MSBA 7004
Operations Analytics

Class 1-1: Introduction to Operations Analytics
Process view of operations
2024

MSBA 7004 Teaching Team

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MSBA 7004 Teaching Team

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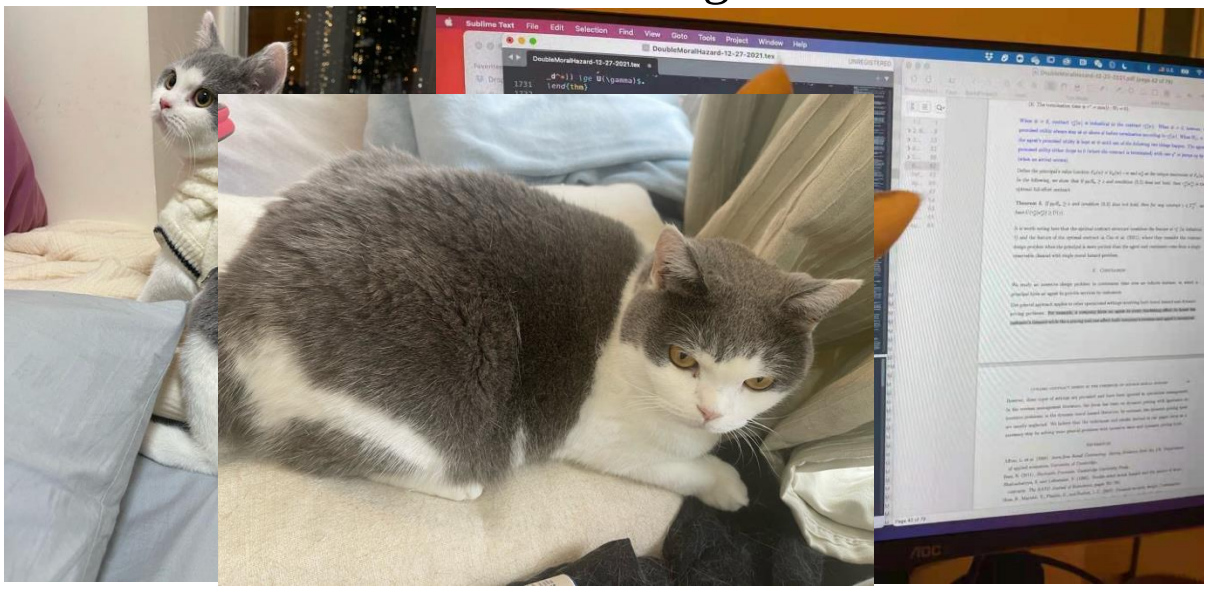
TA: Shawn Li, ls499858@hku.hk, C/D class grading and administrative work

Assistant Instructor: Bagel



Getting to Know you

Please bring your "Name Tent" to every class.

Who am I?

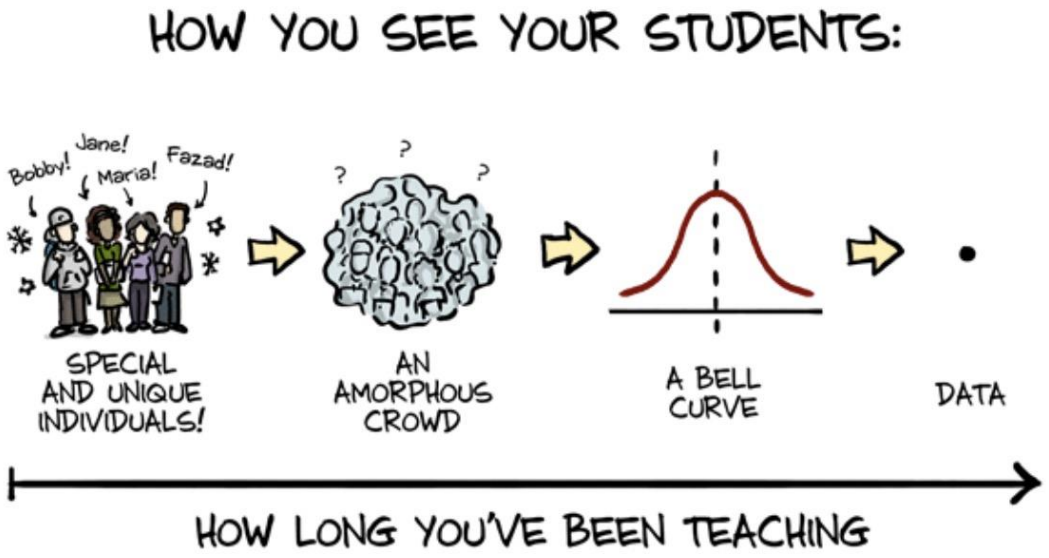
- **Partial Economist**
  - BA in Econ (Nankai)
  - MA in Econ (Duke)

- **Failed Mathematician**
  - Love Mathematics (Dreamed of being Mathematician)
  - ~~Applied Mathematics~~, Applying mathematics

- **Operations Researcher**
  - PhD in T&O
  - Research Interest: Platform Design, Information Design, Dynamic Contract and Sustainability (reducing food waste)

Teaching experiences

- Instructor:
  - Introduction to Business Analytics, undergraduate course in HKU.
  - Operations management, BBA undergraduate course in U of M.
  - Operations analytics, MSBA course in HKU.
- Teaching assistant:
  - Operations management, EMBA course in U of M.
  - Business statistics and analytics, MBA course in U of M.
  - Revenue management, BBA undergraduate course in U of M.



Research


READ.
WRITE.
RINSE.
REPEAT.
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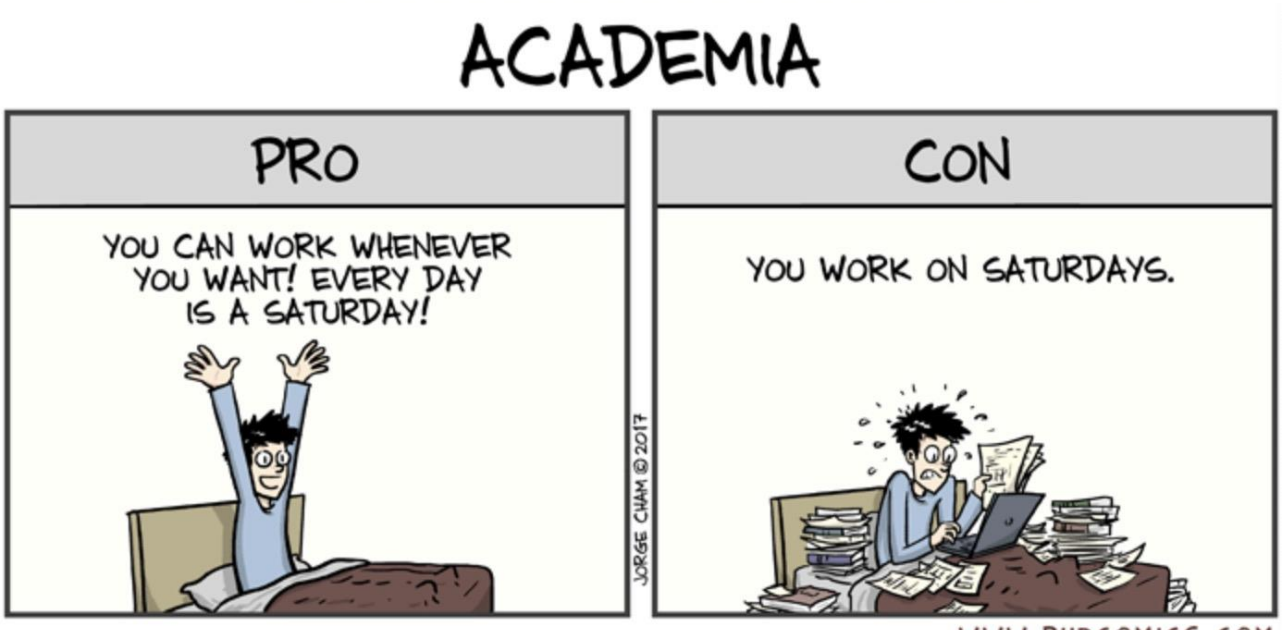
THE RESEARCH CYCLE.
PHDCOMICS.COM


ACADEMIA
PRO
YOU CAN WORK WHENEVER YOU WANT! EVERY DAY IS A SATURDAY!
JORGE CHAM © 2017
CON
YOU WORK ON SATURDAYS.

Research

- Research Interest: dynamic contract, platform design, information design, revenue management, finance technology, sustainability (reducing food waste),

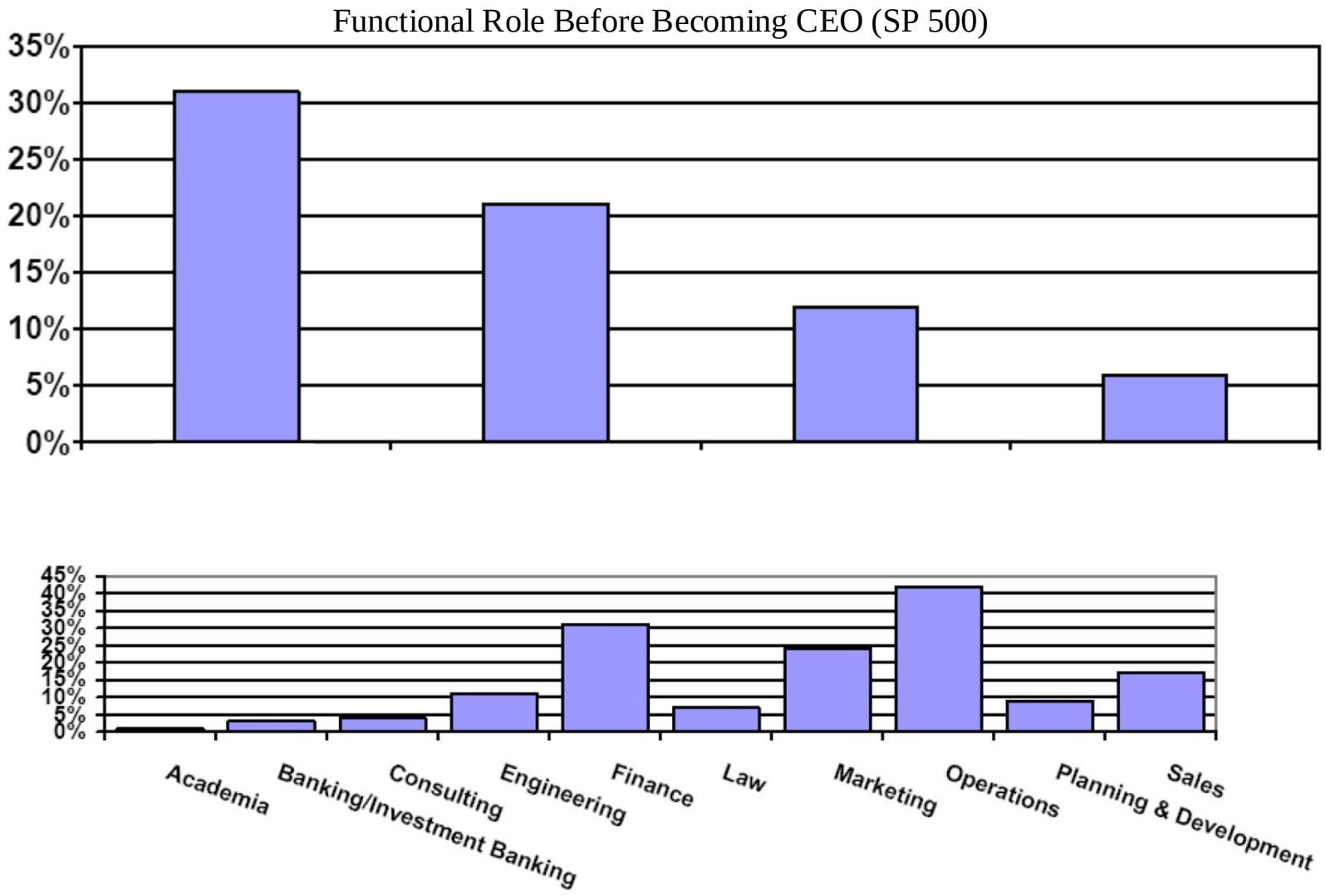
- Dynamic Contract Design:
  - "Optimal Contract to Induce Continued Effort", with Peng Sun, ***Management Science***, 64(9), pp. 4193-4217, 2018.
  - "Optimal Contract for Machine Repair and Maintenance", with Peng Sun and Izak Duenyas, ***Operations Research***, 69(3): 916-949, 2021.
  - "Comment on 'Optimal Contract to Induce Continued Effort' ", with Ping Cao and Peng Sun, ***Management Science***, 68(1): 796-808, 2022 (correcting a mistake in Section 4 of the original paper).
  - "Punish Underperformance with Suspension: Optimal Dynamic Contracts in the Presence of Switching Cost", with Ping Cao and Peng Sun, ***Management Science***, 70(5): 3030-3037.
  - "Dynamic Contract Design in the Presence of Double Moral Hazard", with Peng Sun and Izak Duenyas, ***Management Science***, accepted.
- Information Design:
  - "Optimal Advertisement Content and Product Line Design", with Wei Zhang

Research

- Platform Design:
  - ”Information design and pay mechanism in the gig economy market", with Zhen Lian and Feifan Zhang
  - ”Price Competition and Contract Design on the Online Healthcare Platform under Information Asymmetry", with Fangyuan Cao, Jie Wang and Yong-Hong Kuo
- Revenue Management:
  - “Pricing and Addiction Control for Digital Services”, with Jiacheng Chang and Xiao Lei
- Finance Technology:
  - ”Optimal Delegation Contract Design under Multiple Moral Hazard", with Mingliu Chen and Ruiting Zuo

- Fundings:
  - Optimal Dynamic Contract in queuing system, ***Hong Kong Government Funding (Early Career Scheme)***
  - Early or Late Warnings: A Dynamic Information Design Perspective, ***Hong Kong Government Funding (General Research Fund)***
  - Information design and pay mechanism in the gig economy, ***Hong Kong Government Funding (General Research Fund)***

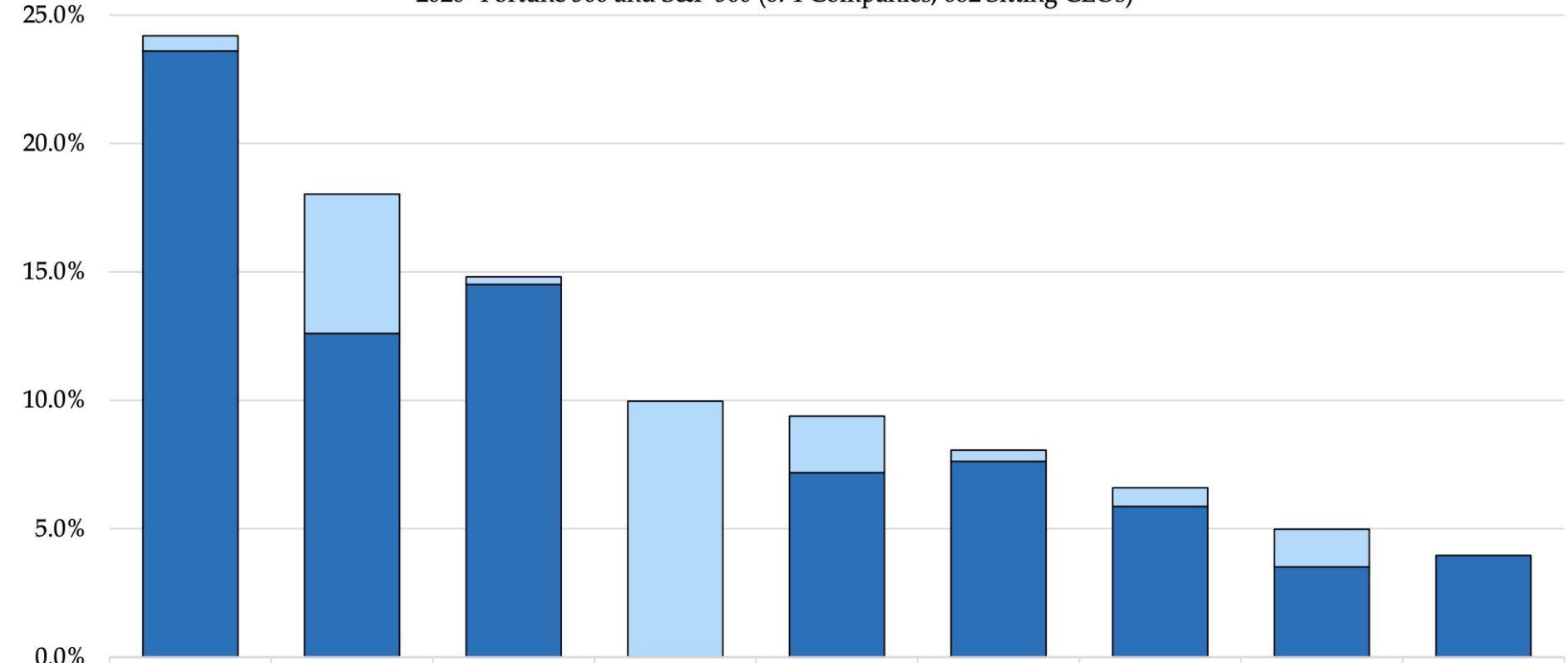
Career Paths of SP 500 CEOs



Source: SpencerStuart 2008

The most common path to CEO is an internal promotion from the COO role

Immediate Previous Position of Sitting CEOs (Internal vs. External)
2020* Fortune 500 and S&P 500 (674 Companies; 682 Sitting CEOs)



	COO	Divisional President	President	CEO	Operating Executive	President/COO	CFO	Other	Founder
External	0.6%	5.4%	0.3%	10.0%	2.2%	0.4%	0.7%	1.5%	0.0%
Internal	23.6%	12.6%	14.5%	0.0%	7.2%	7.6%	5.9%	3.5%	4.0%
Total	24.2%	18.0%	14.8%	10.0%	9.4%	8.1%	6.6%	5.0%	4.0%

What do you think of when you hear "operations"?

What do you think of when you hear "operations"?

What do you think of when you hear "operations"?

Manufacturing, Producing Food (Getting supply from factories).

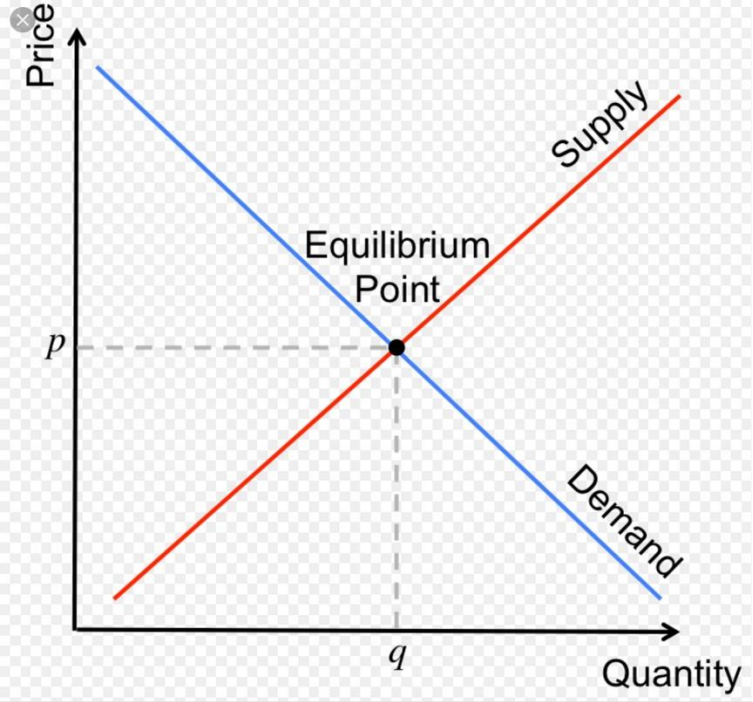
Providing services to customers.

What is meant by “Operations”?

惠康 wellcome

Match Supply and Demand

If supply and demand don't match

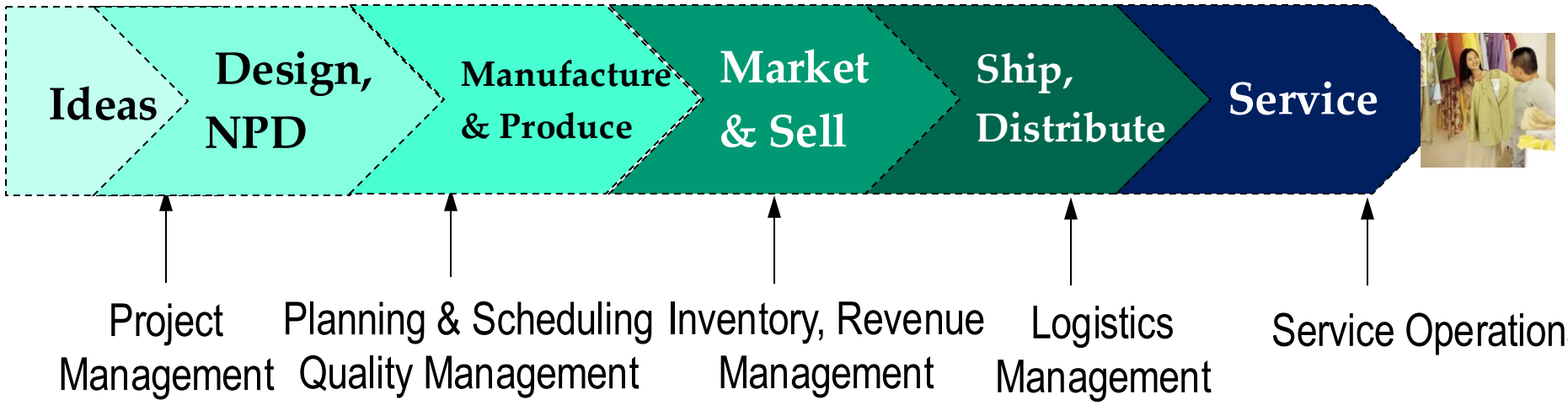


Excess supply = Wasted resources

Excess demand = Lost revenue

What is Operations Management?

- **Operations management** is the organization and control of fundamental business activities that provide goods and services to customers.



What is meant by “Operations”?

Allocate right people with different skills to right projects.

- “Operational Excellence
  On going focus on problem solving, improvement, and GBS (Global Business Services) transformation on outputs toward delivering high quality, seamless, and consistent business solution”, KPMG 2015

ZARA

- “The secret of Zara’s success is its speed—four weeks for a new fashion idea to hit the shops—and the feedback that store managers send to head office, to help it fine-tune its ideas. There is also firm control from Spain, the sole logistics hub.”

  – The Economist

Other examples…

瑪麗醫院
Queen Mary Hospital

- "The average time patients spend waiting to see a health-care provider is 22 minutes, and some waits stretch for hours, according to a 2009 report by Press Ganey Associates, a health-care consulting firm, which surveyed 2.4 million patients at more than 10,000 locations. Orthopedists have the longest waits, at 29 minutes; dermatologists the shortest, at 20. The report also noted that patient satisfaction dropped significantly with each five minutes of waiting time.

  – The Wall St. Journal

Scheduling test, operations

Efficiently Allocate resources

Manage waiting time

Healthcare Operations

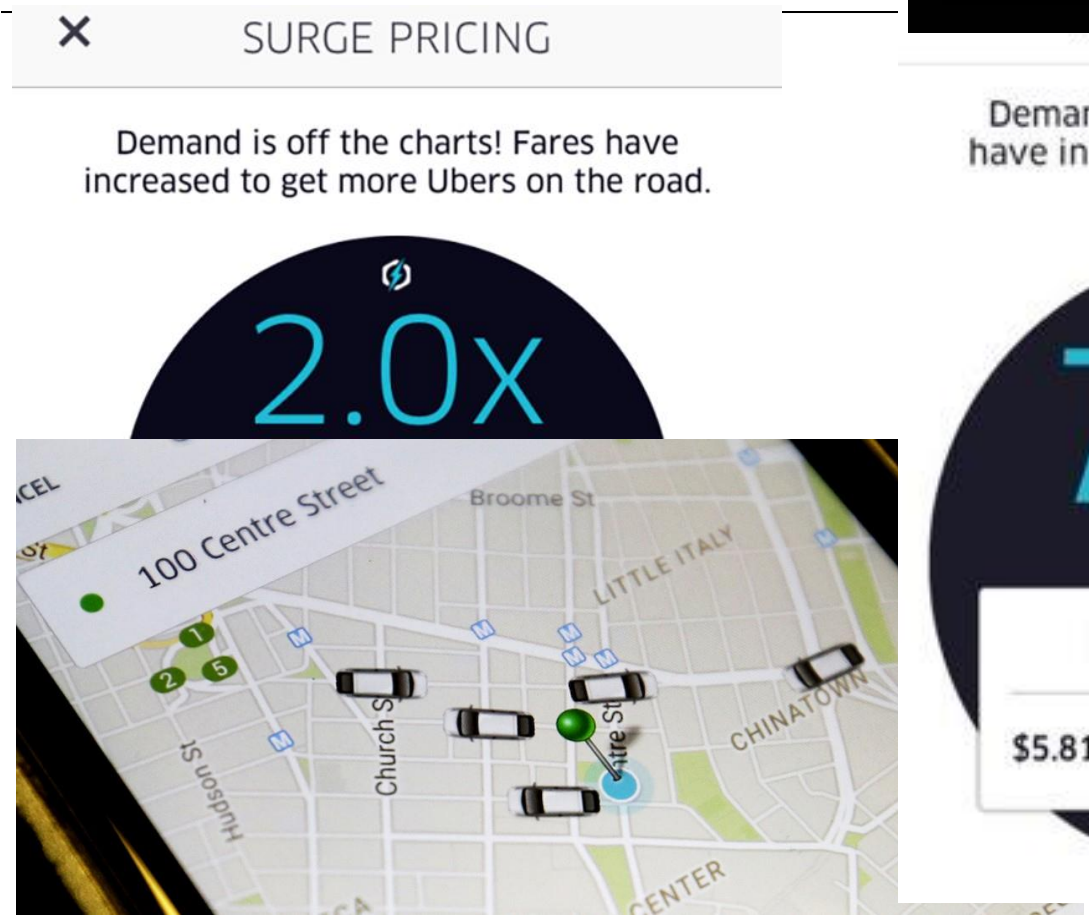
Second case: Shouldice Hospital (efficiently use resources)

Recent project: Online Healthcare Platform

Do they have operations?

Uber

DiDi



Match supply and demand:

Customer side: surge pricing

Driver side: information and pay mechanism (recent paper)

Didi: shift from full info to less info.

Uber and Lyft: shift from no info to more info. Why?

Mainland China market (enough drivers and optimization)

US market (attract more drivers)

Do they have operations?

Do they have operations?

Design products, loot boxes, matching systems

Dynamic pricing

Recent paper: control addiction not sacrificing revenue using dynamic pricing

Do they have operations?

How do they make money?

Sell subscriptions to customers

Design recommendation algorithm

Producing TV series/videos

Do they have operations?

amazon

淘宝网
Taobao.com

Quality management, Inventory and revenue management, logistics management (ship/distribute) and service operations (after-sales).

Do they have operations?

Selling Tickets (Price, Yearly membership, Express Tickets)

Running their own hotels, restaurants

Manage waiting lines

Traditional OM

- Production planning and scheduling
- Inventory management
- Warehouse & transportation

Modern OM

- Today OM studies many kinds of business processes.
- OM concerns both *manufacturing* and *service* industries.

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Queen Mary Hospital

Managing across organizational functions

- Operations and marketing
  - Marketing "we won and brought the customers and they messed up once again."
  - Operations "they make impossible promises to customers."
    - Amazon prime promises 2 days delivery.
      - Operations: Warehouses, inventory, delivery and fulfillment
- Operations and finance
  - Operations affect financial measures of companies.
    - Snapple (juice): Acquired by Quaker Oats (oat meals) in 1994 for $1.7B. 27months later, sold at $300M. Snapple's revenue dropped from $700M to $500M over same time period.
- Operations and human resource
  - Operations is about making better use of limited resource.

Course Goals: *Operations Analytics*

1. Understand operations as an *integrating managerial* function
2. Learn how to *evaluate* and *improve*

- Course is structured to answer:

1. What is a good operations? What is an improvement?
   - ***Process view*** + *Strategic role of Ops*
2. Where to target for improvement?
   - *Identify metrics by linking process flows with financial flows*
3. How to improve?
   - *Improve each metric*

Operations + Analytics

- Organizations as entities must match the supply of what they produce with the demand for their product.

- This course introduces a number of quantitative models and qualitative strategies to solve problems an organization faces in its operations.
  - A “quantitative model” is a mathematical procedure or equation that takes inputs and outputs a number that either instructs a manager on what to do or informs a manager about a relevant performance measure.
  - A “qualitative strategy” is a guiding principal

Operations + Analytics

- The **operations management and analytics** tools can be applied to ensure resources are used as efficiently as possible.
  - The **operations management and analytics** tools can be used to make desirable trade-offs between competing objectives.
  - The **operations management and analytics** tools can be used to redesign or restructure our operations so that we can improve performance along multiple dimensions simultaneously.

- You will be able to
  - understand how (business) organizations operate
  - with fundamental operations management concepts
  - and frame problems into questions and derive answers.

Administrative Arrangements

Course Materials

- Required Materials
  - Lecture notes, assignments, practice problems (on *Moodle*)
  - Cases
    - *Kristen's Cookie* (*Harvard Business Review*)
    - *Shouldice Hospital* (From textbook *Operations and Supply Chain Management*, Jacobs, F. Robert and Chase, Richard B., McGraw-Hill/Irwin)
    - *Dual Sourcing Planning* (Kellogg Business Case)
      - ***Up on moodle***
- Recommended Text Books
  - *Managing Business Process Flow (Anupindi, Chopra, Deshmukh, Van Mieghem, and Zemel), Reserved at library*
  - *Operations and Supply Chain Management (Jacobs & Chase), Reserved at library*
  - *Matching supply with demand (Cachon & Terwiesch), Reserved at library*

Assessment

Individual assignments	30%
Group assignment	10%
In-Class Participation + Attendance	10%
Final Exam	50%
Total	**100%**

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Group assignment	10%
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Final Exam	50%
Total	**100%**

- Individual assignment policy
  - Strict due date/time (posted online) enforced, no excuses
- 4 individual assignments
- ***First individual assignment plan: release Oct 18 after 10 pm, due Oct 23, 1:30 pm***

Assessment

Individual assignments	30%
Group assignment	10%
In-Class Participation + Attendance	10%
Final Exam	50%
Total	**100%**

- Group assignment policy
  - Strict due date/time (TBD) enforced, no excuses
- Group project report and peer evaluation form
- More details to be announced in the second half
- Fill in the group registration form

Assessment

Individual assignments	30%
Group assignment	10%
In-Class Participation + Attendance	10%
Final Exam	50%
Total	**100%**

- Take attendance
- In-Class Participation
  - ***Mere presence is not participation; In-class practice problems will count.***
  - ***In class practice questions and pop-up surveys (they are not quiz, only participation will be recorded).***
  - ***If you participate (ask or answer questions) during the class, I will distribute you a sticky note. Please write down your name and UID and return it to me. If I forget to distribute the note, please ask for it during the break.***
  - ***If you forget to do this, please send TA (cc me) an email (including what you asked or answered) at the end of every class (no later than 10 pm of the day).***

Assessment

Individual assignments	30%
Group assignment	10%
In-Class Participation + Attendance	10%
Final Exam	50%
Total	**100%**

- Homework assignments, practice problems
- More details to be announced

Attendance policy

- An attendance rate of **70%** is required for all Master of Science in Business Analytics courses. Failure to meet the **70%** attendance requirement will result in a fail grade in the course concerned.

Academic Conduct

- No disruptions in class
  - ***NO CROSSTALKING***
  - ***NO CELL PHONE (including phone calls)***
    - Tablets or laptops for taking notes are allowed
  - DO NOT BE LATE
- You might be failed in the participation grades, if you fail to follow the class rule.
- Academic dishonesty is **ABSOLUTELY NOT TORELATED.**
  - **No second chance.**

Manage Lecture Slides and Course Materials

- Every one topic
  - One before-class slides
- Every one class one topic
  - One after-class slides
- Combined Moodle (ABCD): Before class slides, assignments, tutorial materials.
- Separate Moodle: after class slides, answers for the practice problems.

Class Schedule

COURSE CONTENT AND TENTATIVE TEACHING SCHEDULE	
Class	**Topic**
1	Introduction to Operations Analytics: What is Business Operations? Process analysis: Capacity analysis
2	Process analysis: Capacity analysis, continued
3	Process analysis: Kristen's cookie case Process analysis: Inventory and Little's Law Due Individual Assignment 1 by start of Class 3: Kristen's cookie case
4	Variability analysis: Uncertainty in operations and queueing models
5	Process analysis: Shouldice hospital case Process analysis: Multi units, Project management and critical path method Due Individual Assignment 2 by start of Class 5: Shouldice hospital case
6	Inventory analysis: Economic Order Quantity, demand uncertainty, lead time, and safety stock Inventory analysis: Continuous vs. Periodic review
7	Inventory analysis: Demand uncertainty and Newsvendor Case: Dual sourcing management
8	Inventory management case: Dual sourcing game Due Group Assignment by start of Class 8: Dual-sourcing strategy
9	Supply chain analysis: Bullwhip effect and incentive conflict Due Individual Assignment 3 after Class 9: Inventory
10	Revenue analysis: Selling to a Newsvendor Revenue management Due Individual Assignment 4 after Class 10

Process View of Operations

MSBA7004 Operations Analytics

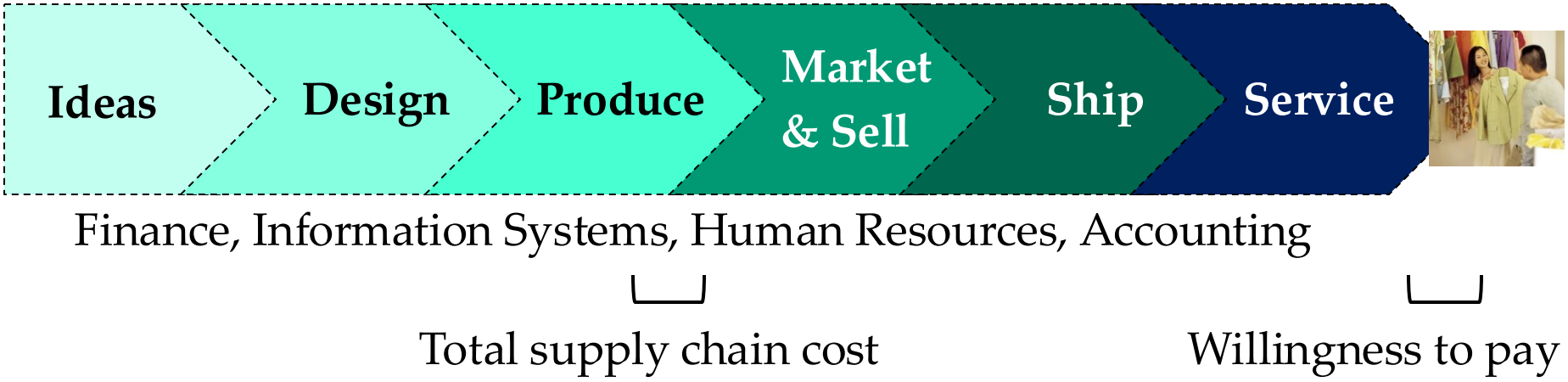
2024

Managing Business Process Flows: Ch 1 + 2 Processes and Strategy Module

- **What is Operations?**
  - Strategic role of Ops
  - **Process view of Ops**
- What is good Operations?
  - A Strategic Framework for Operations
  - Ops: Competencies and Processes
- Aligning strategy and operations:
  - Focus
  - Relationship between process choice and strategy

Bringing goods and services to customers: Value maximization and supply chain surplus

- Value is created through a chain of activities, including customer exchanges



- Difference = supply chain surplus = value
  - Objective of the firm is to maximize this value
  - Customers choose the product that gives them highest *customer surplus (=value perceived by themselves – price)*

The Process View of Ops: motivation

- Each successful organization has achieved strong financial performance by providing products that meet customer expectations at a production and delivery cost that is significantly lower than the value perceived by customers.
- How success of organizations is closely linked to their effective management of business processes that produce and deliver goods and services to their customers.

- *How can we represent organizations as a collection of business processes?*
- *What types of metrics do they use to monitor and manage process performance?*
- *How do they design their processes to deliver superior financial performance?*

What is a Process?

A process is a transformation of inputs into outputs through a network of activities and buffers, utilizing resources, IT structure, and management

Activities: resources are used and value being added

Buffers: resources are not used/value are not being added

How to allocate resources to different activities

Process Management

Information structure

What information is needed and is available to whom in order to perform activities

Network of **Activities** and **Buffers**

Inputs

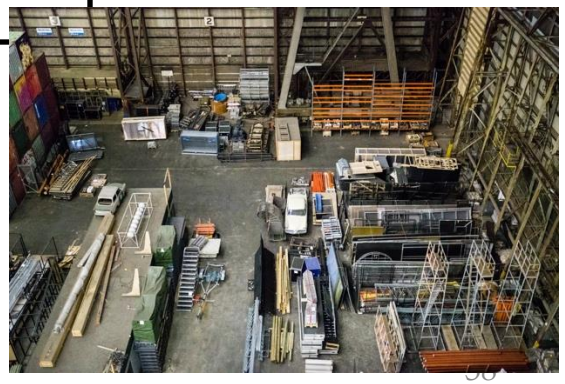
Flow units/Entities
(customers, data, material, cash, etc.)

MSBA student

Outputs

Goods
Services

Student with BA knowledge



Resources

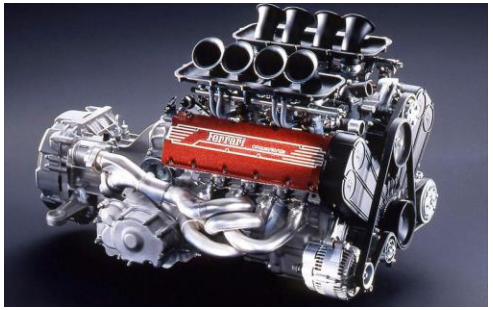
Labor & Capital

Questions to ask when adopting a process view

1. What is the **process boundaries**? What is the input and output?
    1. MSBA program or MSBA 7004
    2. Apple: manufacturing of Iphone or a specific apple store

Different process boundaries lead to different process view.

- **Process boundary** defines the beginning and the end of the process. MSBA 7004: first lecture - final exam. In the McDonald's Kitchen example, the beginning of the process is "place an order" and the end of the process is "deliver".
- **Inputs** refer to any tangible or intangible items that "flow" into the process from the environment; they include raw materials, component parts (manufacturing companies), energy, data, and customers in need of service (service companies).
  - Engines, tires, and chassis are examples of inputs from the environment into an auto assembly plant.



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- **Outputs** are any tangible or intangible items that flow from the process back into the environment, such as finished products, pollution, processed information, or satisfied customers.
  - For example, cars leave as output from an assembly plant to the dealerships.

Questions to ask when adopting a process view

1. What is the **process boundaries**? What is the input and output?

2. What is the **flow unit** or the unit of analysis?

- Depending on the process, the **flow unit** may be a unit of input, such as a customer order, or a unit of output, such as a finished product. The flow unit can also be the financial value of the input or output. For example, the flow at an Amazon warehouse can be analyzed in terms of books, customer orders, or dollars.

Questions to ask when adopting a process view

1. What is the **process boundaries**? What is the input and output?

2. What is the **flow unit** or the unit of analysis?

3. "Attach yourself to the flow unit" and record its **process steps** through the process.

4. Who does the work? What are the **resources** for each activity?

5. What information is required to perform each activity? Where does this information come from? This specifies the **information flow.**

Examples of Processes

Organization	Inputs	Process	Outputs
Auto Factory	Auto parts, raw materials	Fabrication and assembly	Automobiles
Restaurant	Hungry customers (Raw food)	Serving customers (Cooking)	Satisfied customers (Prepared food)
MSBA Program	Students with no knowledge in BA	Learning, practicing	Students with knowledge in BA and prepared for jobs

Note: The process depends on the perspective you take

Examples of Flow Units

Process	Flow Units	Input-Output Transformation
Production	Products	From the receipt of raw materials to the completion of the finished product
Customer Services	Customers	From the arrival of a customer to their departure
Order fulfillment	Orders	From the receipt of an order to the delivery of the product

Advantages of Adopting a Process View of Organizations

- Applies to any organization
- Applies at any level
- "horizontal," i.e., across functions, view of the organization (list activities) in contrast to the usual vertical views along the lines of functional departments
  - Highlights externalities
  - Highlights integration and problems
- Is always "customer aware" and focused on outcomes
  - Especially in service industry, customers are flow units.

- Key Property: focus on *flows* rather than *snapshots*
  - Focus on process rather than people has higher likelihood of leading to cooperation and significant improvement

→ the process view is a unified, customer-centric model of the organization that facilitates analysis and improvement in a systematic manner

What is Operations?

" The **process** of bringing

goods and services

to **customers/markets**"