Operations & Business Process Management

Prof. Apurva Jain

MSIS 503

Session 1

□ Introduction

Recent Headlines

What are the problems we see? Why?

United, Delta, Southwest and American Postpone and Scrap Over 2000 New Flights at Major US Airports Including O'Hare, LAX and Denver, Paralyzing Travel and Leaving Masses of Tourists Stranded

Saturday, July 12, 2025

https://www.travelandtourworld.com/

As ER overcrowding worsens, a program helping to ease the crisis may lose funding

"Patients are leaving early or dying waiting" in emergency departments, one expert said. Overwhelmed staff members have reached a breaking point.

Feb 7, 2024. https://www.nbcnews.com/

May 21, 2025

Another 'Breakdown' in Federal Student Aid?

Financial aid officers report widespread problems with the federal student aid system after Education Department layoffs, including processing delays they say could affect the current cycle.

https://www.insidehighered.com/

UW struggles with new cloud-based finance system, highlighting IT migration difficulties

BY TAYLOR SOPER on October 16, 2023 at 4:16 pm

https://www.geekwire.com

Recent Projects

What are the opportunities to improve? How?

Microsoft - Sourcing Automation Process Improvement

UW team was given an opportunity to research and recommend process improvement steps to shorten the TAT for non-strategic spend low-risk projects.

Alaska Airlines – Process Optimization

Goal Statement: **The FedEx Invoicing Process will be improved through Automation and Lean Six Sigma Methodologies, resulting in a 40% reduction in process time and a 50% improvement in visibility of total spend.**

SimpliSafe - Supplier Adherence Tracking

Develop and implement supplier adherence tracking by analyzing past transactions, forecasting data, and manufacturer/ SimpliSafe partnership.

Tommy Bahama Sales Analysis & Forecasting Project

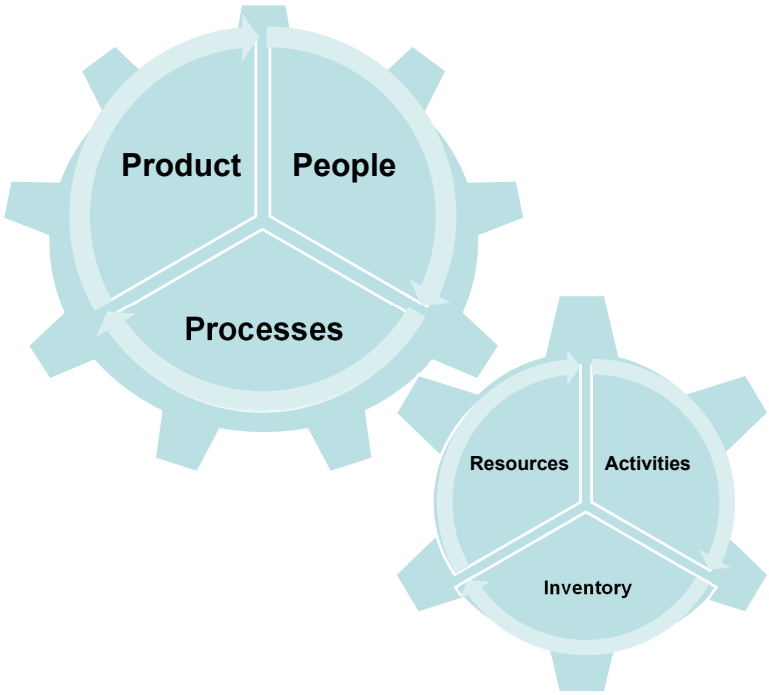
Problem and goal statement: **Phase 1** Forecast product demand for all channels, strong focus on wholesalers. **Phase 2** SKU rationalization.

Problems/ Opportunities

Use the lens of the process view (flow of work and material) to analyze problems and identify opportunities for improvement.

Taking the process view allows us to employ a set of standard concepts and tools to develop solutions and improvement ideas.

Process flow is a sequence of steps in which **resources** complete work-**activities**.



Why take the process view?

Taking a process view allows us to anticipate problems and develop solutions using standard *process concepts*.

Some reasons for the problems discussed earlier.

Long task times, Unnecessary work

Inaccuracy in demand estimation

Insufficient capacity where needed

Too many changes and uncertainty

Varying work requirements, differences in skills required

Lack of the right information at the right time and place

Operations and process flow concepts

→ *Automation*

→ *Forecasting*

→ *Balance*

→ *Variability*

→ *Variety*

→ *Control*

→ *Visibility & Collaboration*

What technologies and tools are available to apply these concepts?

What is the best way to use these tools?

Course Objective:

Improve process flow performance

Course Structure:

1. Identify Flow
2. Automate Work
3. Forecast Workload
4. Balance Capacity
5. Mitigate Variability
6. Manage Variety
7. Collaborate across Flow

Grading

	% of total grade
Process discussion and class participation (individual)	10%
Three quizzes (individual)	45%
Group assignment (group)	15%
Final Exam (individual)	30%

Workload Schedule

Availability for help

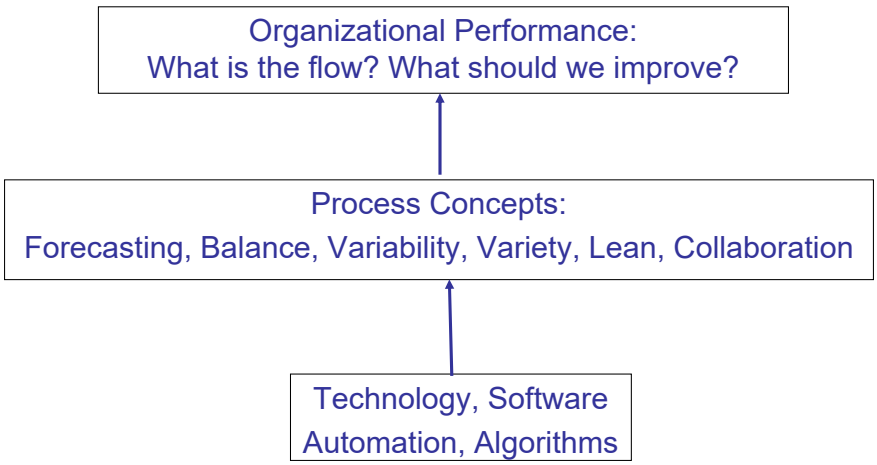
Canvas website

Quantitative + Qualitative

Engagement

Feedback / Response

A main theme of the course is to develop a *set of concepts* to analyze and articulate how technology and automation improves the workflow performance of an organization.



Using these concepts will allow you to design technology solutions that improve the process and to better communicate these improvements to users.

Reasons why you should think about process flow improvement:

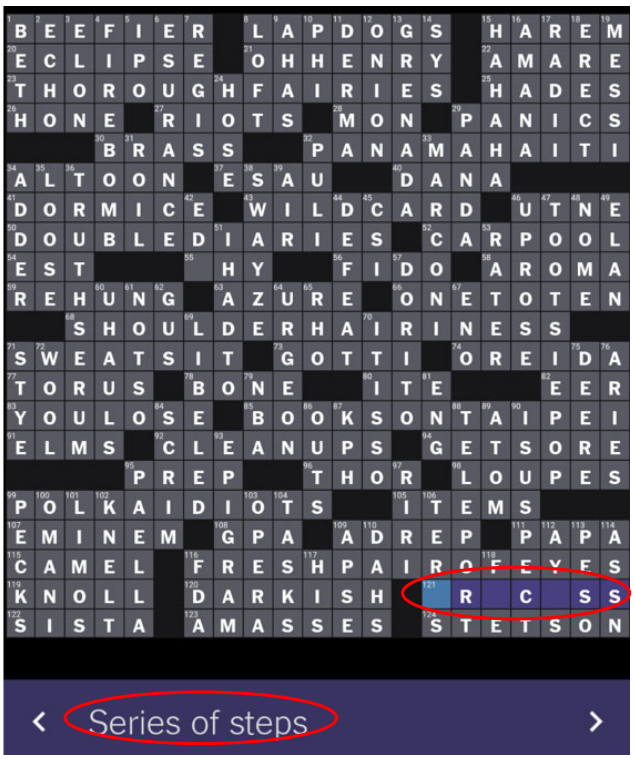
Problems and Opportunities are everywhere. Thinking about process flow provides a universally applicable approach to solving organizational problems.

In your work, you will be a part of a process. To get ahead, you must think about the improvement of that process.

Automation of processes has been one of the biggest drivers of change in businesses.

You will be part of the software development process. Ideas from this class will help you think about improvement in that process.

A process improvement idea that is general enough to be scaled up can be your start-up pitch!



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Session 1
1. Identify Flow
   1.1 Elements of Flow
   1.2 Performance of Flow
   1.3 Process Discovery

Next
2. Automate Workflow
3. Forecast Demand
4. Balance Capacity
…

A great variety of application contexts

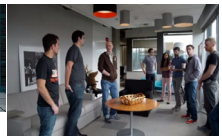
- Manufacturing
- Services
- Retail
- Office workflow
- Healthcare
- Software Development
- Data Centers
- P2P
- Fulfillment
- Sourcing
- Projects

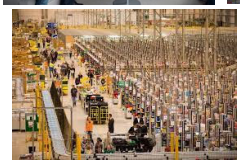
Different industries have different ways to make operations decisions and use different terminologies for process issues and metrics.

This make it harder to develop a standard method to make process improvements.

Contemporary examples of interest:

- Onboarding process
- Digital advertising placement
- Content streaming process
- Online purchasing & Delivery
- Agile software development

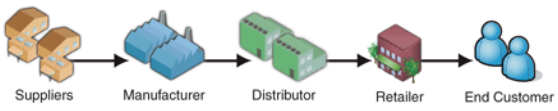




A great variety of process scopes

Process scope refers to the part of flow we choose to focus on. A broad scope (supply chain flow) may involve multiple firms while a narrow scope (workflow) may involve a few teams or departments.

Supply Chain level:

Inventory
Location
Suppliers

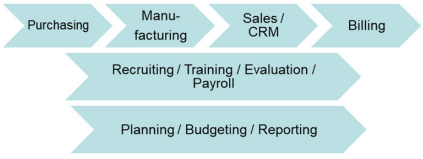


Firm level:

Capacity
Layout
Scheduling

Workflow level:

Process Improvement
Quality Control
Change implementation



Order-to-cash
Quote-to-order
Procure-to-pay
Issue-to-resolution
Apply-to-approval

A great variety of perspectives

There is a great variety of approaches for process analysis, an alphabet soup of acronyms. We can divide them based on what they focus on.

Documentation perspective:

Focuses on detailed mapping and documentation for possible coding and automation.

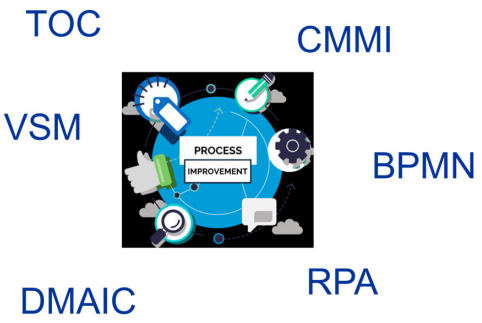
Decision perspective:

Focuses on identifying main decisions and modeling trade-offs to optimize them.

Improvement perspective:

Focuses on identifying and removing non-value-adding activities.

Process Analysis Alphabet Soup



Identify flow: a simple model

Let us propose a simple but universal model that can handle the great variety of contexts and different levels of decision-making.

Flow is a sequence of steps in which resources complete work-activities on flow-units that can be stored as inventory.

Process flow map or model

Identify flow: model elements

- *Flow-units* enter the system
  : a customer, an order, an application, a project
- *Activities* (tasks, work) are performed on flow-units
- *Resources* perform Activities on flow-units
  : programmers code, nurses nurse, factories manufacture
- *Inventory* is an accumulation of flow units

To identify flow elements, look at:

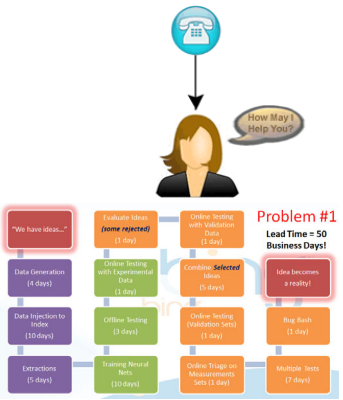
- what is flowing through the system: flow-unit
- what work is being done to add value: activities
- who or what is doing the work: resources

To improve flow, focus on:

- Resources, their types and capacities (*Decision perspective)*
- Activities, their work-content and sequence (*Improvement perspective)*

A few examples from past years

1. Client's contact center is implementing a live chat software . How should we redeploy the CSRs/team-members?



2. Ideas for improving search engine functionality take too long to deploy. What should be changed?

3. Customer expect smooth omnichannel ordering experience. What should we expect?

Identify elements of flow

What can we do in our process-flow that will help us win the customer?

Flow: Sequence of steps	Flow-Unit	Resources / Activities/ Inventory	Performance Metric
Call center: call arrival to resolution	Customer call / text	CSR / record & raise ticket	
Bing: idea to deployment	Proposed Idea	Developers/ Coding	
Nordstrom: From supplier to customer	Order for a Dress / bag..	Trucker/transport/warehouse	

How do we improve a metric of interest?

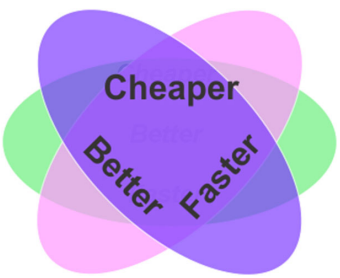
Identify Flow Performance metrics

Cost
- Efficiency, Productivity
- Measured by:
  - cost per unit
  - utilization
  - inventory

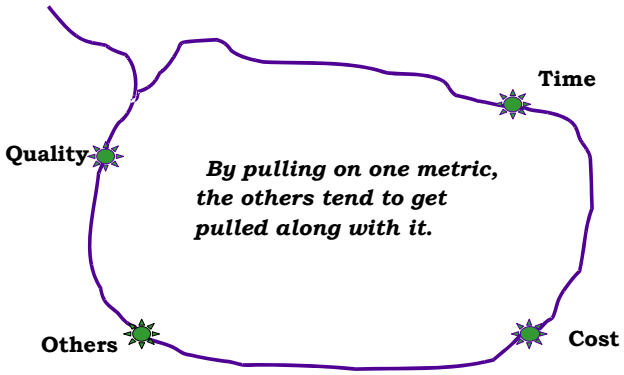
Quality
- Product & Process quality
- Measured by
  - Defect rate
  - DPMO, Sigma-Level
  - Customer satisfaction

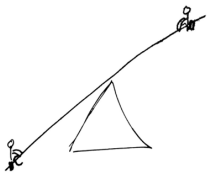
Time
- Responsiveness to demand
- Measured by:
  - customer lead time
  - flow time
  - Waiting

Flow Improvement:



Trade-off: Improving performance on one dimension may influence others.





Typical trade-offs:
Cost vs. Time vs. Quality

Identify elements of flow

Metrics: What can we do in our operations/process-flow that will help us win the customer?

Flow: Sequence of steps	**Flow-Unit**	**Resources / Activities/ Inventory**	**Performance Metric**
Call center: call arrival to resolution	Customer call	CSR / record & raise ticket	Wait: Time Resolution %: Quality CSR Utilization: Cost
Bing: idea to deployment	Proposed Idea	Developers/ Coding	How long: Time Coding: Quality
Nordstrom: From supplier to customer	Dress or bag	Trucker/transport/warehouse	Availability: Time Inventory: cost

How do we improve a metric of interest? Improvement Ideas: Identify the trade-offs

- Asking current employees to also handle chats

  - may reduce cost but decrease quality or increase time

- Removing an approval layer from the idea deployment process

  - may decrease time but increase cost

- Changing how sales are accounted for in omnichannel fulfillment

  - may decrease time (availability of items) but increase cost

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      Activities, Inventory

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Process Discovery by Documentation

There are many methods availably to visually document the workflow in a process.

- Process map, Process flow chart
- Swimlane diagram, SIPOC
- Value stream map
- Business process modeling
- Software: Visio

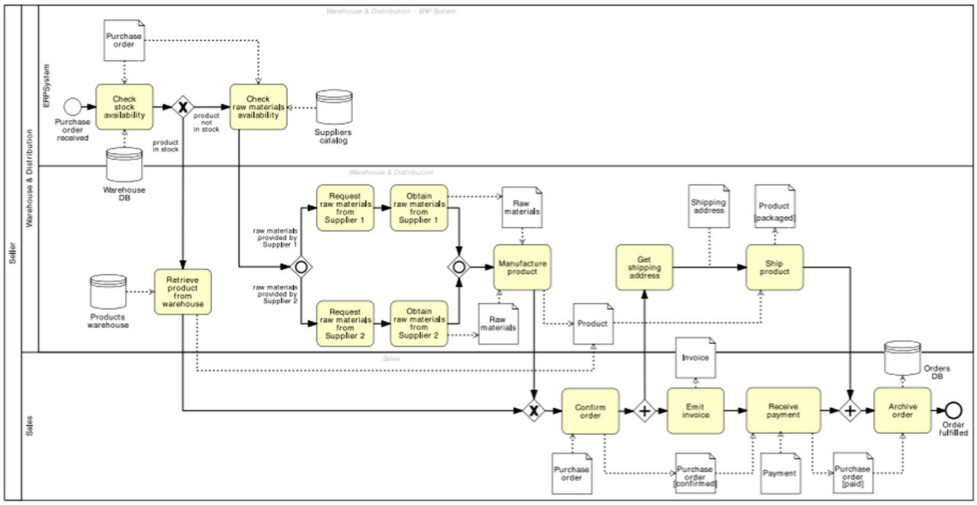
Each of these tools have their own, slightly different, visual notations.
Pros and cons?

An example

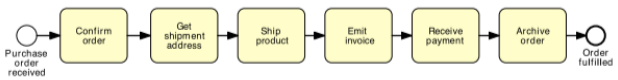
Sticky note process map

An example

Purchase order fulfillment process



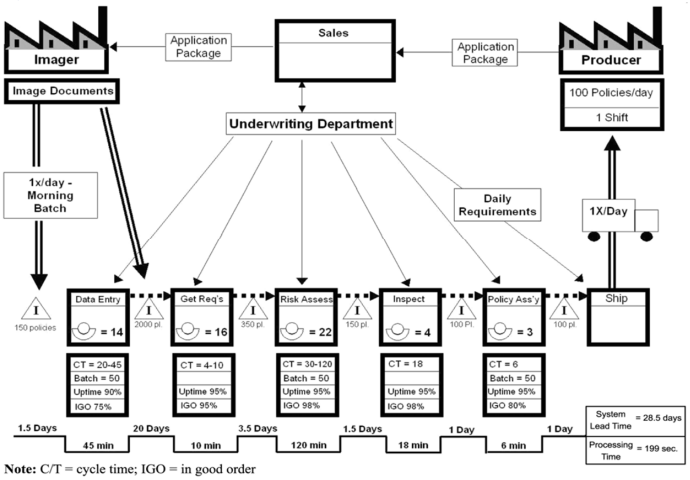
a simple model:



An example

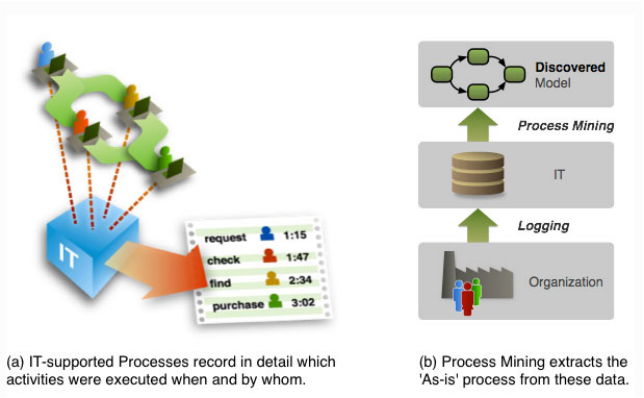
Value Stream Map

Shows value vs non-value time and activities
Provides key interim and system-level performance metrics



Other Tools: **SIPOC, Swim lane Chart, Spaghetti Diagram**

Process Mining and Discovery

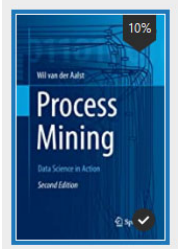


(a) IT-supported Processes record in detail which activities were executed when and by whom.

(b) Process Mining extracts the 'As-is' process from these data.

The goal of process mining is to use event data to extract process-related information, e.g., to automatically discover a process model by observing events recorded by some enterprise system.

Ref: Fluxicon.com

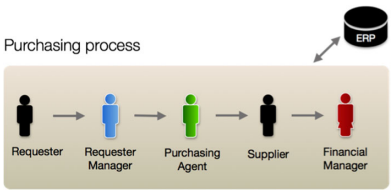


Process Mining
Wil M. P. van der Aalst

An example

Purchasing process: Event data

Case ID	Start Time	Complete	Activity	Resource	Role
339	31:00.0	23:00.0	Create Purchase Requisition	Nico Ojenbeer	Requester
339	34:00.0	40:00.0	Analyze Purchase Requisition	Maris Freeman	Requester Manager
339	29:00.0	52:00.0	Amend Purchase Requisition	Elvira Lores	Requester
339	24:00.0	30:00.0	Analyze Purchase Requisition	Heinz Gutschmidt	Requester Manager
339	36:00.0	38:00.0	Create Request for Quotation Requester M	Francis Odell	Requester Manager
339	34:00.0	58:00.0	Analyze Request for Quotation	Magdalena Predutta	Purchasing Agent
339	50:00.0	03:00.0	Amend Request for Quotation Requester	Penn Osterwalder	Requester Manager
339	10:00.0	34:00.0	Analyze Request for Quotation	Francois de Perrier	Purchasing Agent
940	31:00.0	08:00.0	Create Purchase Requisition	Immanuel Karagianni	Requester
940	58:00.0	06:00.0	Create Request for Quotation Requester	Esmana Liubiata	Requester
940	30:00.0	56:00.0	Analyze Request for Quotation	Francois de Perrier	Purchasing Agent
940	46:00.0	59:00.0	Send Request for Quotation to Supplier	Magdalena Predutta	Purchasing Agent
940	44:00.0	31:00.0	Create Quotation comparison Map	Francois de Perrier	Purchasing Agent
940	38:00.0	52:00.0	Analyze Quotation comparison Map	Kim Passa	Requester
940	52:00.0	52:00.0	Choose best option	Anna Kaufmann	Requester
940	31:00.0	22:00.0	Settle conditions with supplier	Magdalena Predutta	Purchasing Agent
940	48:00.0	59:00.0	Create Purchase Order	Francois de Perrier	Purchasing Agent
940	33:00.0	44:00.0	Confirm Purchase Order	Esmeralda Clay	Supplier
940	32:00.0	46:00.0	Deliver Goods Services	Esmeralda Clay	Supplier
940	59:00.0	00:00.0	Release Purchase Order	Kim Passa	Requester
940	41:00.0	42:00.0	Approve Purchase Order for payment	Karel de Groot	Purchasing Agent
940	11:00.0	11:00.0	Send invoice	Kiu Kan	Supplier
940	28:00.0	28:00.0	Authorize Supplier's Invoice payment	Pedro Alvares	Financial Manager
940	11:00.0	19:00.0	Pay invoice	Karalda Nimwada	Financial Manager



An example

Purchasing process: Event data

What does the actual workflow for this process look like?

Illustration of features in many real processes:
Multiple types of flow-units
Batched flow-units
Conditional branching
Parallel activities
Shared resources
Feedback loops

Implementation notes/challenges: Identifying flow elements & metrics

1. To list activities and resources, gather a group with representation from all relevant departments. Use a software (e.g. Visio) or sticky-notes on whiteboard.

2. Process flows often have variations designed to take care of exceptions. It may be necessary to recognize different types of flow-units. Flow-unit may change form in the middle of flow.

3. Determining the scope or boundaries of flow is important: where does it start/end? What is the level of aggregation: how much detail should be included? Answer to such questions often depends on improvement project goals.

4. To identify metrics, start with taking a customer's (external) perspective. What will help win customers? Cheaper, Better, Faster? Internal metrics usually focus on costs. That may not be enough.

5. Think about prioritizing different metrics. For example, is it more important to keep cost down or is it more important to be fast in serving customer? Recognize the trade-off between different dimensions.

Key points and takeaways

- Observe a problem or opportunity. Interpret the context to identify the flow of work or materials that can be improved to address the problem.
- To define a flow, identify:
  - what is flowing through the system: flow-unit
  - what work is being done to add value: activities
  - who or what is doing the work: resources
- To define a flow's performance metrics, focus on customers
  - Cost, Time, Quality
  - Recognize trade-offs between metrics
  - Consider how different firms deliver different cost and time performance
- Document or Map the process flow using traditional tools like Swimlane or Sipoc charts, or use process mining–based software tools.

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Look at the world in terms of flow of work and material.

This will open up new ways to improve performance on:
Cost
Time
Quality

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1. Identify Flow
 1.1 Elements of Flow
  Flow-units, Resources, Activities, Inventory

 1.2 Performance of Flow
  Cost, Time, Quality
  Trade-Offs

 1.3 Process Discovery
  Event logs, Maps

Next
Start discussion board post

2. Automate Workflow
3. Forecast Demand
4. Balance Capacity

A Moment of Reflection

Please describe a process flow from your experiences at work or outside work, something that you feel interested in thinking about and improving.

If you would prefer not to share something from your own experience, you can use outside examples for inspiration. Slides at the end of Session 1 list links from a variety of contexts and also examples related to pandemic-related processes; pick the one you like.

Specifically, list the following:
Flow-unit, and any three steps in the flow.
Important flow performance measures for the flow.
What is the problem / What would you like to improve?
How can technology help? Can you scale it to be a start-up pitch?

For now, it is fine to start by answering only some of these questions. As the class progresses and you see other process improvement concepts, you can come back to add to your answer. Please keep the overall length brief about the length of this prompt; I hope this will motivate people to read as many as possible. Please make sure to respond to at least one of your class members' posts. Also, please be ready to talk (1-2 minutes) about your post in later class sessions.

Examples

Flow-improvement thinking applies to a variety of application contexts.
The first step is to identify elements of flow:

- Manufacturing process flow example: https://www.youtube.com/watch?v=4DKkueqcKmQ
- Service (restaurant kitchen) tour: https://www.youtube.com/watch?v=kW140spadx8
- Fulfillment process: https://www.youtube.com/watch?v=Y-lBvI6u_hw&t=1s
- Healthcare patient flow: https://www.youtube.com/watch?v=aHDkFSPvGao&ab
- Knowledge / Office Workflow in a lab: https://www.youtube.com/watch?v=kEwkOxxN6KQ&t=419s
- Software development process: https://www.youtube.com/watch?v=i-QyW8D3ei0
- Security incident workflow: https://www.youtube.com/watch?v=HSYcpjtFJW8
- Data center tour: https://www.youtube.com/watch?v=XZmGGAbHqa0

Examples

Some recent high-profile stories with process problems.

College aid application
https://abc11.com/post/fafsa-application-problems-department-of-education-works-to-fix-federal-aid/14790301/

Southwest delays
https://www.transportation.gov/briefing-room/dot-penalizes-southwest-airlines-140-million-2022-holiday-meltdown

Testing delays in the USA
https://www.npr.org/2020/05/28/863558750/coronavirus-testing-machines-are-latest-bottleneck-in-troubled-supply-chain

Vaccine development time
https://www.nytimes.com/interactive/2020/04/30/opinion/coronavirus-covid-vaccine.html

Port delays
https://www.weforum.org/agenda/2021/11/global-supply-chain-crisis-los-angeles-port/