



Operations & Logistics Management in Air Transportation

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Istanbul Technical University

Air Transportation Systems and Infrastructure

Air Transportation Management

Strategic Planning

M.Sc. Program

Module 1 : 9 June 2014

ADMINISTRATIVE MATTERS

- About the Instructors:
- David Gillen (UBC, Sauder School of Business)
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COURSE MATERIALS

- Required Materials-(Posted on the course website)
 - Syllabus (Posted on the course website)
 - Class slides, notes and other required readings
 - Course pack (cases)

- Recommended Materials
 - Matching Supply with Demand: An Introduction to Operations Management by Gerard Cachon & Christian Terwiesch, McGraw Hill
 - Irwin (2013, 3rd edition) – referred to as C&T in suggested readings

COURSE REQUIREMENT AND GRADING

Assignments and Cases	40%	3-4 assignments; In groups of 4 students (assignments 20% and Cases 20%)
Final Exam	45%	
Participation	15%	Criteria
Working in teams		Maximum of 4 people may work on assignments. Working in teams is not required but is encouraged.
<i>Ad hoc</i> Homework		Important for applying concepts

LEARNING OBJECTIVES-what are we trying to accomplish

- What is logistics?
 - Historically about cost economics
 - Contemporarily about demand generation
- What is operations?
 - Some clarification about terminology
 - Processes, supply chain management?
- Introduction to the “process perspective”
 - Operations focus on intra-firm processes
 - Logistics traditionally focuses on inter-firm processes

Emerge from
this course
with a Solid
Skills Set

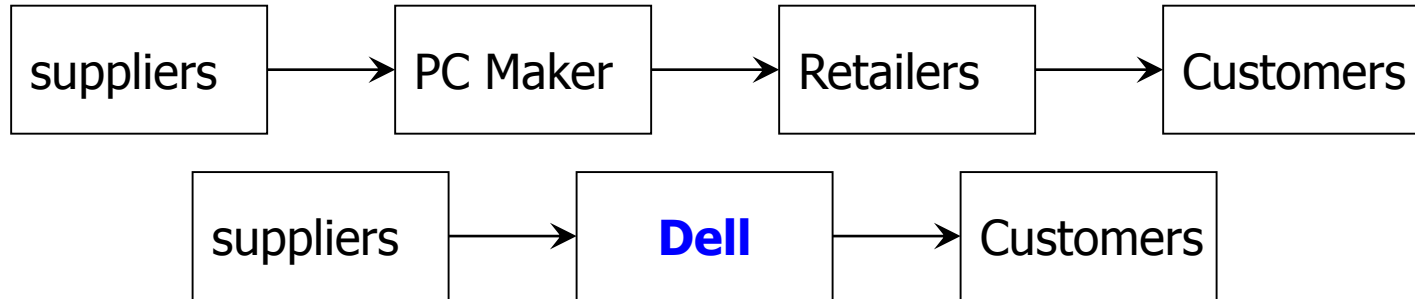
PC INDUSTRY 2005 (OLDER DATA)

	Dell	IBM	Apple	HP
Revenue (billion \$)	55.9	91.1	13.9	88.7
Net income (billion \$)	3.6	8.0	1.6	3.7
Number of employees	65,200	341,750	14,800	150,000
Revenue per employee	\$ 857,000	\$ 270,000	\$ 940,000	\$ 591,000
Income per employee	\$ 55,000	\$ 23,000	\$ 108,000	\$ 25,000
Days of inventory	4.6	19	6.1	38

Source: COMPUSTAT database, finance.yahoo.com



DELL COMPUTER



How it operates

- Bypassing dealers and selling directly to customers
- Assemble-to-order
- Information sharing with component suppliers in real-time
- Customer finances supplies before receiving product

What it benefits

- Eliminating dealers' markup; closer customer relationship
- Reduced finished goods (PC) inventory
- Reduced raw material (components) inventory
- For suppliers: better production scheduling, less inventory
- For customers: **Low price**

Dell's Messages

- ***Competitive strategy*** is about being different. It means deliberately choosing a different set of activities to deliver a unique mix of values.
- Different from other computer manufacturers who create technological values, *Dell creates values in balancing supply and demand.*
- Dell 'pulls' the product for delivery with customization, IBM & HP 'push' the product with standardization.

SOUTHWEST AIRLINES [Link to video](#)

Southwest targets customers who want convenience at low cost



How it operates

- Point-to-point flights between midsize cities and secondary airports in large cities
- No meal, no interline baggage transfer, no business class
- Frequent departure, automated ticketing
- All 737 aircrafts

What it benefits

- Avoiding congestion; faster turnaround at the gate (15 min); few aircrafts needed
- Reduced cost; faster turnaround at the gate
Attracting convenience-sensitive customers
- Reduced maintenance cost
- For customers: **Low price**

Southwest's Messages

- *Competitive strategy* is about being different. It means deliberately choosing a different set of activities to deliver a unique mix of values.
- Rethink revenue management.
Southwest airline creates values (low price and frequent departures) for price- and convenience-sensitive customers by sacrificing certain services.
- Reduce operational costs by being efficient and flexible
 - Even boarding the airplane is a simplified process!

IKEA

[Link to video](#)



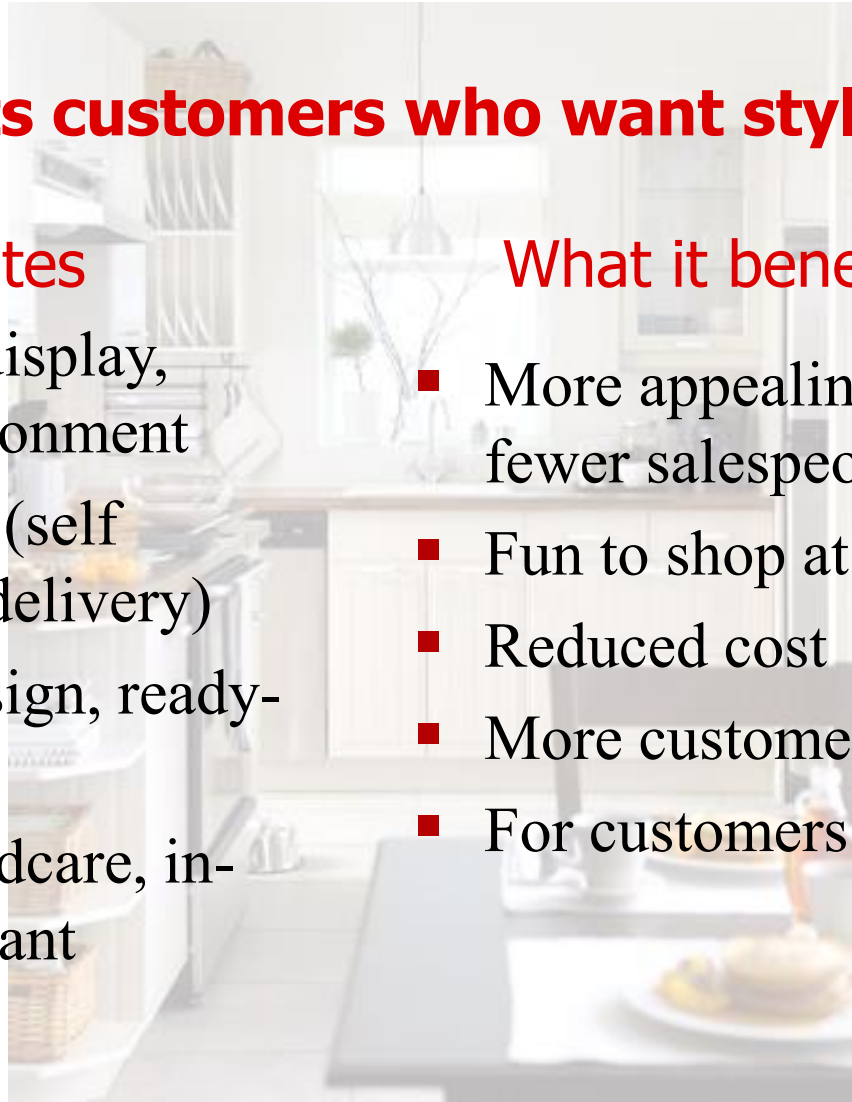
IKEA targets customers who want style at low cost

How it operates

- Room-like display, family environment
- Self-service (self pickup and delivery)
- Modular design, ready-to-assemble
- In-store childcare, in-store restaurant

What it benefits

- More appealing to customers, fewer salespeople needed
- Fun to shop at IKEA
- Reduced cost
- More customer satisfaction
- For customers: **Low price**



IKEA's Messages

Competitive strategy

- is about being different. It means deliberately choosing a different set of activities to deliver a unique mix of values.

Operational strategy

- Different from other furniture stores where budget-constrained shoppers are reluctant to step in, IKEA creates values for these customers. All of the IKEA designs and services are aligned with the needs of its customers.
- Be smart about selling cheap low quality furniture
- Increase revenue and decrease costs at the same time.
- Make customers act like 'employees'

FRESH EXAMPLE: YOUR MECHANIC

- Winner of TechCrunch Disrupt 2012
- Aim: streamline the process of getting your car fixed or serviced without having to leave home
- 80% of car issues do not require the expensive amenities found in shops



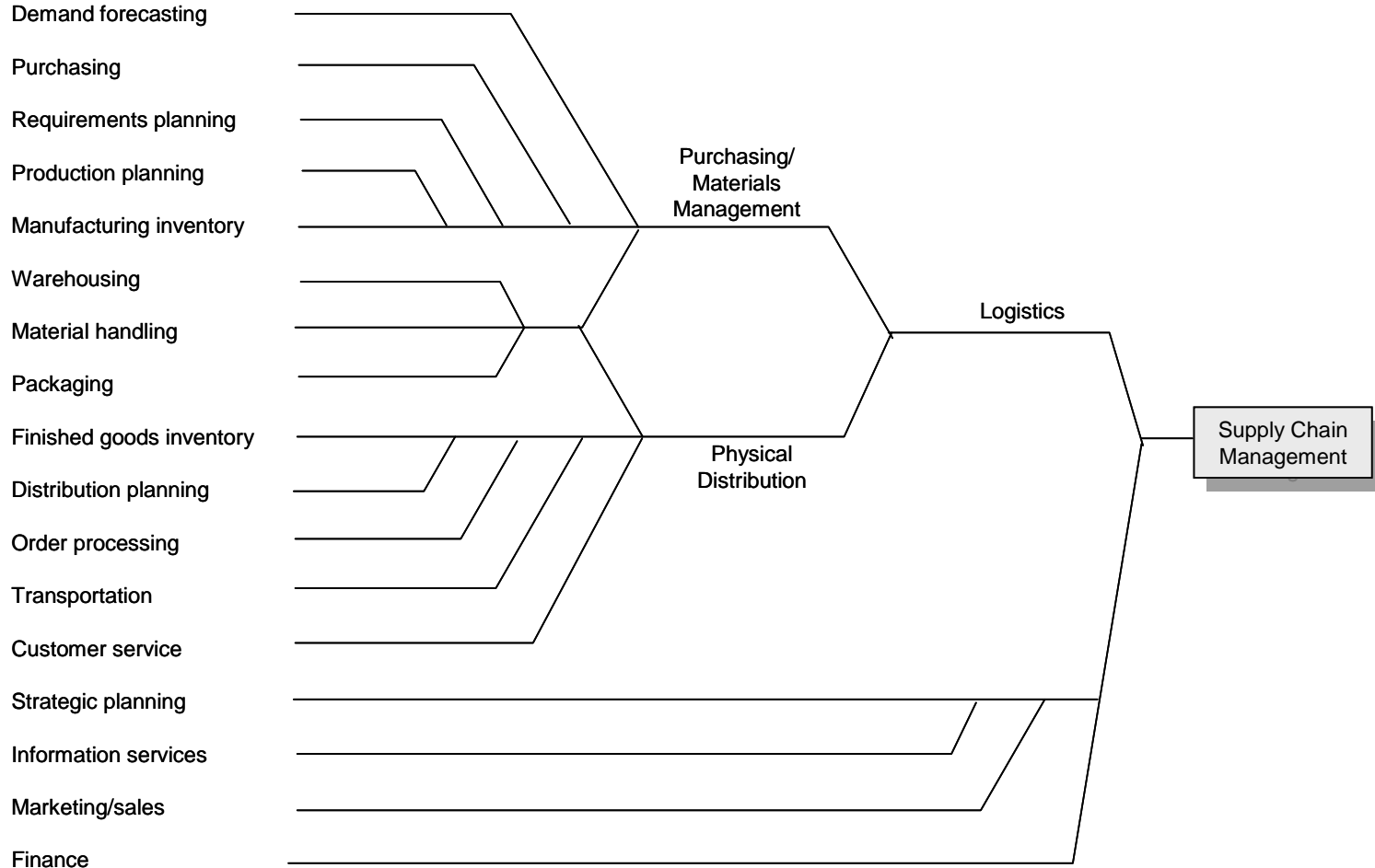
- What other services might this work with? Hair cuts/styling, manicures, pedicures, wardrobe choice?

EVOLUTION OF SUPPLY CHAIN MANAGEMENT

Activity fragmentation to 1960

Activity Integration 1960 to 2000

2000+



Year	Concept	Tool	Originator
1900	Scientific management	Time and work-study	Frederick Taylor
	Industrial psychology	Motion study	Frank & Lillian Gilbreth
1920	Mass production	Assembly line	Henry Ford & Henry Gantt
	Economic lot size	EOQ applied to inventory control	F.W. Harris
1930	Quality control	Sampling inspection, SPC	Walter Shewhart
	Hawthorne Studies of worker motivation	Work analysis	Elton Mayo
1940	Operations Research	Simplex method of LP	George B. Dantzig
1970	Computers in business	MRP, Inventory Management	IBM
	Service quality & productivity	Mass production in the service sector	McDonalds
1980	JIT, TQC, and factory automation	Kanban	Tai-Ichi Ohno
	Synchronous manufacturing	Theory of constraints	Eliyahu M. Goldratt
1990	Total quality management	ISO	ISO
	Business process reengineering	Radical change	M. Hammer
	Supply chain management	SAP	SAP, Oracle
2000	E-commerce	Internet	Amazon, eBay

THE TRADITIONAL VIEW OF OM

- OM used to be the science of manufacturing, production, and *logistics*.
- Traditionally, typical operational issues were:
 - Given demand forecasts and product lines, how should the production be planned, sequenced and scheduled?
 - How should inventories of the raw materials and work in process goods be managed (warehoused, transported, etc.)?
- These traditional issues are **still crucial** to the success of today's business.

WHERE DOES LOGISTICS FIT?

- *Traditional view*: ‘is the process of planning, controlling and implementing the efficient, cost effective flow and storage of raw materials, in-process inventory finished goods and related information, from the point of production to the point of consumption AND meeting customer needs and requirements. (supply side)
- *Modern*: it is the integration of all of these processes to achieve better relationships to ensure a sustained competitive advantage (demand side)

THE CURRENT VIEW OF OM

- Today OM refers more generally to the study of business processes.
- OM concerns both **manufacturing** industries and **service** industries.
- Today, typical issues are:
 - How can we manage tradeoffs?
 - How can we balance supply and demand?
 - How can we provide the best value to the customers?
- OM has changed from being purely **tactical** to more **strategic**.

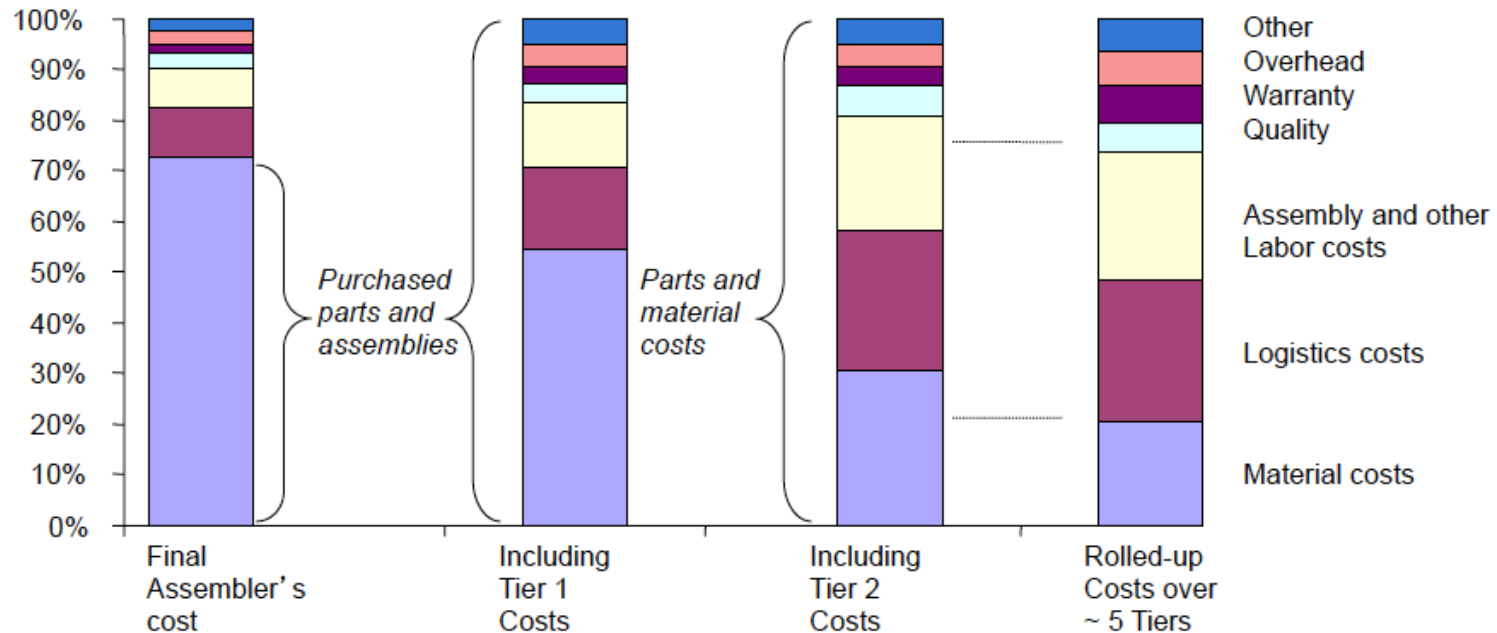
WHAT IS OPERATIONS?

- Delivering value by the proper *execution* of strategic goals
 - “When companies fail to deliver on their promise, the most frequent explanation is that the ... strategy was wrong. But the strategy is ... not often the cause. Strategies fail most often because they are not executed well.” *Execution: The Discipline of Getting Things Done* by Larry Bossidy and Ram Charan
- Three Key Points of Execution
 - **Execution** is a discipline, and integral to strategy
 - **Execution** is the major job of the business leader
 - **Execution** must be a core element of an organization’s culture

The Economic Consequences of the Supply-Demand Mismatch are Severe

	Air travel	Emergency room	Retailing	Iron ore plant	Pacemakers
Supply	Seats on specific flight	Medical service	Consumer electronics	Iron ore	Medical equipment
Demand	Travel for specific time and destination	Urgent need for medical service	Consumers buying a new video system	Steel mills	Heart surgeon requires pacemaker at exact time and location
Supply exceeds demand	Empty seat	Doctors, nurses, and infrastructure are under-utilized	High inventory costs; few inventory turns	Prices fall	Pacemaker sits in inventory
Demand exceeds supply	Overbooking; customer has to take different flight (profit loss)	Crowding and delays in the ER, potential diversion of ambulances	Foregone profit opportunity; consumer dissatisfaction	Prices rise	Foregone profit (typically not associated with medical risk)
Actions to match supply and demand	Dynamic pricing; booking policies	Staffing to predicted demand; priorities	Forecasting; quick response	If prices fall too low, production facility is shut down	Distribution system holding pacemakers at various locations
Managerial importance	About 30% of all seats fly empty; a 1-2% increase in seat utilization makes difference between profits and losses	Delays in treatment or transfer have been linked to death;	Per unit inventory costs for consumer electronics retailing commonly exceed net profits.	Prices are so competitive that the primary emphasis is on reducing the cost of supply	Most products (valued \$20k) spend 4-5 months waiting in a trunk of a sales person before being used

Cost Structure of an Automotive Company



- Vast majority of costs are driven by purchasing (design determines purchasing costs)
- Understand cost structures
- Economic tools of negotiations / auctions
- Streamline supply base
- Help suppliers develop their processes: by working with suppliers and sub-suppliers, costs can be improved (link to lean)

EXHIBIT 4

Eliminating delays

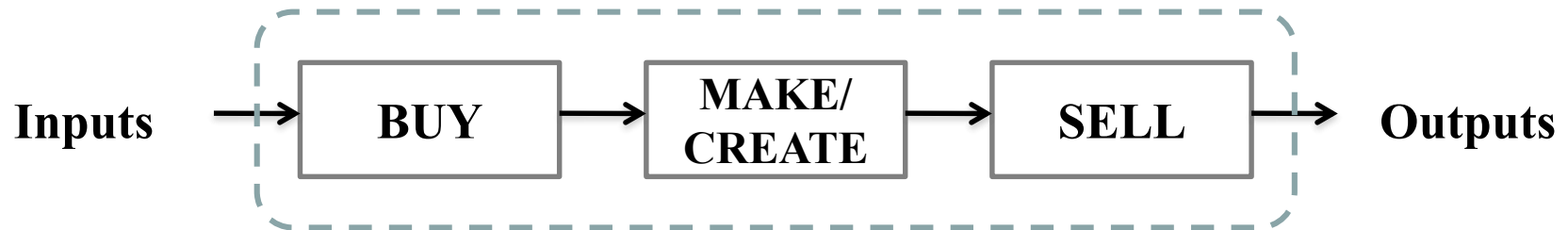
	Turnaround time between flights ¹		Lean techniques
	Average number of minutes per step	Best practice: minimum number of minutes per step ²	
Unload passengers ³	6:14	4:38	<ol style="list-style-type: none"> 1. Stricter controls on carry-on bags, fewer passengers moving back in aisle to find bag 2. Cleaning crew in position ahead of time 3. Standardized work flow, timing, and methods, such as cleaning supplies in prearranged kits 4. Visual signal from cabin crew to agent when plane is ready to board—for example, light flashing at top of ramp 5. Active management of overhead storage bins by flight attendants 6. Passenger information list delivered by agent following last passenger to board 7. Agent ready at aircraft to close door
Wait for cleaning crew to board aircraft	0:24	0:18	
Clean airplane	11:48	9:40	
Wait for transmission to gate of cabin crew's approval to board	4:11	0	
Wait for first passenger to board	4:06	0	
Load passengers	19:32	16:00	
Wait for passenger information list	1:58	0:13	
Close aircraft door	0:57	0:09	
Detach boarding ramp	1:39	0:43	
Total time (including initial steps³)	52:18	33:11	

¹For Airbus A320 single-aisle medium-range airliner (disguised example).

²Assumes rudimentary application of lean techniques; further reductions may be possible.

³Initial steps (attaching boarding ramp, opening aircraft door, and waiting for first passenger to deplane) can't be significantly reduced.

EXECUTION: TRANSFORM INPUTS INTO OUTPUTS



Inputs

- Capital
- Materials
- Equipment
- Facilities
- Labor
- Knowledge
- Time

Transformation

- Buy
- Make/ Create
- Sell
- Move

Outputs

- Products
- Services

Operations Management is the management (design, operation, and improvement) of the transformation processes that create value.

SERVICE VS. PRODUCTS



- Intangible, perishable output
- Output cannot be inventoried
- High customer contact
- Short response time
- Small facilities
- Labour intensive
- Quality not easily measured
- Local markets

- Physical, durable output
- Output can be inventoried
- Low customer contact
- Long response time
- Large facilities
- Capital intensive
- Quality easily measured
- Regional, national, or international markets

PROCESSES: EXAMPLES

- *You order a computer from Dell.* What are the different steps that Dell takes in fulfilling your request?
- *You walk into a car dealership,* and drive out with a new car. What steps had to be completed to get that car to you?
- *You go into a restaurant for a fine meal.* What steps did the restaurant have to go through to create a satisfactory experience for you?
- *Your telephone is not working.* You call the phone company. What steps does the company need to execute to respond to your problem?
- *You have to operate a flight* from IST to Izmir, what steps would you have to do to make this happen? Suppose it was a flight from IST to FRA, what are the differences in steps if any?

TRANSFORMATION PROCESSES: EXAMPLES

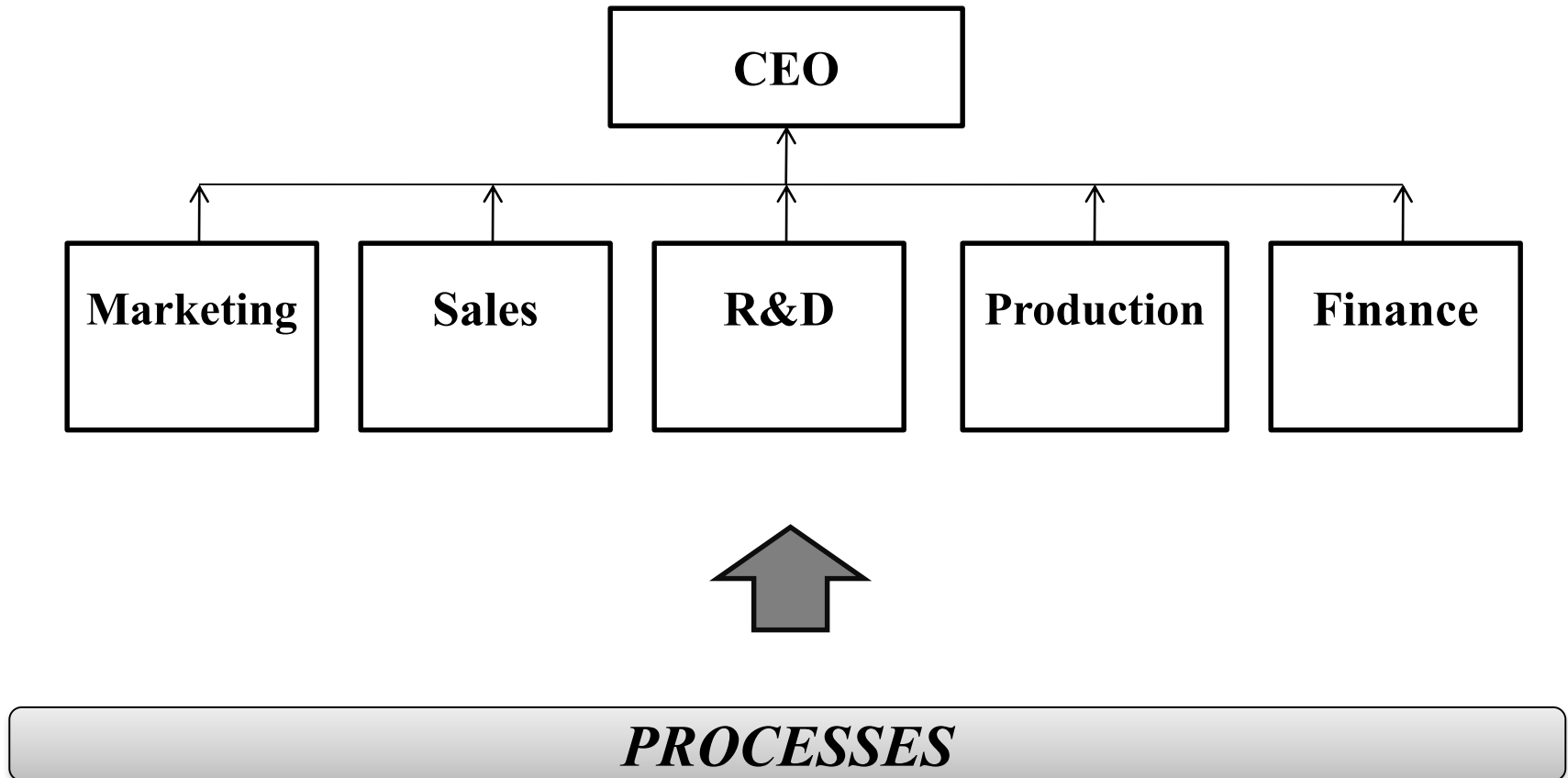
Production System	Primary Inputs	Transformation	Primary Outputs
<i>Automobile Factory</i>	Purchased parts raw materials, tools, equipment, workers	Fabrication and assembly	Automobiles
<i>Restaurant</i>	Hungry customers, raw materials, workers, equipment	Transform raw materials into food and serve the customers	Satisfied customers
<i>University</i>	Students, teachers, staff, books, supplies, buildings	Transmit information, develop knowledge and skills	Educated individuals

EVERY ORGANIZATION HAS SEVERAL PROCESSES

At a PC manufacturer ...

- Assembly Process: Transforms circuit boards, a PC case, screws, wires, ... and assemblers' time into assembled PCs
- Order Fulfillment: Transforms customer orders into delivered orders
- Accounting Process: Transforms data into financial statements
- Strategic Planning Process: Transforms inputs including information (about competitors and the external environment) and planners' time into a strategic plan

Processes are often “invisible”



WHICH PROCESSES ARE WE INTERESTED IN?

Operations Management

BUY	Procurement, Financing, Hiring
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MAKE/CREATE	Design, Manufacturing, Production, Service
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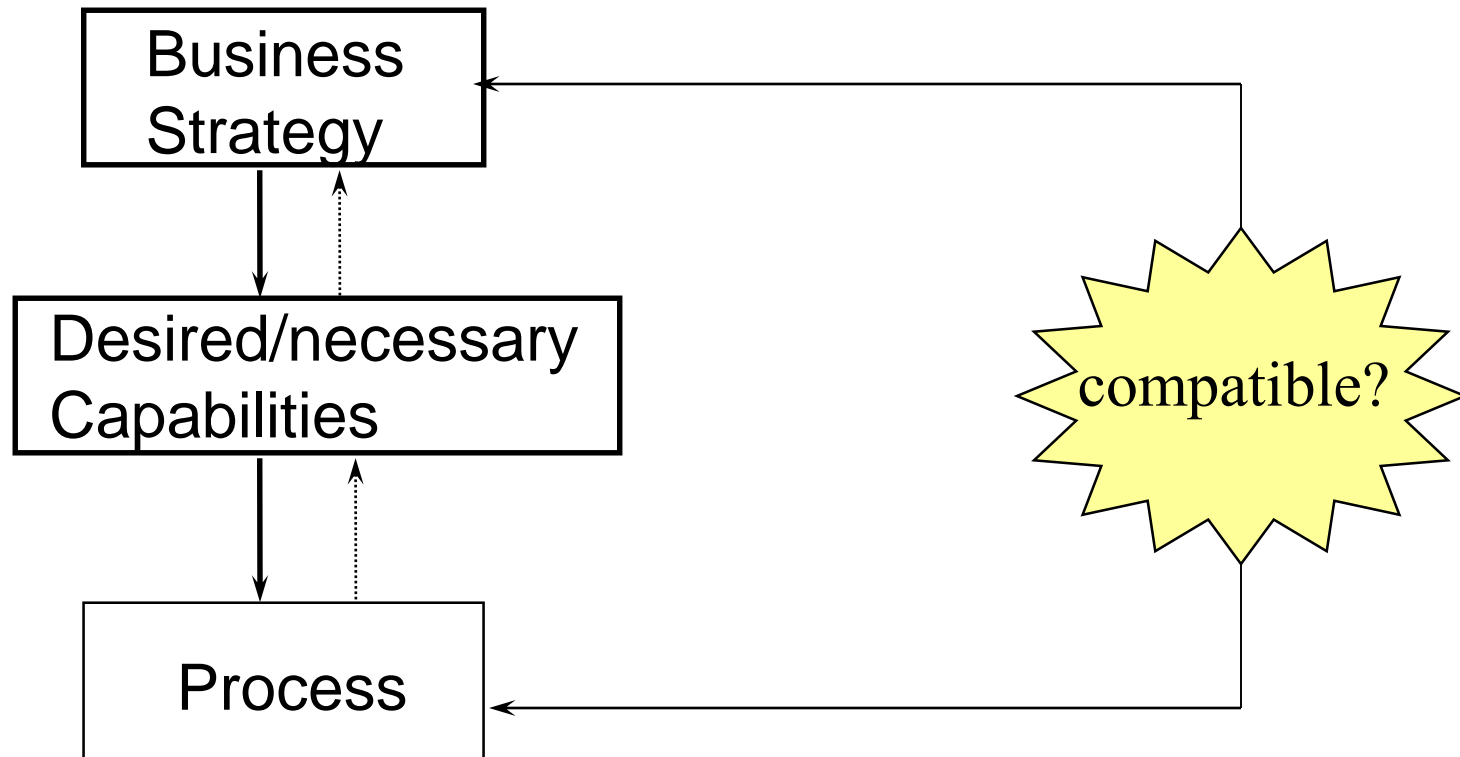
SELL	Distribution, Marketing, Revenue Management
-------------	---------------------------------------------

MOVE	Logistics, Transportation, Warehousing
-------------	-----------------------------------------------

All of the above	Supply Chain Management
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WHAT IS A GOOD PROCESS?

The Strategic View (The Effectiveness View)



THE ELEMENTS OF STRATEGY

Time Horizon

- Short Term
- Intermediate
- Long Term

Evaluation

- Cost
- Quality
- Profitability
- Customer satisfaction

Focus

- Process Technology
- Market Issues
- Volume
- Quality
- Manufacturing Tasks

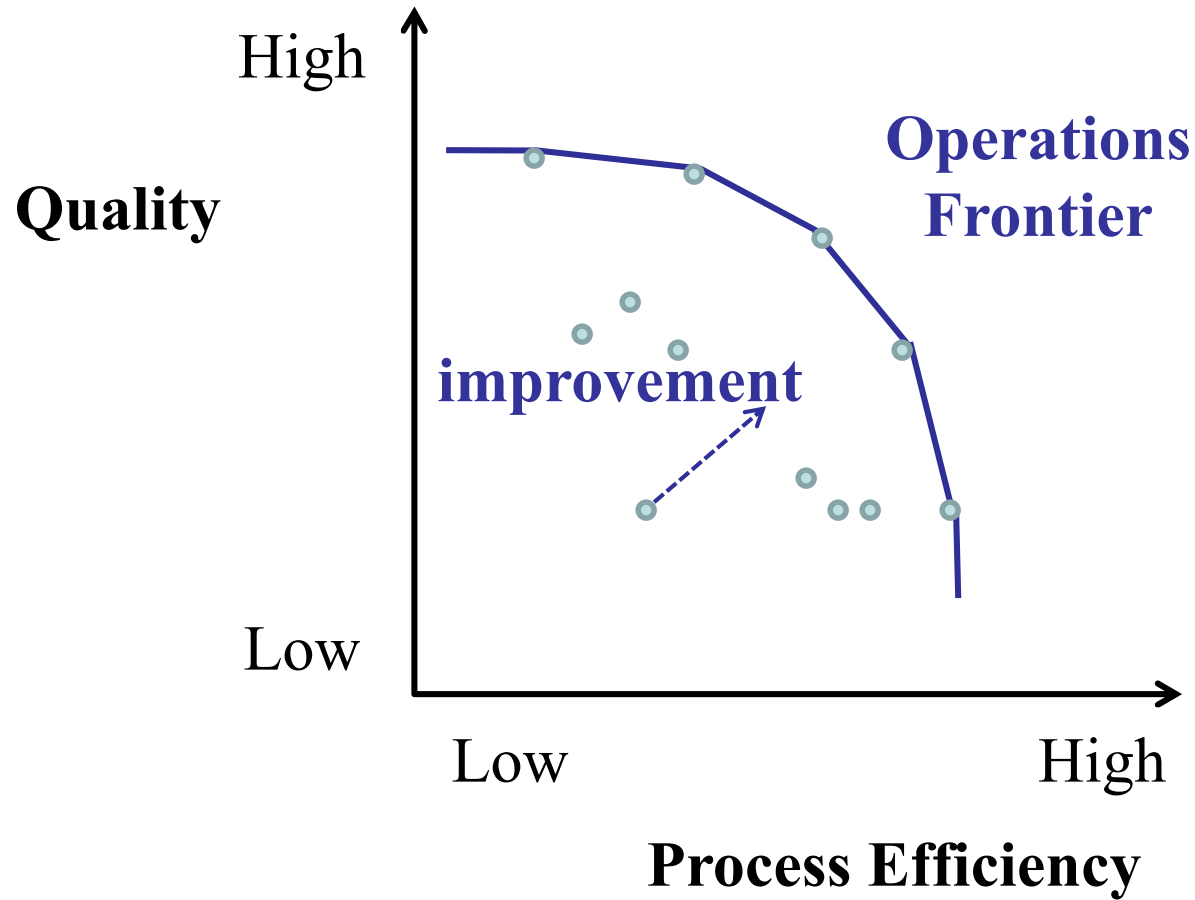
Consistency

- Professionalism
- Proliferation
- Changes in mfg. task
- Explicit goals

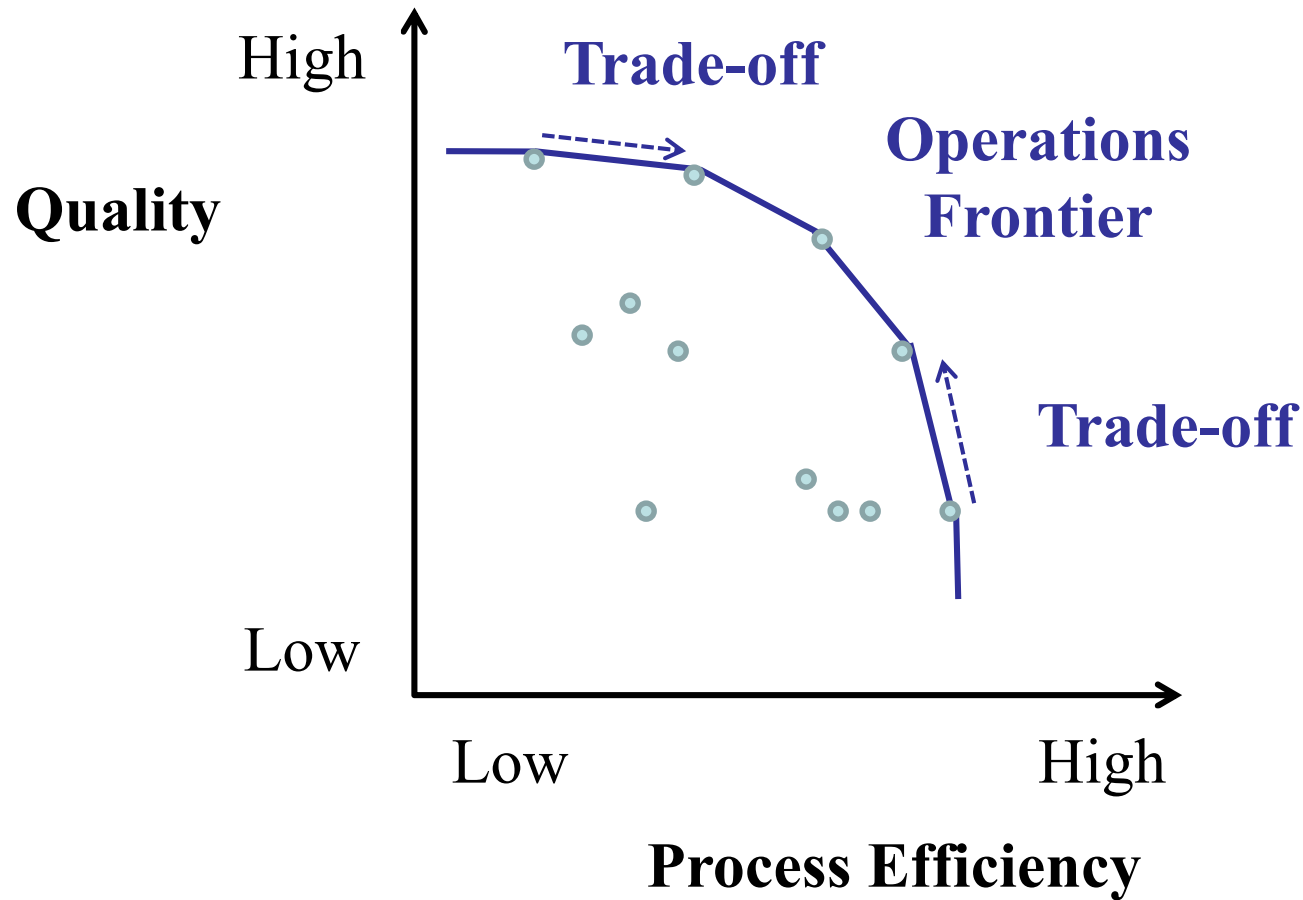
Competitive Dimensions Operational Capabilities Examples

• Price	• Low cost processes	Southwest
• Product quality and reliability	• High quality process • Consistent quality	Rolex McDonalds
• Time	• Delivery speed • On-time delivery • Development speed	UPS Domino's Samsung
• Flexibility	• Customization • Variety • Volume flexibility	Dell Harrods Electricity

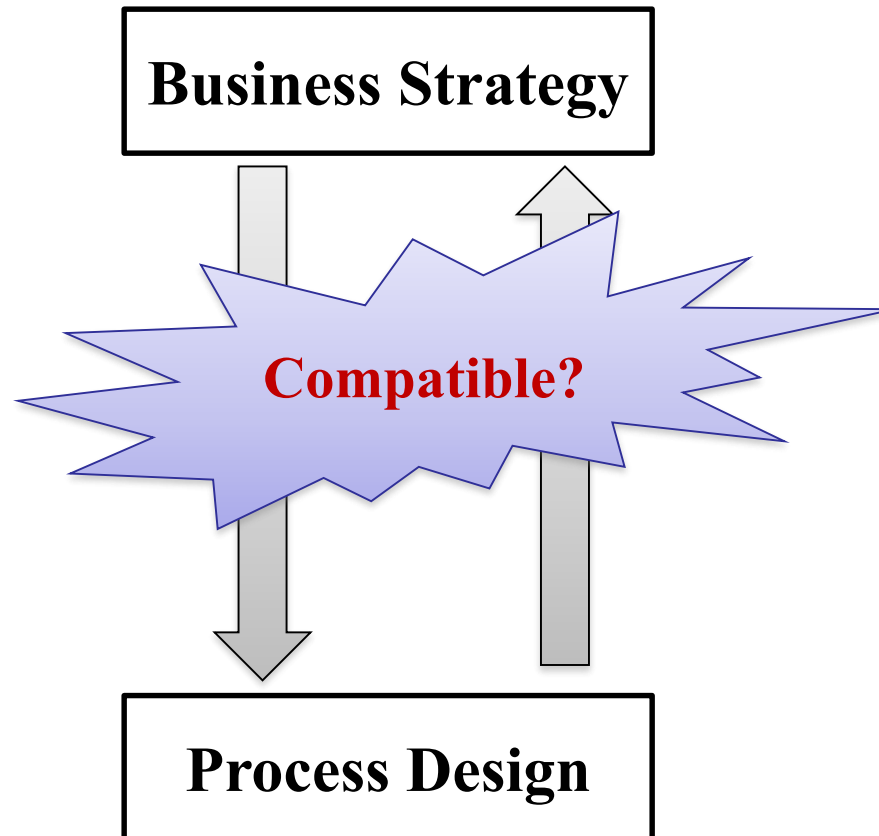
OPERATIONS FRONTIER



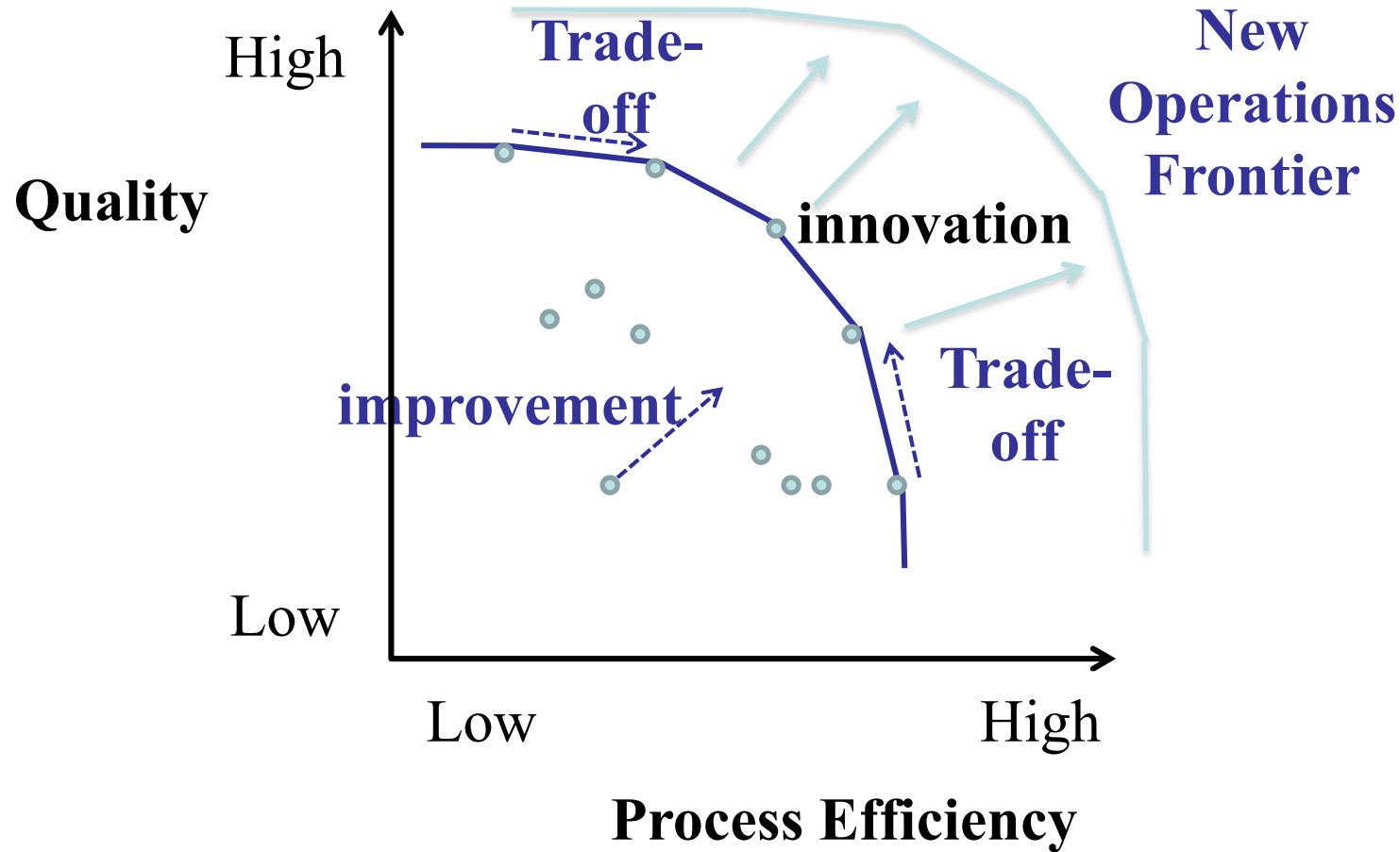
OPERATIONS FRONTIER & PROCESS DESIGN



STRATEGIC FIT



PROCESS INNOVATION



OPERATIONS TACTICS, STRATEGY & *INNOVATION*

- Operations management involves both tactical and strategic issues

Tactical Issues	Strategic Issues
Ensuring that the firm is on the operations frontier	Choosing the correct position on the operations frontier

- **Operations Innovation:** Moving the Operations Frontier

THIS COURSE WILL FOCUS ON PROCESSES

- Making processes visible and *understanding* how a process works
- *Managing* processes
 - **Measuring** process performance
 - **Analyzing** and improving processes
 - **Challenges** in managing processes

HOW TO *MEASURE* PROCESS PERFORMANCE?

- Before we can manage or improve process, we have to know when a process is performing well and when it is not
- So what are the criteria or metrics of performance? What is good or bad performance?
- What is a GOOD PROCESS?
 - Productivity (maximize output for a given amount of input)
 - Efficiency (Minimize cost)
 - Effectiveness (Delivering the right product at the right time to the right customer)

Match supply and demand at least cost

PERFORMANCE METRICS

- Process Efficiency (PEP, TFP)
 - Output / Input
- Process Utilization
 - Capacity Used / Total Capacity
- Quality
 - Defect rate
 - Time to completion
 - Service level (includes consistency)

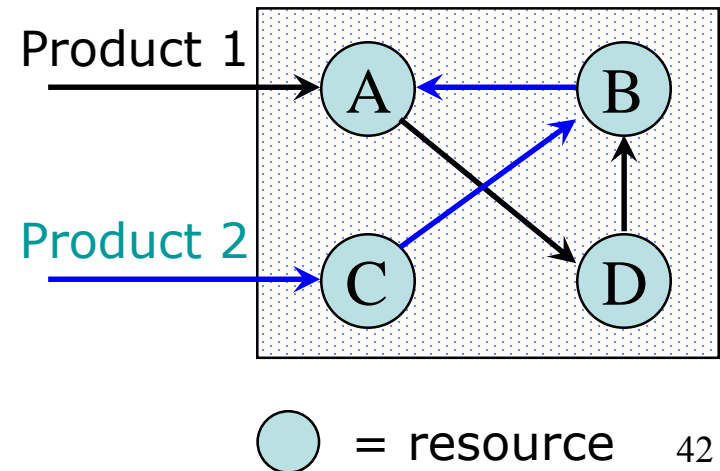
(e.g., Percentage of flow units that spend more than x amount of time within the process)

CLASSIFICATION OF A PROCESS (BY VOLUME)

1. Job Shop
2. Mass Production (Flow or Repetitive)
3. Batch or Intermittent Production

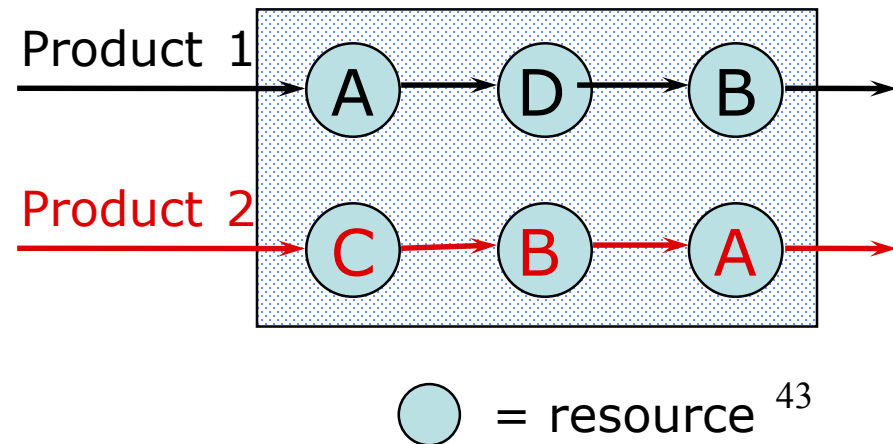
JOB SHOP PRODUCTION

- Low volume
- Engineered-to-order and/or made-to-order
- Manufacturing process is intrinsically variable and cannot be optimized once and for all
- Functional or process layout



MASS PRODUCTION - (FLOW OR REPETITIVE)

- Flow production: Non-discrete products using a continuous process
- Repetitive production: Assemblies using a continuous process
- Process Layout
- Low Cycle Times



INTERMITTENT PRODUCTION : (BATCH PRODUCTION)

- A form of manufacturing in which the jobs pass through the functional departments in lots, and each lot may have different routing (APICS Dictionary).
- Normally, involves setup costs and medium product mix competing for resources.



CHARACTERISTICS OF PROCESSES:

JOB SHOP VS. FLOW SHOP

Type of Process	Product Volume	Equipment Specialization	Product Variety	Machine Setup Frequency	Labor Skills	Variable Cost
Job Shop	low	low	high	high	high	high
Batch						
Flow Shop	high	high	low	low	low	low

Equipment specialization is the opposite of equipment versatility

Product-Process Matrix

		Low volume Many products				High volume Standard products		Very high volume Commodity products	
		One of a kind		Very low volume					
		Product		Process					
Job shop	Project	Space shuttle							
	Job shop			Print shop					
	Batch					Bakery			
Flow shop	Assembly line or Flow shop					Car assembly			
	Continuous flow							Petroleum refining	

What is a Good Process?

LESSONS FROM THE PP MATRIX

- Importance of matching product attributes to process
- Importance of matching product/process position to competitive strategy
- The trade-off between the **flexibility** of a job shop and the **efficiency** of an assembly line

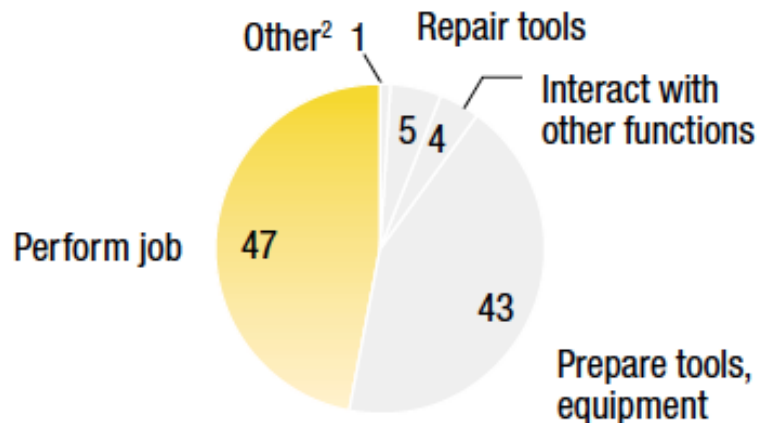
EXHIBIT 2

Wasted time

Percentage of time spent by activity (disguised example)

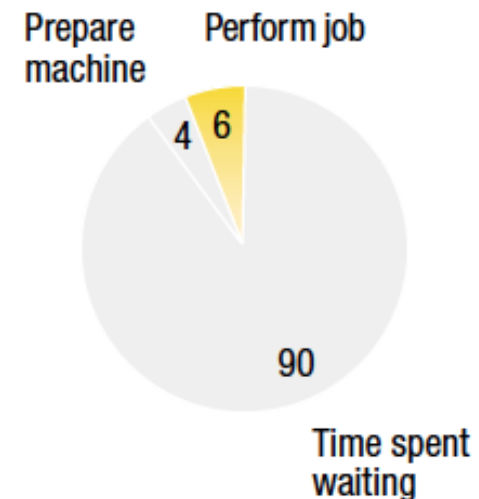
A-1 check¹ (airframe)

100% = ~30 scheduled person-hours



Landing-gear subassembly (machining T-bolt)

100% = 47 scheduled workdays



¹Aircraft undergo multiple A-checks, whose type and sequence depend on the aircraft's particular maintenance program.

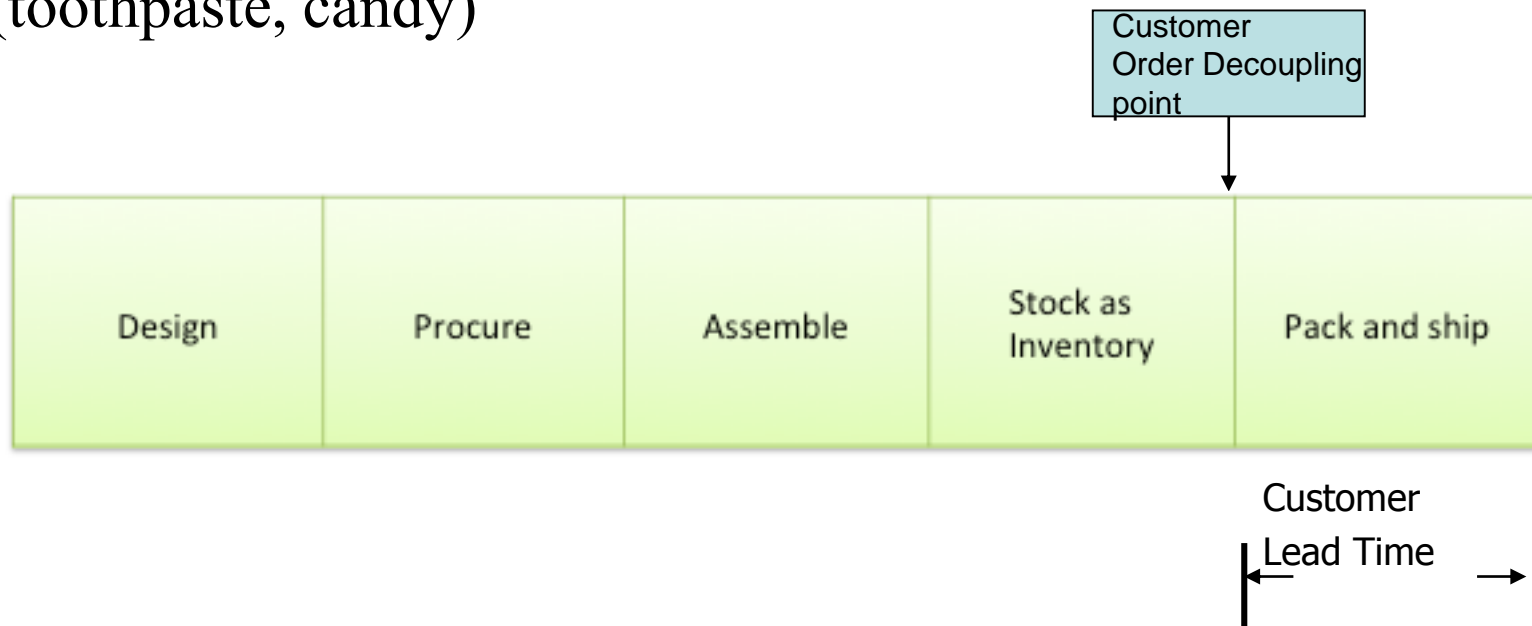
²Includes nonvalue-adding activities such as time spent waiting.

CLASSIFICATION OF PROCESSES: BY CUSTOMER INTERFACE

- Make to Stock (MTS)
- Make to Order (MTO)
- Assemble to Order (ATO)
- Engineer to Order (ETO)

MAKE TO STOCK (MTS)

- Immediate delivery of goods
- Based on a predictable demand pattern
- Customer orders do not affect the production process directly.
- Examples: off-the-shelf items from big (cars, TV sets) to small (toothpaste, candy)



MAKE TO ORDER (MTO)

- Production starts after the order is received from the customer
 - Produced to customer specifications
 - Customer is willing to wait
 - Product is expensive to make and store
 - High product mix
- Examples: custom home, tailor made suit, commercial airplanes, wedding cake, professional services

Customer Order
Decoupling Point (CODP)



<----- Customer Lead Time ----->

ASSEMBLE TO ORDER (ATO)

- Produce and stock Modular component
- Assemble the finished goods according to the component selected by the customer
- Modular design
 - Independent component units which integrate as a whole
- Allows customization with standard products
- Examples: standard vacation packages, food assemblies, (Dell?)

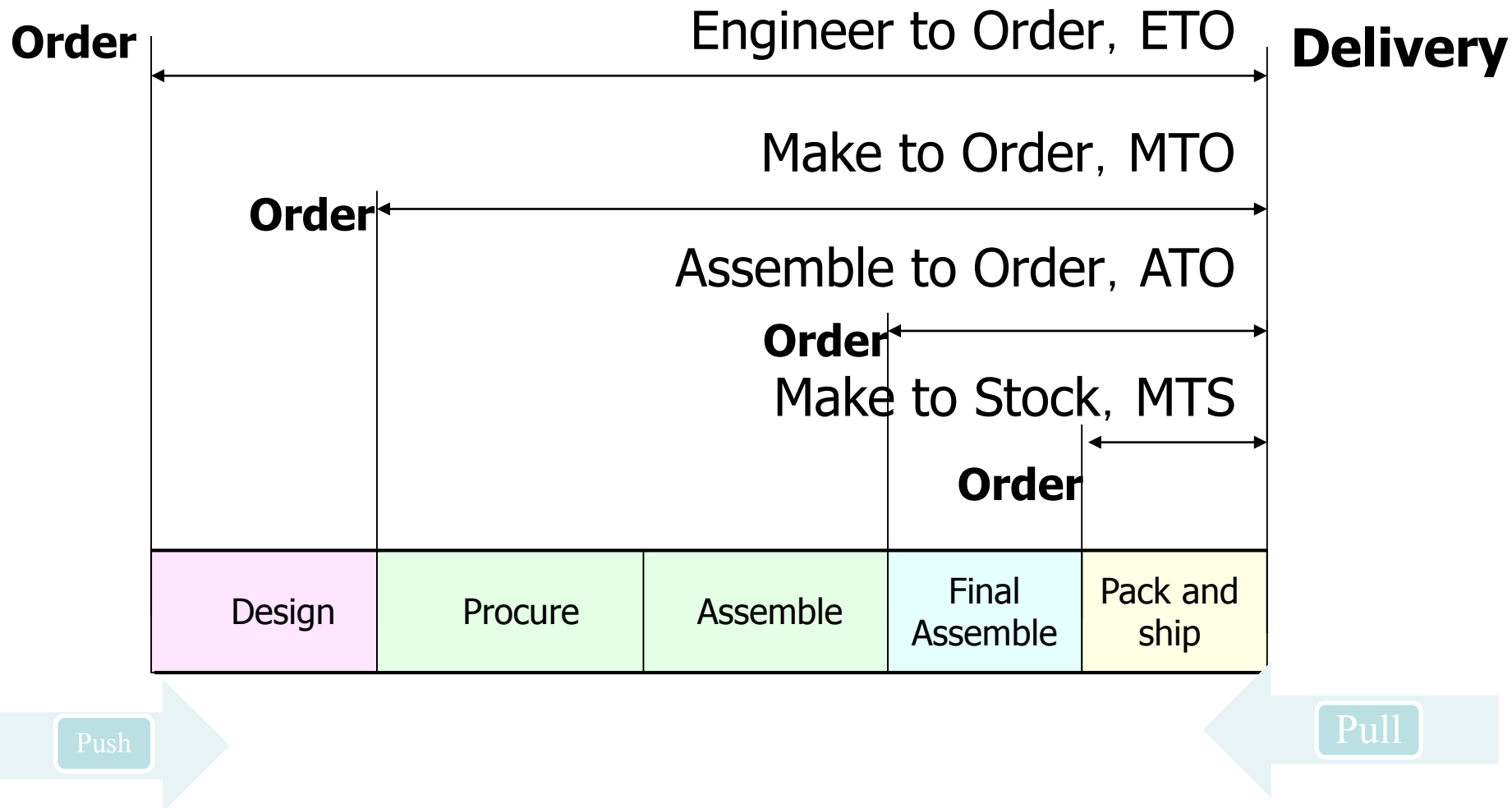
Customer Order
Decoupling Point (CODP)

food



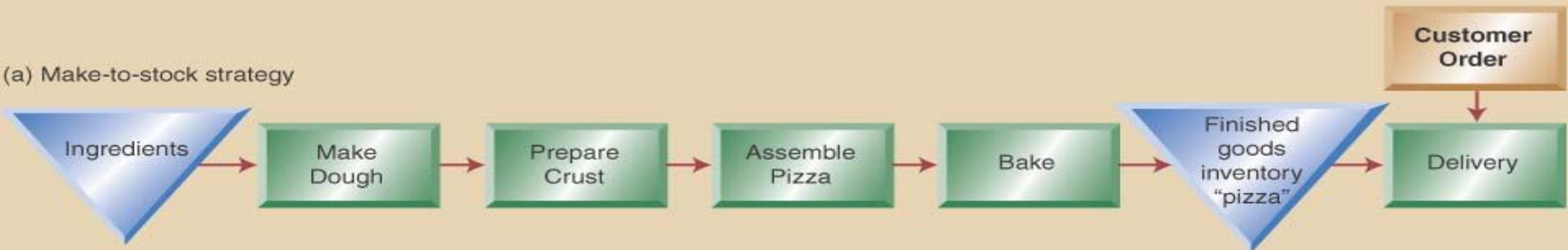
| <- Customer Lead Time ---> |

MANUFACTURING ENVIRONMENTS

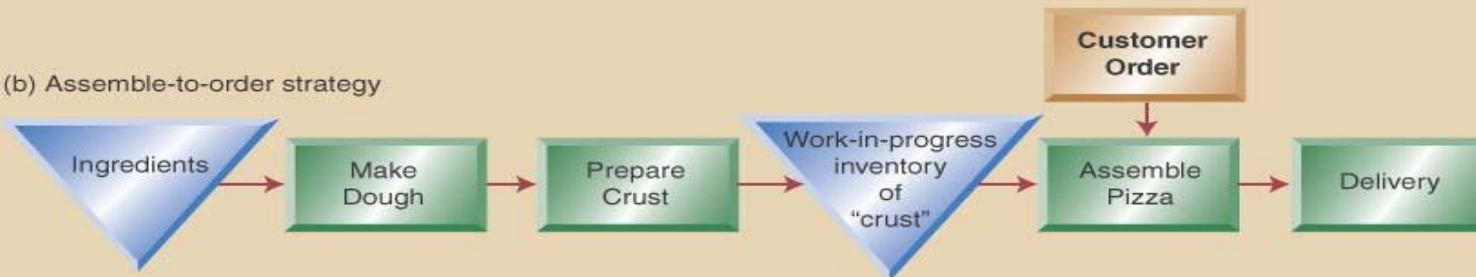


OVERVIEW OF STRATEGIES

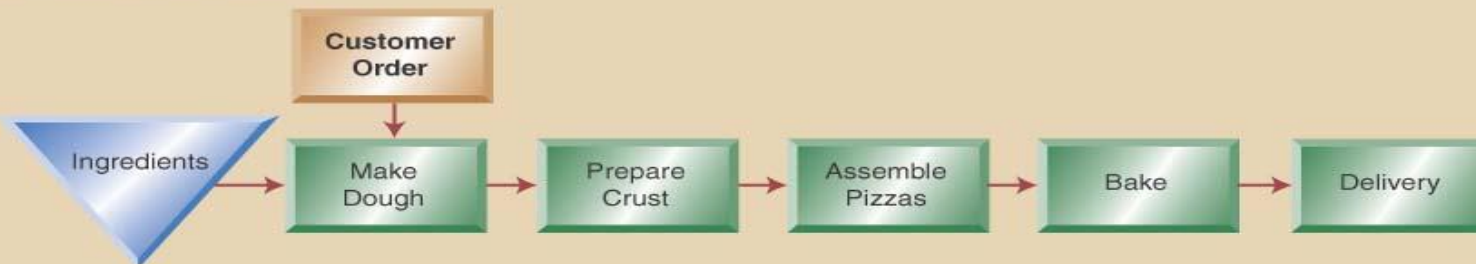
(a) Make-to-stock strategy



(b) Assemble-to-order strategy



(c) Make-to-order strategy



THIS IS ALL OBVIOUS, RIGHT?

- Maybe in theory, but what happens in practice?
- What can go wrong?
- The business world is full of uncertainties and making sure that your processes perfectly is not easy!
- But ... some companies consistently do a lot better than their competitors

WHAT CAN GO WRONG?

- Processes can be *badly designed*
 - E.g., do not fit the purpose
- Processes can be *inefficient*
 - E.g., mismatch between supply and demand
- Ideally, the process should be designed and managed to efficiently meet the demands placed on it

EXAMPLES

- Apple

Tim Cook, executive vice president of global sales and operations for the Cupertino, Calif.-based company, said Apple shipped 1 million Nanos in the final 17 days of the quarter but fell well short of demand. “Demand for this product is staggering,” he said. “We ended the quarter with enormous backlog.” (Forbes Oct 12 2005)

Who paid for this mismanagement?

Partly due to this inventory problem, on Oct. 11th 2005 Apple Stock Dropped 10%

EXAMPLES

- **Flu Vaccine:** In the 2009-2010 flu season, 95 million doses of flue vaccine were produced but demand was much lower and excess vaccines had to be destroyed. In the next season, insufficient vaccines were available and there were widespread shortages.
- **Polar Vortex:** In January, 2014 when extremely cold weather hit Canada and the U.S., airports were shut for 2-3 days (Pearson Airport in Toronto accounts for 50% of flights was shut for 2 days!) *“We are really sorry about the inconvenience faced by the passengers and we apologize for that and I can promise, going forward, we can and will do a better job,”* [YYZ cancelled 600 flights, US airports in Midwest and northeast cancelled 31,00 on Monday and 4200 on Tuesday

GENERAL MOTORS VERSUS TOYOTA

	GM Framingham	Toyota Takaoka
Assembly hours per auto	31	16
Assembly space per auto	8.1	4.8
Assembly defects per 100 autos	135	45
Average inventory of parts	2 weeks	2 hours

Source: International Motor Vehicle Program, MIT, 1990

GENERAL MOTORS VERSUS TOYOTA (2007)

	GM	Toyota
Revenue (billion \$)	181.12	262.39
Net income (billion \$)	-4.39	17.15
Number of employees	263,000	323,650
Revenue per employee	\$688,672	\$810,733
Income per employee	-\$16.692	\$52,977
Market Cap. (billion \$)	\$5.66	\$141.07
Days of inventory	44	31

Source: finance.yahoo.com

RETAIL INDUSTRY (2007)

	Walmart	Sears
Revenue (billion \$)	378.8	50.7
Net Income (billion \$)	12.9	0.83
Number of employees	2,100,000	337,000
Revenue per employee	\$180,381	\$150,445
Income per employee	\$6,143	\$2,463
Days of inventory	45	103

Source: finance.yahoo.com

AIRLINE INDUSTRY

- In 2008, Southwest Airlines posted a profit for its 36th consecutive year
- Between 2001 and 2005, the US airline industry posted \$42 billion in net losses
 - Some airlines filed for bankruptcy protection, and many underwent massive efforts to restructure their business

LESSONS

- Every organization (manufacturing or service) has a process at its core for creating goods and services
- More visible measures of performance (e.g., profits, return-on-assets, customer satisfaction) directly depend on how good this process is

SECRETS OF BETTER EXECUTION

- Understand the “physics of process flows”
 - How to map processes?
 - How to measure and analyze process performance?
 - What are some key operational challenges (or trade-offs)?
- Once you understand the process, you can
 - Design processes
 - Optimize process performance
 - Overcome operational challenges

The Operations/Logistics Strategy Triangle

Inventory Strategy

- Forecasting
- Storage fundamentals
- Inventory decisions
- Purchasing and supply scheduling decisions
- Storage decisions

Transport Strategy

- Transport fundamentals
- Transport decisions

Customer service goals

- The product
- Logistics service
- Information sys.

Location Strategy

- Location decisions
- The network planning process

