

MSBA 7004

Operations Analytics

Class 1-1: Introduction to Operations Analytics
Process view of operations
2023

MSBA 7004 Teaching Team

Instructor: Prof. Huiyin Ouyang

Email: oyhy@hku.hk

Office: KKL 1321

Tutor: Yiran Zhang, juv1230@connect.hku.hk

TA: Anthony Wong, aswwong@hku.hk

MSBA 7004 Teaching Team

Instructor: Feng (豐) TIAN (田)

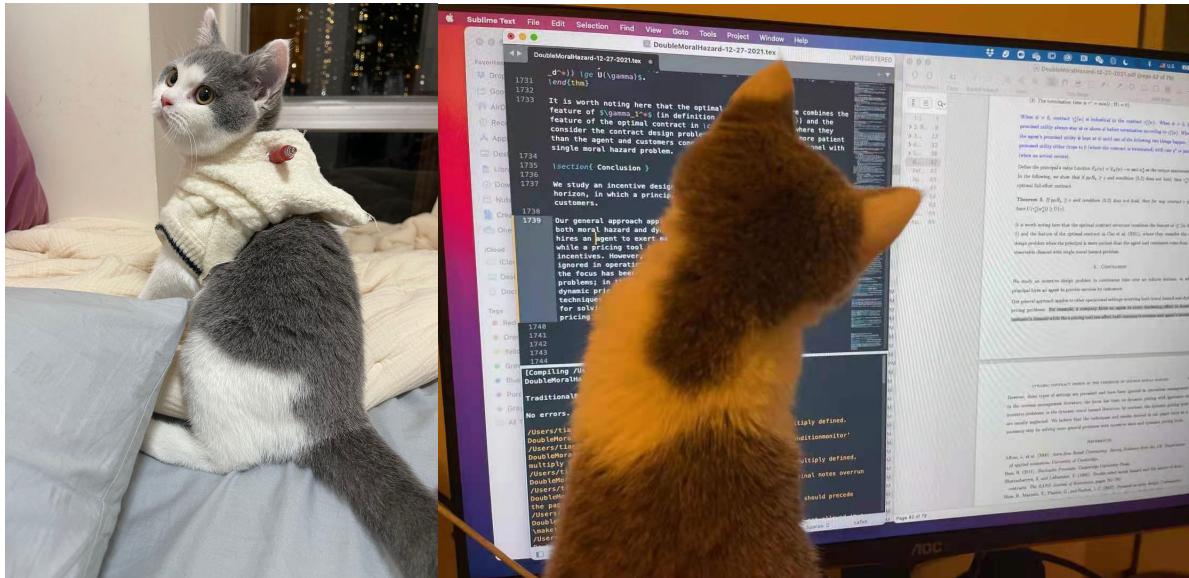
Email: fengtian@hku.hk

- Office: KKL1312
- Office Hours: Monday 7:40 - 8:40 pm,
Thursday 4:40 – 5:40 pm or By
appointment.

Tutor: Yaxiang Zhou, zyx0820@hku.hk

TA: Allison, ah1122@hku.hk

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**

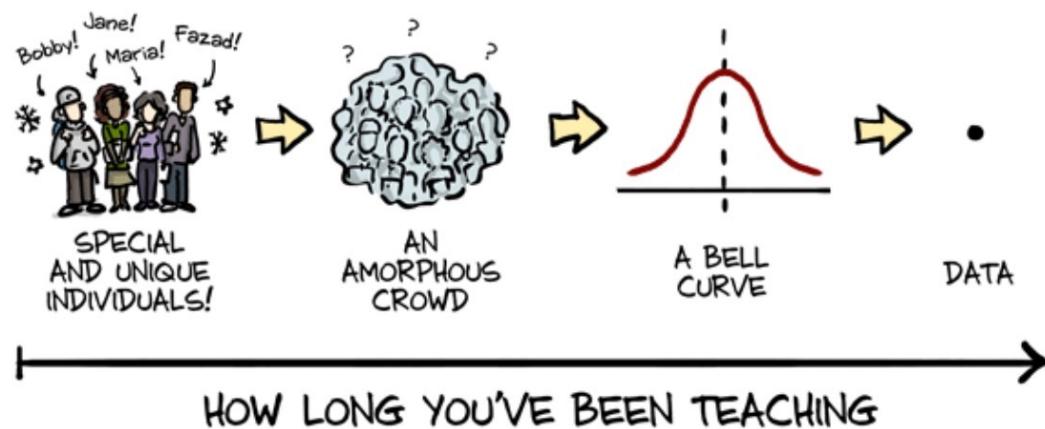
- PhD in T&O
 - Research Interest: Innovation Competition,
Dynamic Contract and Sustainability (reducing food waste)



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.

HOW YOU SEE YOUR STUDENTS:



Research



ACADEMIA



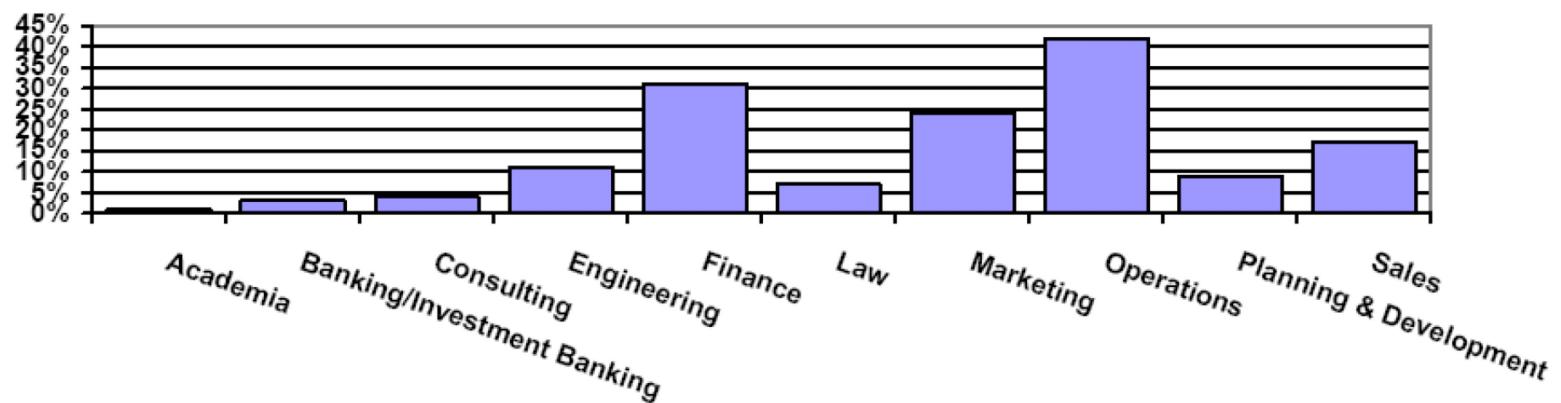
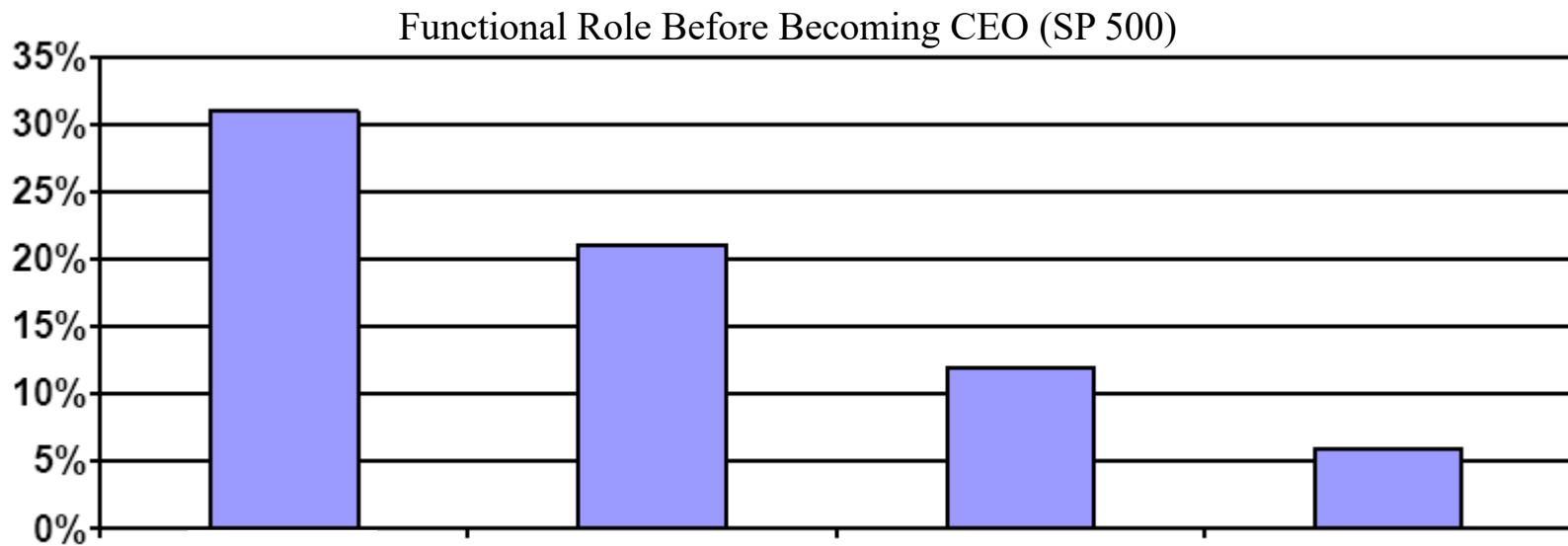
Research

- Research Interest: innovation competition, dynamic contract, sustainability (reducing food waste), platform design, information design, finance technology
- **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*, 2021
 - "Comment on 'Optimal Contract to Induce Continued Effort' ", with Ping Cao and Peng Sun, *Management Science*, 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*, forthcoming
- **Platform Design:**
 - "Information design and competition between ride-sharing platforms", with Zhen Lian and Feifan Zhang
- **Information Design:**
 - "Early or Late Warnings?", with Shouqiang Wang and Feifan Zhang

Research

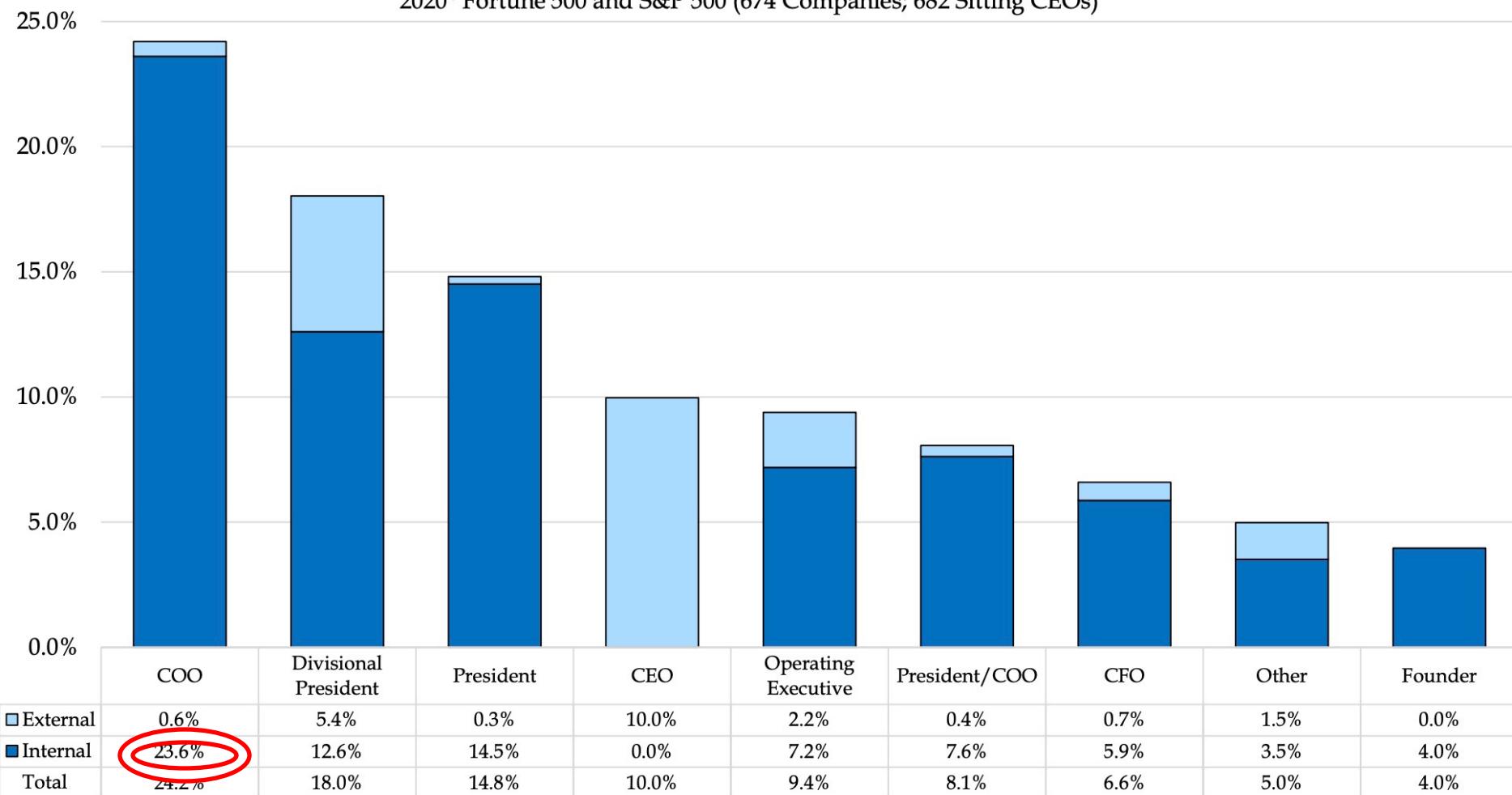
- Research Interest: innovation competition, dynamic contract, sustainability (reducing food waste), platform design, information design, finance technology
- **Finance Technology:**
 - "Optimal Delegation Contract Design under Multiple Moral Hazard", with Mingliu Chen and Ruiting Zuo
- **Sustainability:**
 - "On the Profitable Buffet Design to Cut Food Waste", with Yuwen Hu, Ekaterina Astashkina, and Izak Duenyas
- **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)***

Career Paths of SP 500 CEOs



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)



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).

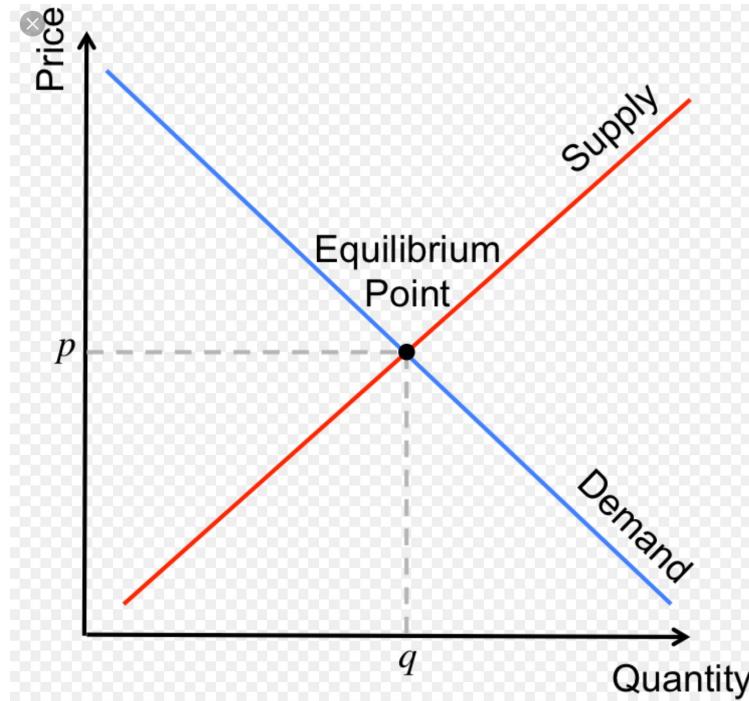
Providing services to customers.

What is meant by “Operations”?



Match Supply and Demand

If supply and demand don't match



Excess supply =

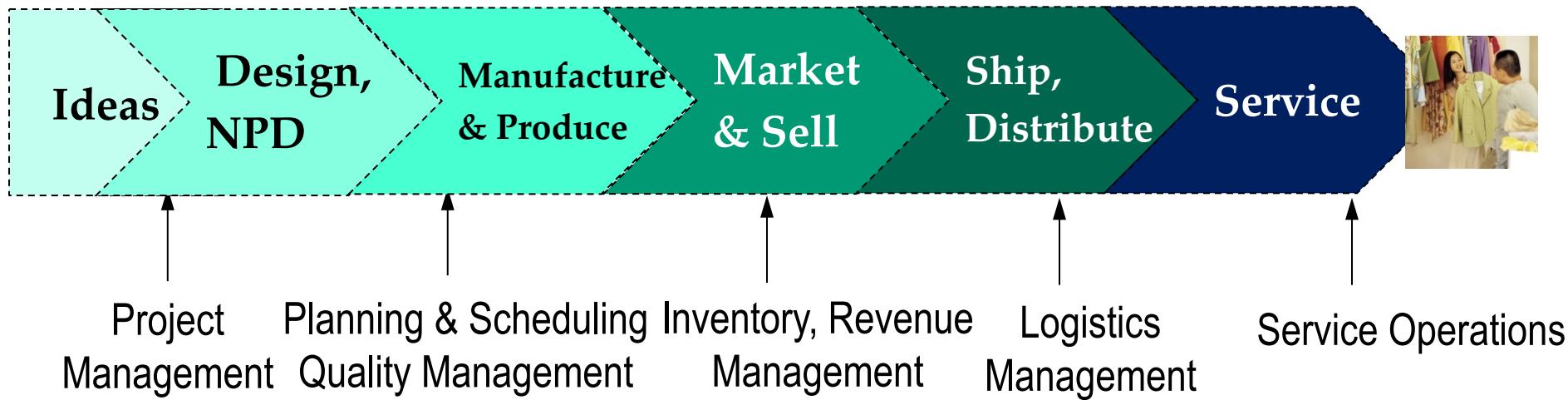
Wasted resources

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”?



ZARA

- “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

- “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

Healthcare Operations

Second case: Shouldice Hospital (efficiently use resources)

Group assignment: Evaluate a healthcare policy that reduce hospitals' readmission rate

Do they have operations?



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

Do they have operations?

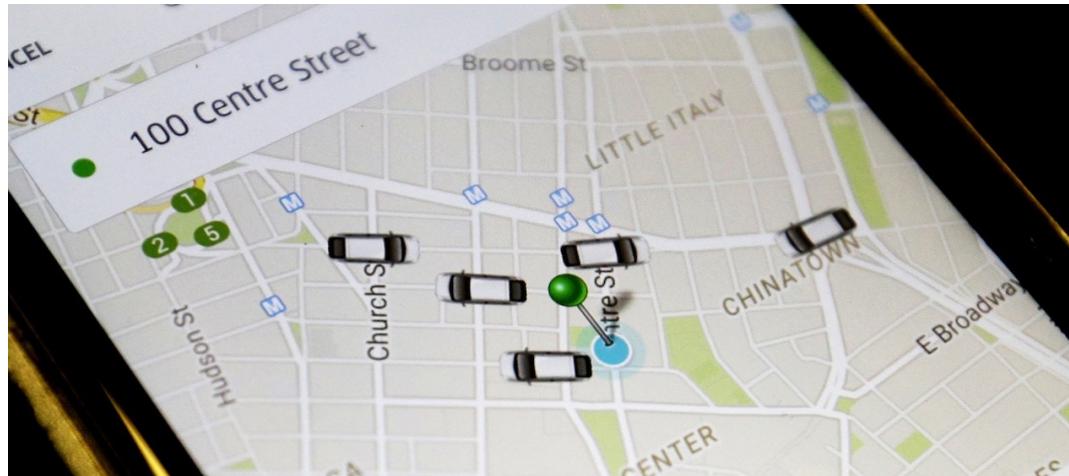
Uber



X

SURGE PRICING

Demand is off the charts! Fares have increased to get more Ubers on the road.



SURGE PRICING

Demand is off the charts! Rates have increased to get more Ubers on the road.



X

Do they have operations?

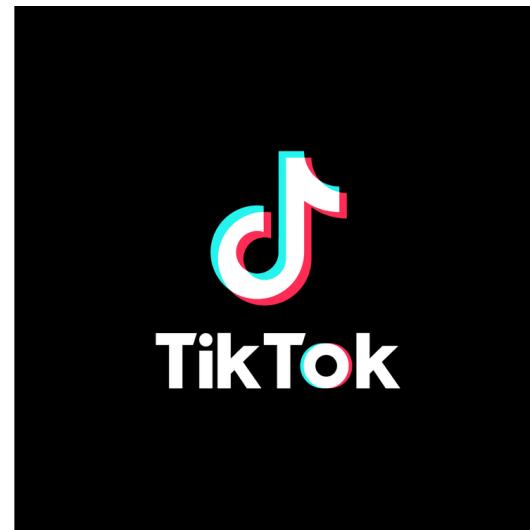


Selling Tickets (Price, Yearly membership, Express Tickets)

Running their own hotels, restaurants

Manage waiting lines

Do they have operations?



Producing TV series/videos

Sell subscriptions to customers

Design recommendation algorithm

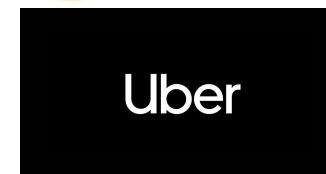
Traditional OM

- 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.



瑪麗醫院
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 and finance
 - Operations affect financial measures of companies.
 - Snapple: Acquired by Quaker Oats 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	25%
Group assignment	15%
In-Class Participation + Attendance	10%
Final Exam	50%
Total	100%

- Individual assignment policy
 - Strict due date/time enforced, no excuses
- Group assignment policy
 - Strict due date/time (TBD) enforced, no excuses
- In-Class Participation
 - ***Mere presence is not participation; In-class practice problems will count.***

Assessment

Individual assignments	25%
Group assignment	15%
In-Class Participation + Attendance	10%
Final Exam	50%
Total	100%

- Individual assignment policy
 - Strict due date/time enforced, no excuses
- 4 individual assignments

Assessment

Individual assignments	25%
Group assignment	15%
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
- Fill in the group registration form

Assessment

Individual assignments	25%
Group assignment	15%
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.*
 - *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.*

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.

Assessment

Individual assignments	25%
Group assignment	15%
In-Class Participation + Attendance	10%
Final Exam	50%
Total	100%

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

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 RELATED.**
 - **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 <u>Due Individual Assignment 1 by start of Class 3: Kristen's cookie case</u>
4	Process analysis: Multi units, Project management and critical path method
5	Process analysis: Shouldice hospital case Variability analysis: Uncertainty in operations and queueing models <u>Due Individual Assignment 2 by start of Class 5: Shouldice hospital case</u>
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 <u>Due Group Assignment by start of Class 8: Hospital readmission reduction program case</u> <u>Due Individual Assignment 3 by start of Class 8: Dual-sourcing strategy</u>
9	Supply chain analysis: Bullwhip effect and incentive conflict
10	Revenue analysis: Selling to a Newsvendor Revenue management <u>Due Individual Assignment 4 by start of Class 10: Inventory</u>

Process View of Operations

MSBA7004 Operations Analytics
2023

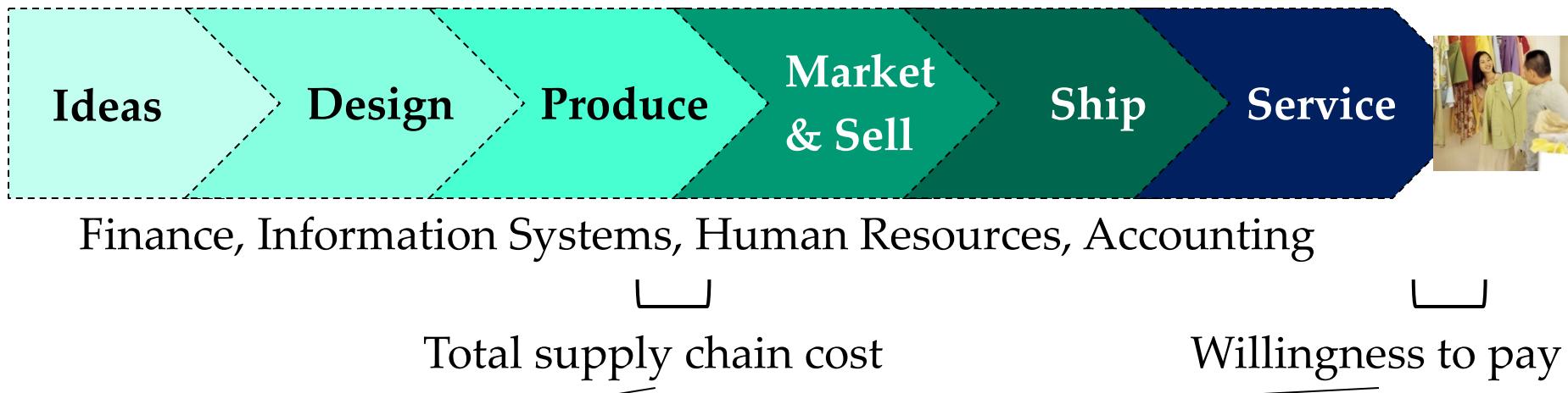
Managing Business Process Flows: Ch 1 + 2

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

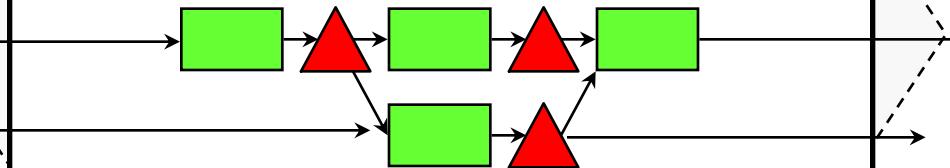
What information is needed and is available to whom in order to perform activities

Outputs

Inputs

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

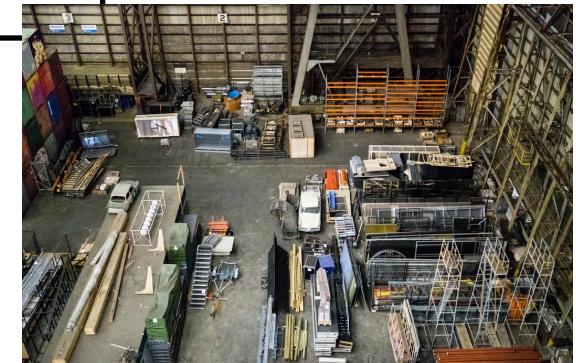
Network of Activities and Buffers



Goods Services

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

- **Process boundary** defines the beginning and the end of the process. 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**”