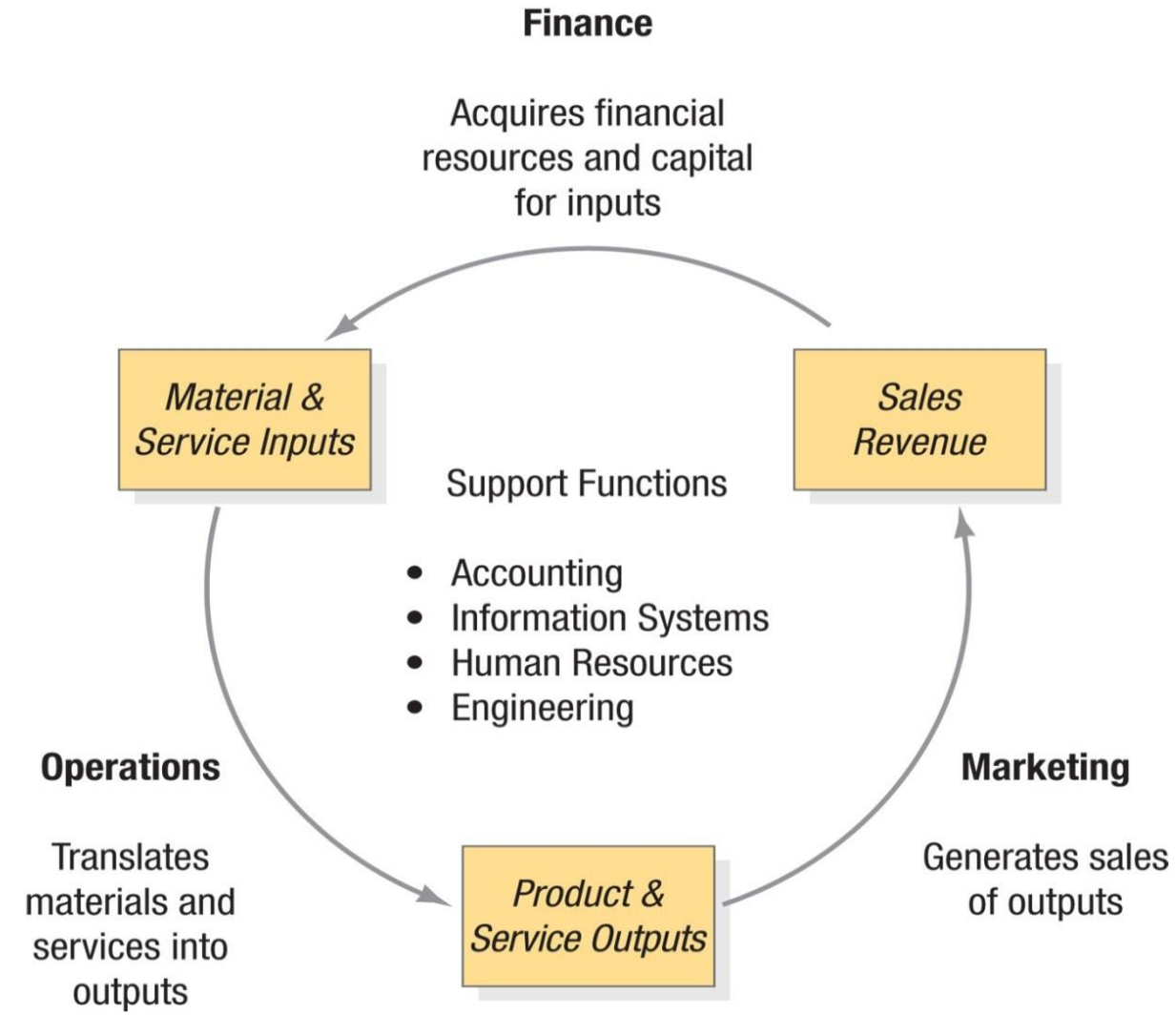
Typical operations decisions

- ***What:*** **What resources are needed, and in what amounts?**
- ***When:*** **When will each resource be needed? When should the work be scheduled? When should materials and other supplies be ordered?**
- ***Where:*** **Where will the work be done?**
- ***How:*** **How will the product or service be designed? How will the work be done? How will resources be allocated?**
- ***Who:*** **Who will do the work?**

OM as a Set of Decisions



Integration between Different Functional Areas of a Business



Historical Evolution of OM

1900

Scientific Management (Frederick W. Taylor)
Systematic approach to increasing worker productivity through time study, standardization of work, and incentives.

1910

Ford Production System
Interchangeable parts, Labor specialization, Moving Assembly Line

1920

Scheduling; Inventory Management; Statistical Quality Control

（经典生产管理学）

(World War II）

（World War II）

1940

OR Applications in OM

Seeks to obtain mathematically optimal (quantitative) solutions to complex production system.

1960

Advanced Manufacturing Technology

Numerical Control Machine，Robot，CAD/CAM/CIMS

1980

Influence of Japanese Manufacturers(TPS/JIT/Lean Produciton)

Operations Management in Services

OM concepts can apply to both manufacturing and service operations.

2000

The Marriage of OM and IT

MRP-MRPII-ERP, OA, SCM/CRM, E-Business

The Impact of IT Waves on OM

- **The first wave (during the 1970s and 1990s)**
  - **CAD,CAM,MRP and ERP automated individual activities in the value chain, from order processing and bill paying to product design and manufacturing.**
- **The second wave (during the 20-21 turn of the century)**
  - **The rise of the internet allowed firms to closely integrate globally distributed supply chains, and realized coordination and integration with outside suppliers, channels, and customers.**

The Impact of IT Waves on OM

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    outside s

The first two waves gave rise to huge productivity gains and growth across the economy. However, products themselves were largely unaffected. Now, the third wave is coming…

The Impact of IT Waves on OM
—The third wave now

- **IT is revolutionizing products and becoming an integral part of the product itself.**
- **These "*smart, connected products*" have become complex systems that combine hardware, sensors, data storage, microprocessors, software, and connectivity in myriad ways.**

Philips Lighting

Users can control Philips Lighting hue lightbulbs via smartphone, turning them on and off, programming them to blink if they detect an intruder, or dimming them slowly at night.

Babolat

Babolat's Play Pure Drive product system puts sensors and connectivity in the tennis racket handle, allowing users to track and analyze ball speed, spin, and impact location to improve their game.

Wind Turbine

When smart wind turbines are networked, software can adjust the blades on each one to minimize impact on the efficiency of turbines nearby.

The Impact of IT Waves on OM
—The third wave now (cont'd)

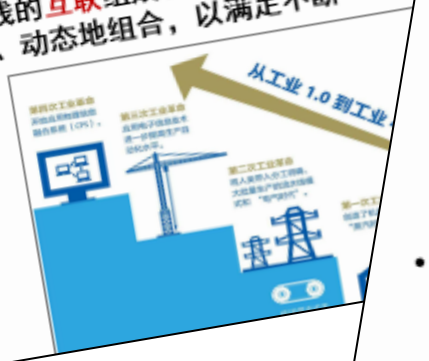
- Producing these "*smart, connected products*" create the need for new activities such as **product data analytics and security**.
- This will trigger even more innovation, productivity gains, and economic growth than the previous two.
- this have unleashed a ***new era of competition.***

The Impact of IT Waves on OM

—The third wave now (cont'd)

互联网时代的新技术浪潮
——德国的工业4.0

- 推动制造业向智能化转型
- 智能工厂：将传感器、嵌入式终端系统、智能控制系统、通信设施通过信息物理系统（Cyber-Physical System，CPS）形成一个智能网络，使产品与设备之间、设备与设备之间以及数字世界和物理世界之间能够互联，不同类型和功能的单机设备互联组成智能生产线，不同智能生产线的互联组成智能工厂，这些智能生产线、智能工厂可以自由、动态地组合，以满足不断变化的制造需求
- 智能生产：动态配置的生产方式，从事作业的智能设备能够通过网络实时访问相关信息，并根据信息内容自主更换生产材料，切换生产方式



互联网时代的新技术浪潮
——美国的工业互联网

- 依靠机器以及设备间的互联互通和分析软件，改变以前以单体智能设备为主的模式，通过高性能设备、低成本传感器、互联网、大数据收集及分析技术等的组合，提高现有产业的效率并创造新产业。
- 智能互联产品：由物理部件、传感器、数据存储装置、微处理器和软件组成的新产品；产品可作为一个数据采集端，不断将用户的数据上传到云端

The Impact of IT Waves on OM
—The third wave now (cont'd)

互联网时代的新技术浪潮
——德国的工业4.0

- 推动制造业向智能化转型
- 智能工厂：将传感器、嵌入式终端系统、智能控制系统、通信设施通过信息物理系统（Cyber-Physical System，CPS）形成一个智能网络，使世界和物理世界联组成智能生产些智能生产线、变化的制造需求
- 智能生产：动式，从事作业过网络实时访据信息内容自切换生产方式

互联网时代的新技术浪潮
——美国的工业互联网

- 依靠机器以及设备间的互联互通和分析软件，改变式，通过高性能设大数据收集及分析技效率并创造新产业。
- 传感器、数据存储装产品；产品可作为一数据上传到云端

互联网时代的新技术浪潮
——中国制造2025

- 以加快新一代信息技术与制造业深度融合为主线，以推进智能制造为主攻方向，在重点领域试点建设智能工厂、数字化车间，加快人机智能交互、工业机器人、智能物流管理等技术和装备在生产过程中的应用，促进制造工艺的仿真优化、数字化控制、状态信息实时监测和自适应控制。
- “三步走”：
  - 2025迈入制造强国行列，
  - 2035制造业整体达到世界强国阵营中等水平，
  - 2049年进入世界制造强国行列

The Impact of IT Waves on OM
—The third wave now (cont'd)

How can companies achieve sustainable competitive advantage in a shifting industry structure?

- **The basic tenets of strategy still apply.**
- **The foundation for competitive advantage is operational effectiveness .**

Why Study OM?

OM and Competitiveness —Profit logic of companies

Profit=Revenue-Cost

Revenue come from the sale of products and services

Whether products and services can be sold is determined by customer's purchase intention

customer's purchase intention is determined by several key factors - quality, price, delivery and flexibility

These factors are controlled by OM

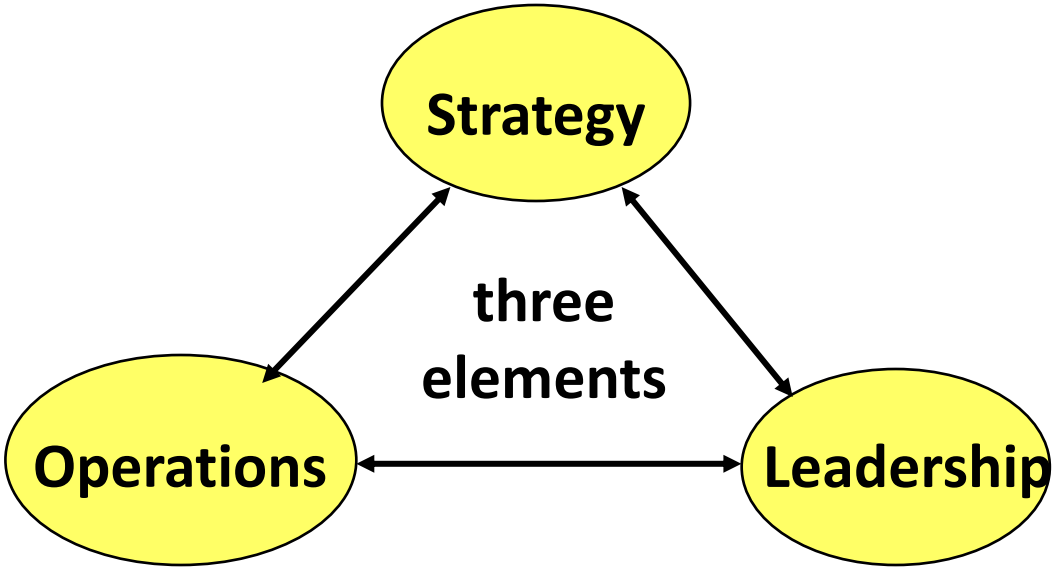
Low cost can be only achieved through efficient procurement and manufacturing as well as timely delivery

These processes' performance is also determined by OM

OM and Competitiveness — The role of OM in enterprises

- **OM are major aspects that enterprises create value**
- **Operations function occupies most of the organization's financial and human resources**
- **Competition among enterprises is ultimately depend on Products and services offered by them**

OM and Competitiveness —Three key elements for business



- **Strategy**—Do "**the right thing**"： What is business goal？
- **Leadership**—How to motivate and guide all employees to the goal?
- **Operations**—How to **rightly** do the "right thing"?

OM's Contributions to Society

- **Higher Standard of Living**
  - –Ability to increase productivity
- **Better Quality Goods and Services**
  - –Competition increases quality
- **Concern for the Environment**
  - –Recycling and concern for air and water quality
- **Improved Working Conditions**
  - –Better job design and employee participation

After This Class ……

- **Reference Reading: Chapter 1, 3, Textbook 1**
- **Get the book "*The Goal*" (《目标》) and begin to read**