

# Production Management (ME-419)

## Module 3 – Supply Management

Supply Disruptions

Aggregate Planning

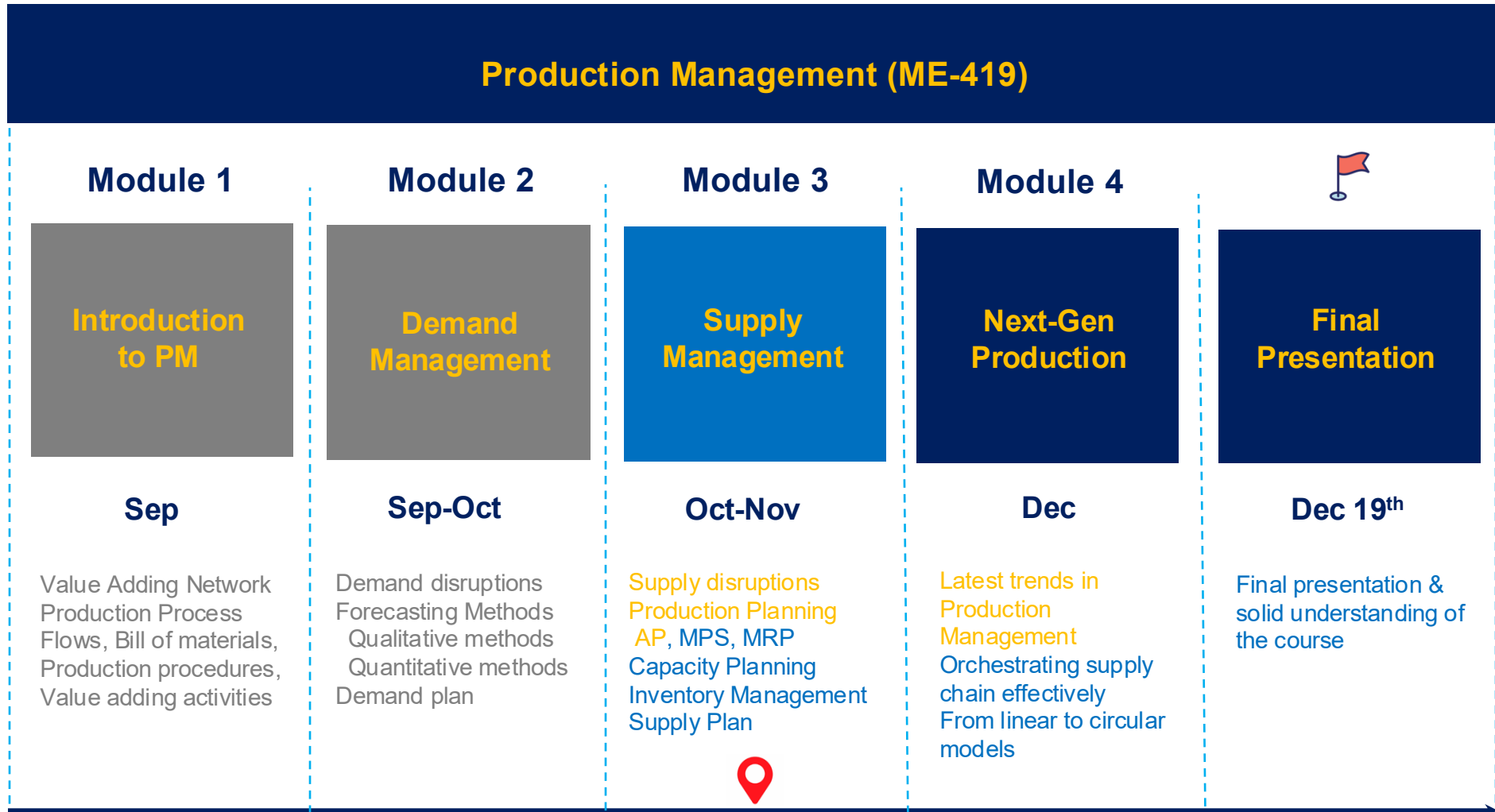
Amin Kaboli

Week 8 – Session 1 – Oct 31<sup>st</sup>, 2025

# Course Framework



**Business plan**  
Strategic plan  
Financial plan



# Module 3 – Supply Management

## Objectives

- Understanding the basic principals of supply management
- Mastering the following concepts and tools
  - Production Planning (AP, MPS, MRP)
  - Capacity Planning (RCCP, CPOPF)
  - Inventory Management
- Developing a feasible supply plan

# Question?



2 min

How to manage demand variation (change) in your manufacturing company?

# How to Manage Demand Variation in Your Company?



Varying the production rate by introducing overtime and/idle time or outside subcontracting



Changing the size of workforce by hiring and firing!

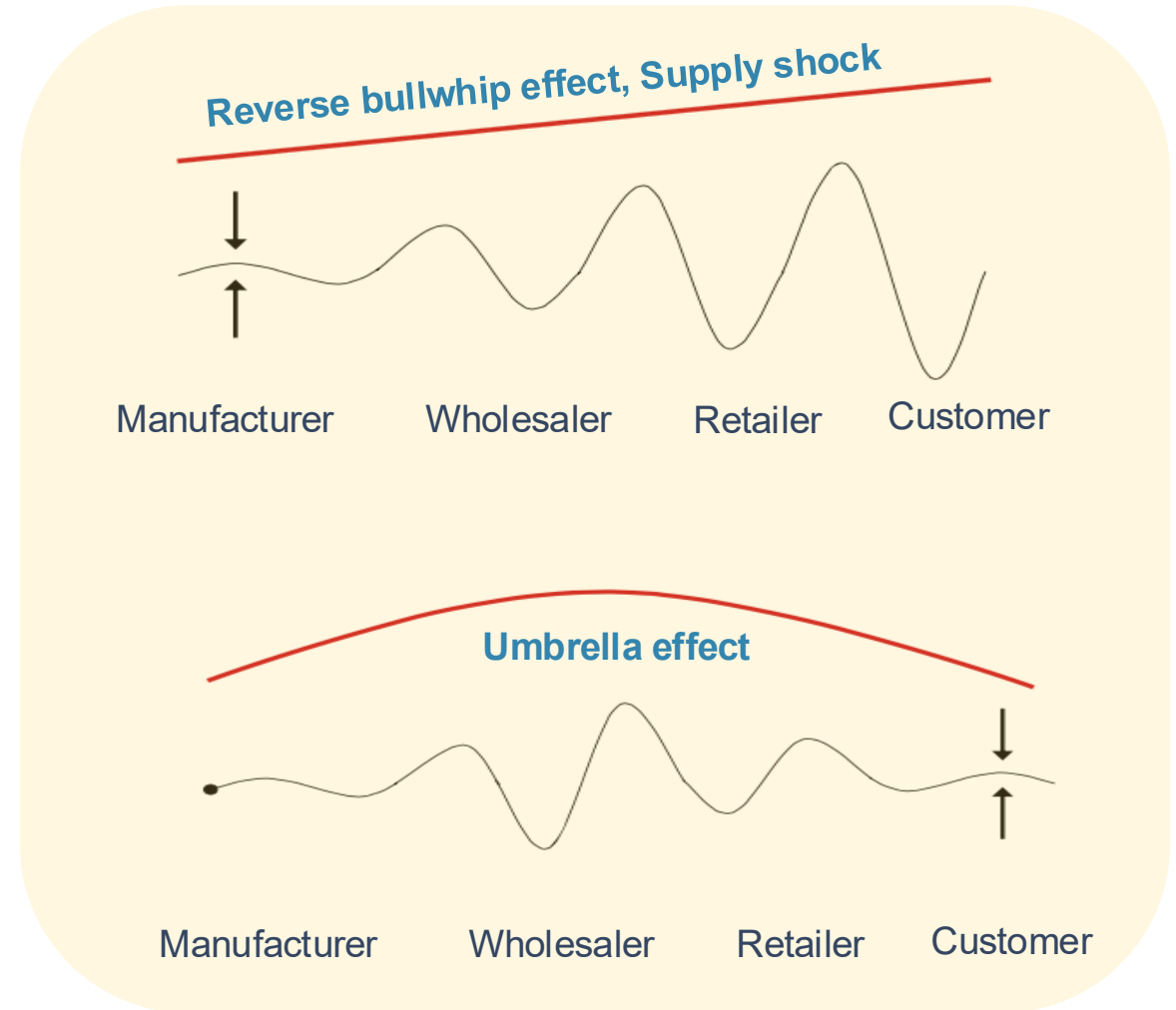
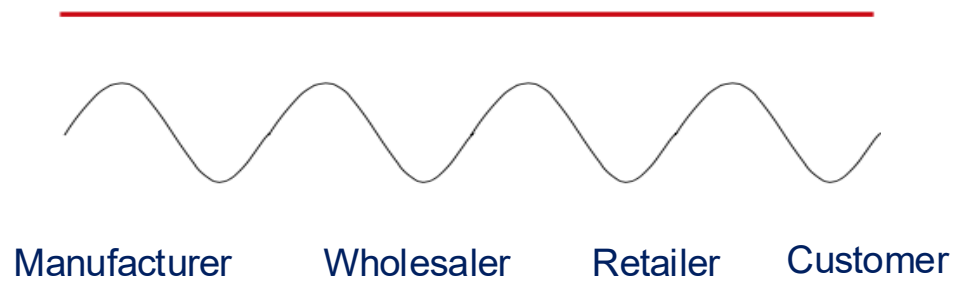


Building up stock

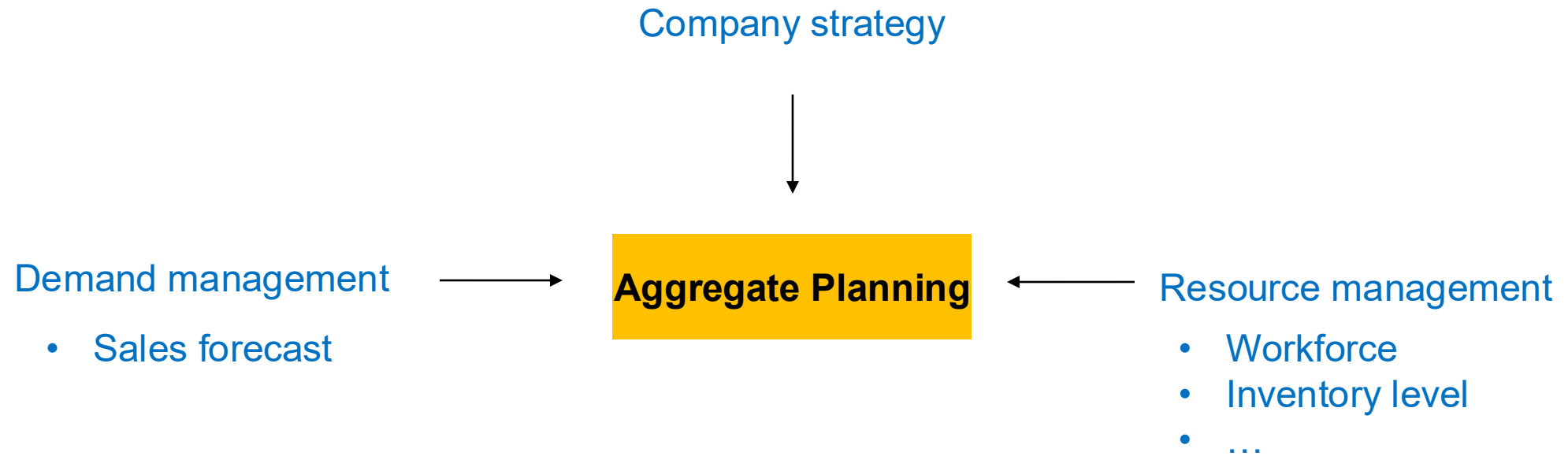


Planning backorders

# Reminder: Demand & Supply Variations



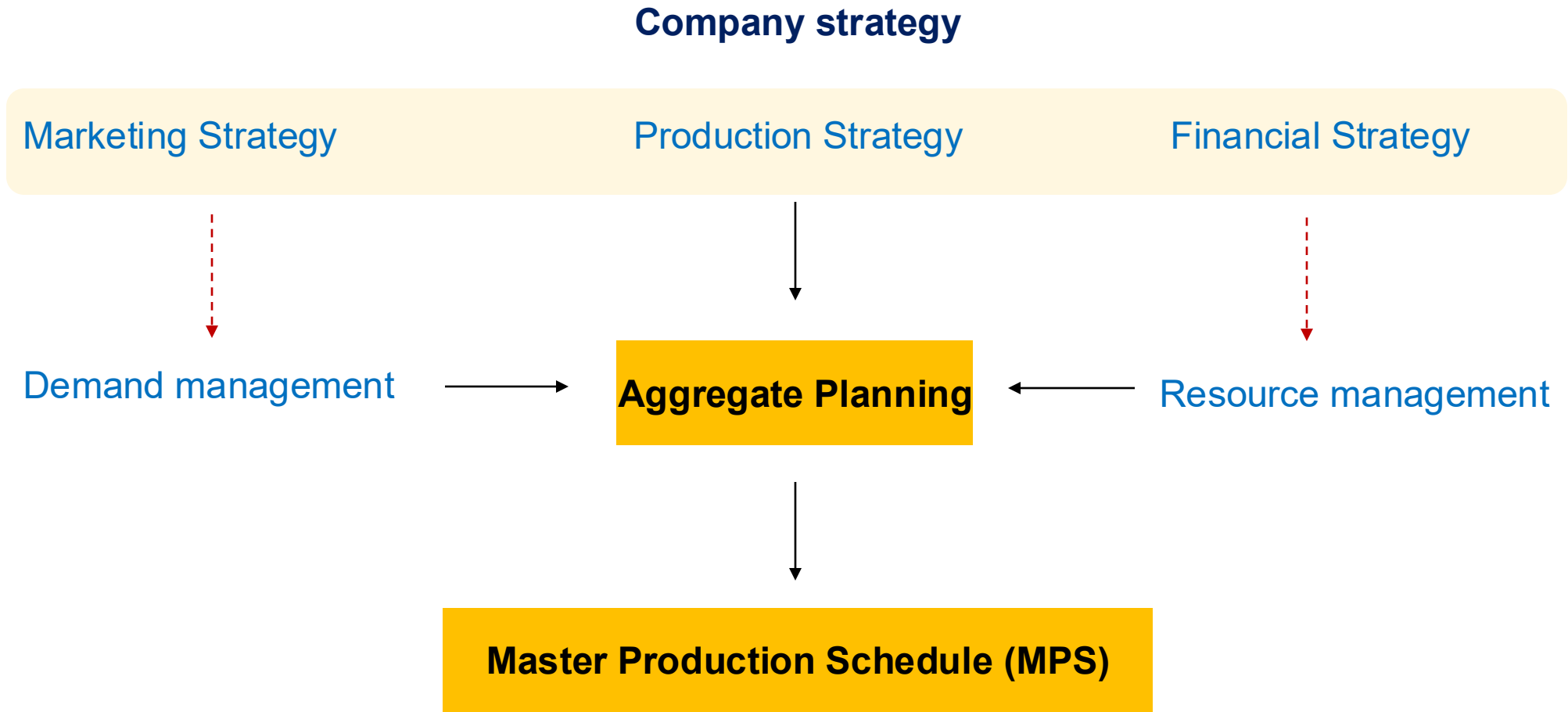
# Aggregate Planning (AP)



## What is aggregate planning?

It translates business plans into rough labor schedules and production plans.

# Aggregate Planning – Extended



# Aggregate Planning – Steps

**Estimation of market demand**



**Resource availability analytics**



**Developing alternative plans**



**Aggregate Planning**

- Product families
- Time period

- Workforce level
- Actual production rate
- Stock availability
- Costs (production, changing workforce, stock)

- **Horizon:** 12 to 18 months
- **Revision:** monthly

# Aggregate Planning – Strategies

- **Level plan** (Stable)
  - Constant workforce
  - Similar production quantities each time period
  - Inventories and backorders to absorb demand
- **Chase plan** (Demand following)
  - Variable workforce (hiring & firing)
  - Variable production quantities
  - Minimizing finished good inventories
- **Hybrid plan** (Mixed)
  - Variable workforce (hiring & firing)
  - Stock build up and backorders to level extreme peaks

# Aggregate Planning – Costs to be Considered

- **Production costs**

- Fixed & variable costs

- Material costs
- Direct labor costs
- Overhead costs
- ...

- **Changing workforce costs**

- Hiring workforce
- Training workforce
- Firing (laying off) workforce
- Overtime compensations

- **Stock related costs**

- Holding costs
- Backorder costs
- Loss on goods destroyed

## Question: What Does Aggregated Plan do?



Given an aggregate sales forecast (product family level), determine production levels, inventory levels, and workforce levels, in order to **minimize total relevant costs over the planning horizon**.

# Exercise 1: Aggregate Plan Strategies



- **Level plan** (Stable)
- **Chase plan** (Demand following)
- **Hybrid plan** (Mixed)

**Task 1:** Create an Aggregate plan (all three strategies)

**Task 2:** Compare the strategies



# Level Plan

- Similar production quantities each time period
- Inventories and backorders to absorb demand
- Constant workforce

Beginning Inventory	2'500
Beginning Workforce	18
Labor Standard (units/worker)	250

Period	Oct	Nov	Dec	Jan	Feb	Mar	Apr
Sales forecast	3'000	6'000	2'000	1'500	4'000	5'500	8'500
Cumulative Sales forecast	3'000	9'000	11'000	12'500	16'500	22'000	30'500
Net Cumulative Sales forecast	500	6'500	8'500	10'000	14'000	19'500	28'000

## Production Planning

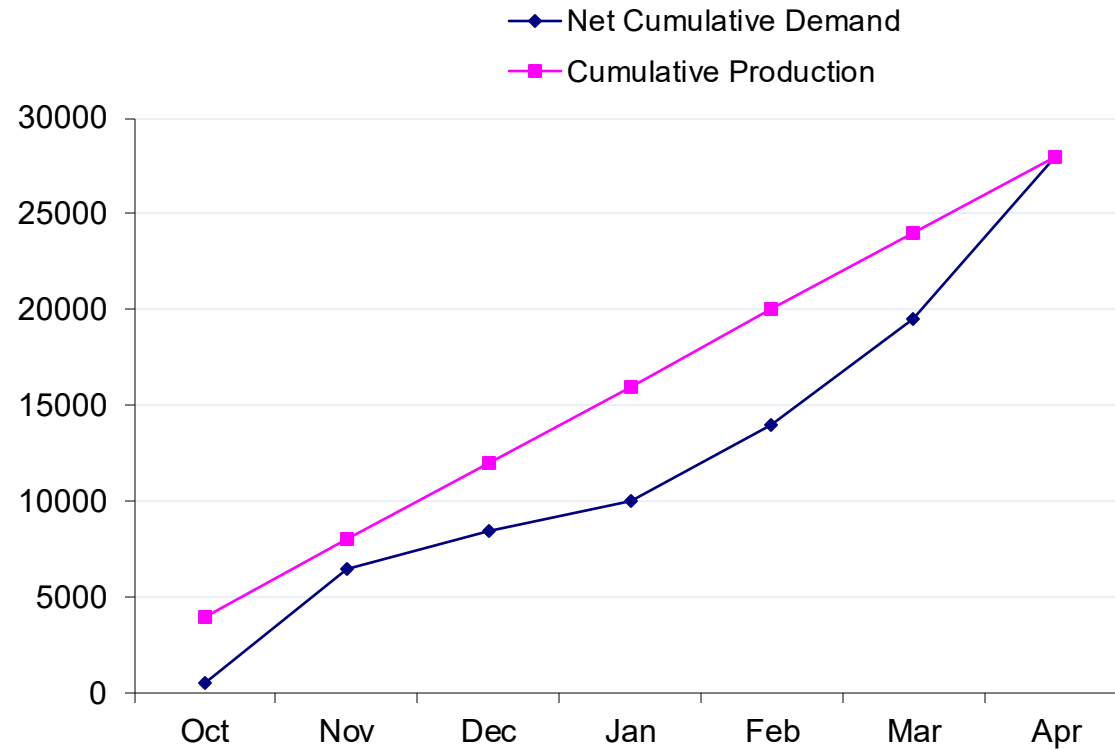
Production	4000	4000	4000	4000	4000	4000	4000
Cumulative Production	4000	8000	12000	16000	20000	24000	28000
Inventory (Excess Units)	3500	1500	3500	6000	6000	4500	0
Backorders (Units Short)	0	0	0	0	0	0	0

## Capacity Planning

Workers Hired	0	0	0	0	0	0	0
Workers Layed Off	2	0	0	0	0	0	0
Workforce Available	16	16	16	16	16	16	16

# Level Plan

- Similar production quantities each time period
- Inventories and backorders to absorb demand
- Constant workforce





# Chase Plan

- Variable production quantities
- Minimizing finished good inventories
- Variable workforce (hiring & firing)

Beginning Inventory	2'500
Beginning Workforce	18
Labor Standard (units/worker)	250

Period	Oct	Nov	Dec	Jan	Feb	Mar	Apr
Sales forecast	3'000	6'000	2'000	1'500	4'000	5'500	8'500
Cumulative Sales forecast	3'000	9'000	11'000	12'500	16'500	22'000	30'500
Net Cumulative Sales forecast	500	6'500	8'500	10'000	14'000	19'500	28'000

## Production Planning

Production	500	6'000	2'000	1'500	4'000	5'500	8'500
Cumulative Production	500	6'500	8'500	10'000	14'000	19'500	28'000
Inventory (Excess Units)	0	0	0	0	0	0	0
Backorders (Units Short)	0	0	0	0	0	0	0

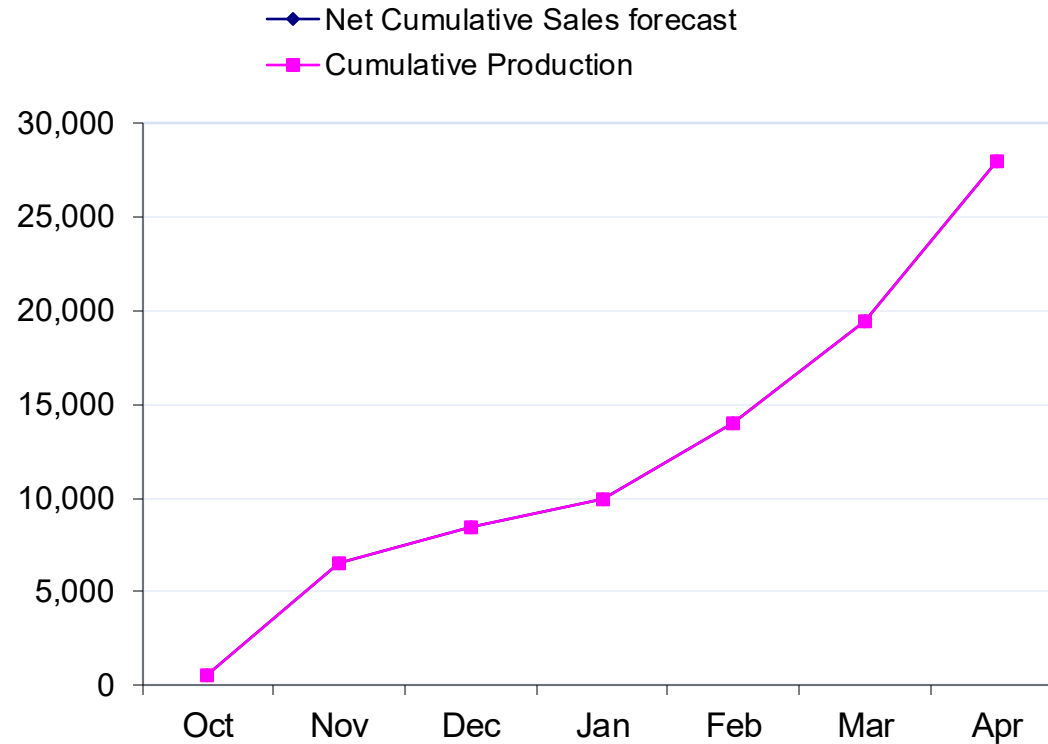
## Capacity Planning

Workers Hired	0	22	0	0	10	6	12
Workers laid Off	16	0	16	2	0	0	0
Workforce Available	2	24	8	6	16	22	34

# Chase Plan



- Variable production quantities
- Minimizing finished good inventories
- Variable workforce (hiring & firing)





# Hybrid Plan

- Stock build up and backorders to level extreme peaks
- Variable workforce (hiring & firing)

Beginning Inventory	2'500
Beginning Workforce	18
Labor Standard (units/worker)	250

Period	Oct	Nov	Dec	Jan	Feb	Mar	Apr
Sales forecast	3'000	6'000	2'000	1'500	4'000	5'500	8'500
Cumulative Sales forecast	3'000	9'000	11'000	12'500	16'500	22'000	30'500
Net Cumulative Sales forecast	500	6'500	8'500	10'000	14'000	19'500	28'000

## Production Planning

Production	3250	3250	2000	1500	4000	5500	8500
Cumulative Production	3250	6500	8500	10000	14000	19500	28000
Inventory (Excess Units)	2750	0	0	0	0	0	0
Backorders (Units Short)	0	0	0	0	0	0	0

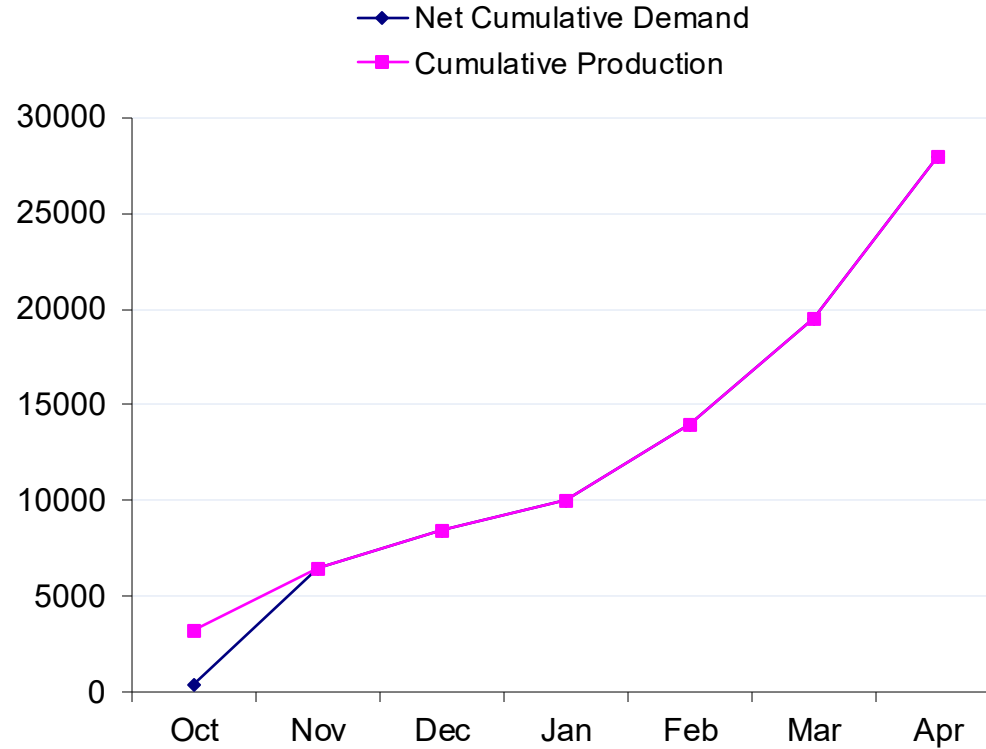
## Capacity Planning

Workers Hired	0	0	0	0	10	6	12
Workers Layed Off	5	0	5	2	0	0	0
Workforce Available	13	13	8	6	16	22	34

# Hybrid Plan



- Stock build up and backorders to level extreme peaks
- Variable workforce (hiring & firing)





# Plan Comparison

- **Level plan (Stable); CHF 1'330'500**
- **Chase plan (Demand following) CHF 1'254'500**
- **Hybrid plan (Demand following) CHF 1'240'750**

Costs (CHF)	Cost Per Unit	Total Units	Total Cost
Regular Time Labor Cost	43.00	28000	1'204'000
Overtime/Subcontracting	14.40	0	0
Inventory Holding Cost	5.00	25000	125'000
Backorders	7.50	0	0
Hiring	500.00	0	0
Layoff	750.00	2	1'500
<b>Total Costs</b>			<b>1'330'500</b>

Costs (CHF)	Cost Per Unit	Total Units	Total Cost
Regular Time Labor Cost	43.00	28000	1'204'000
Overtime/Subcontracting	14.40	0	0
Inventory Holding Cost	5.00	0	0
Backorders	7.50	0	0
Hiring	500.00	50	25'000
Layoff	750.00	34	25'500
<b>Total Costs</b>			<b>1'254'500</b>

Costs (CHF)	Cost Per Unit	Total Units	Total Cost
Regular Time Labor Cost	43.00	28000	1'204'000
Overtime/Subcontracting	14.40	0	0
Inventory Holding Cost	5.00	2750	13'750
Backorders	7.50	0	0
Hiring	500.00	28	14'000
Layoff	750.00	12	9'000
<b>Total Costs</b>			<b>1'240'750</b>

# Production Management (ME-419)

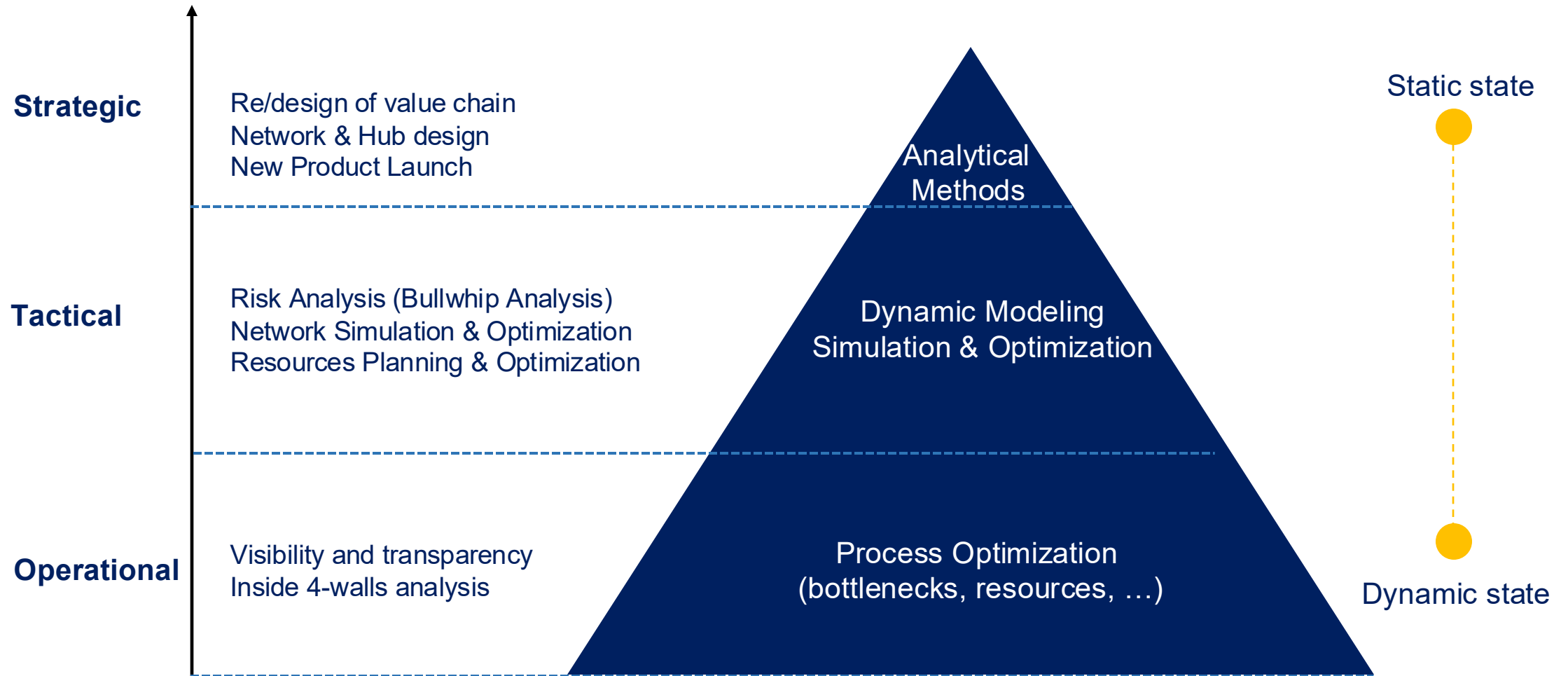
## Module 4 – Next-Gen Production

### Simulation (Why, What, How)

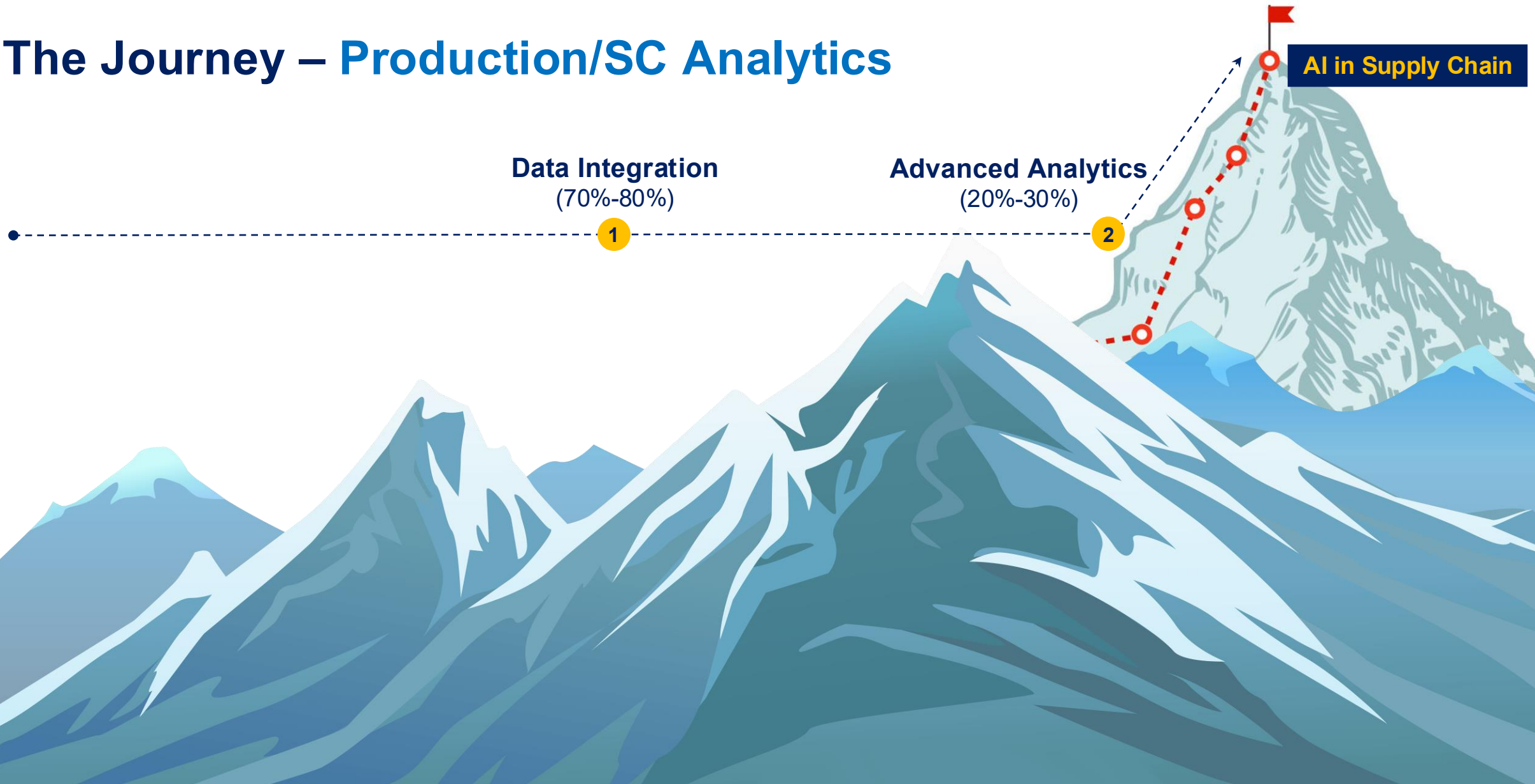
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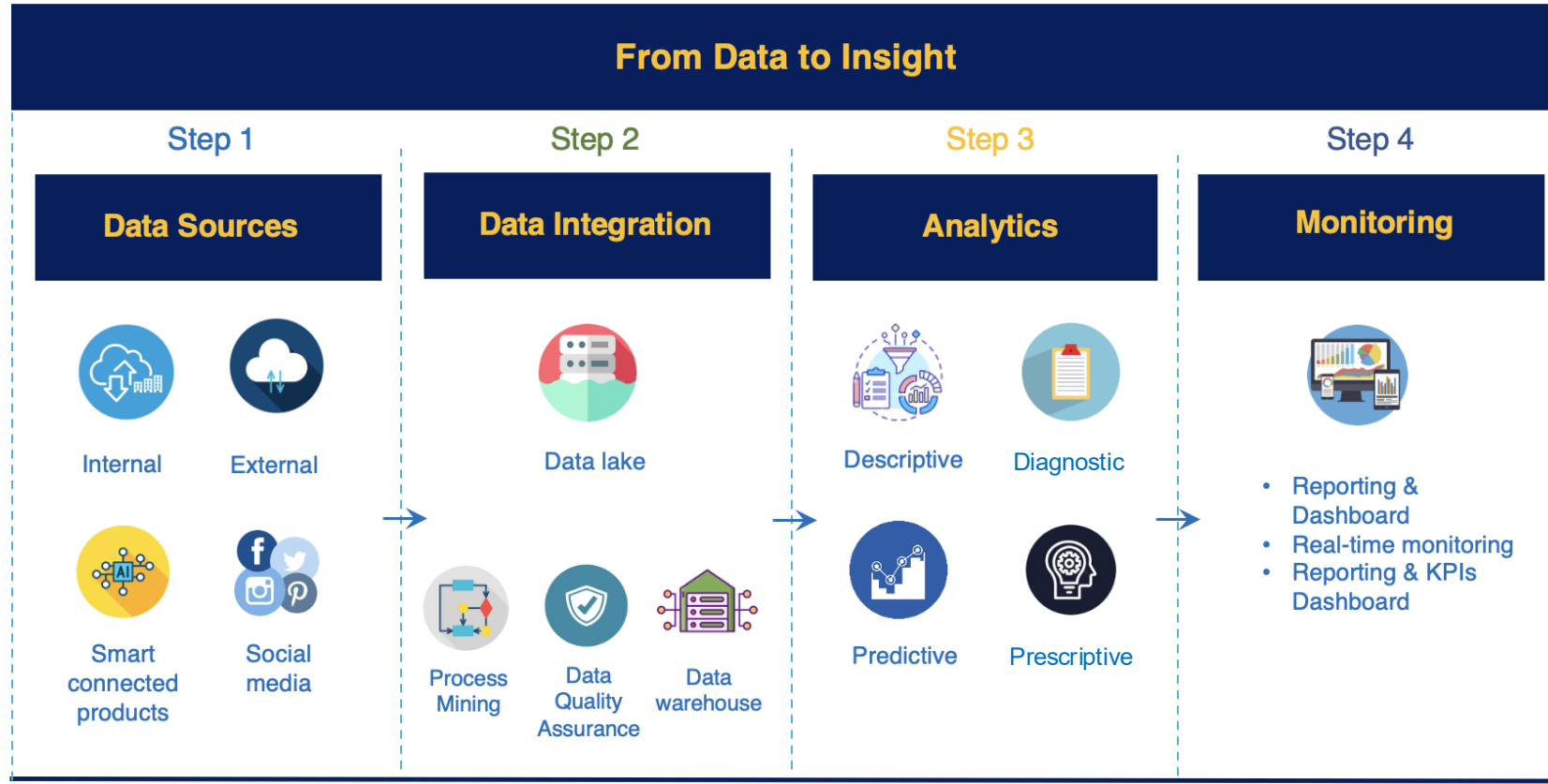
# Production/SC Problems – Ranges



# The Journey – Production/SC Analytics



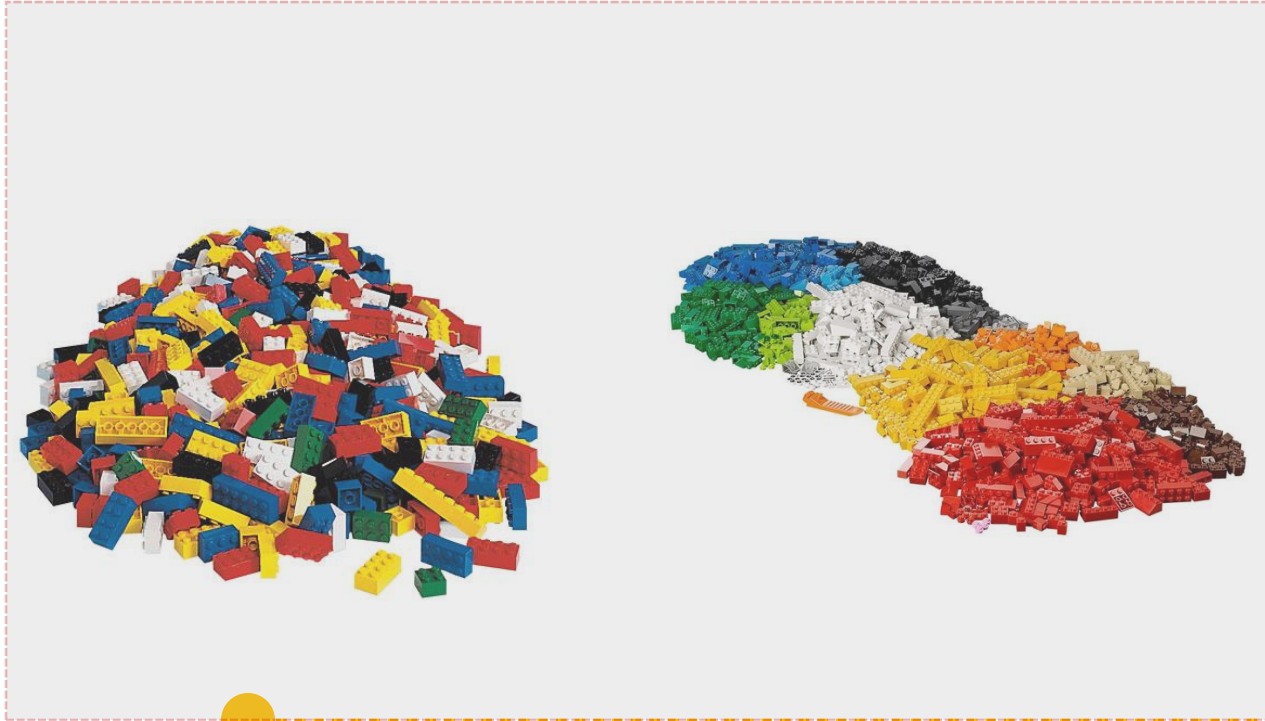
# Analytics – From Data to Insight



## 1. Data Integration:

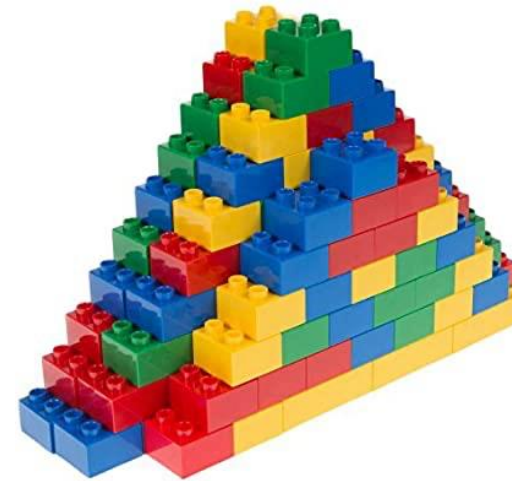
The biggest challenge — collecting, cleaning & preparing data takes 70%-80% of project time.

# Harnessing the Power of Data



Data

Sorted/Cleaned/Arranged

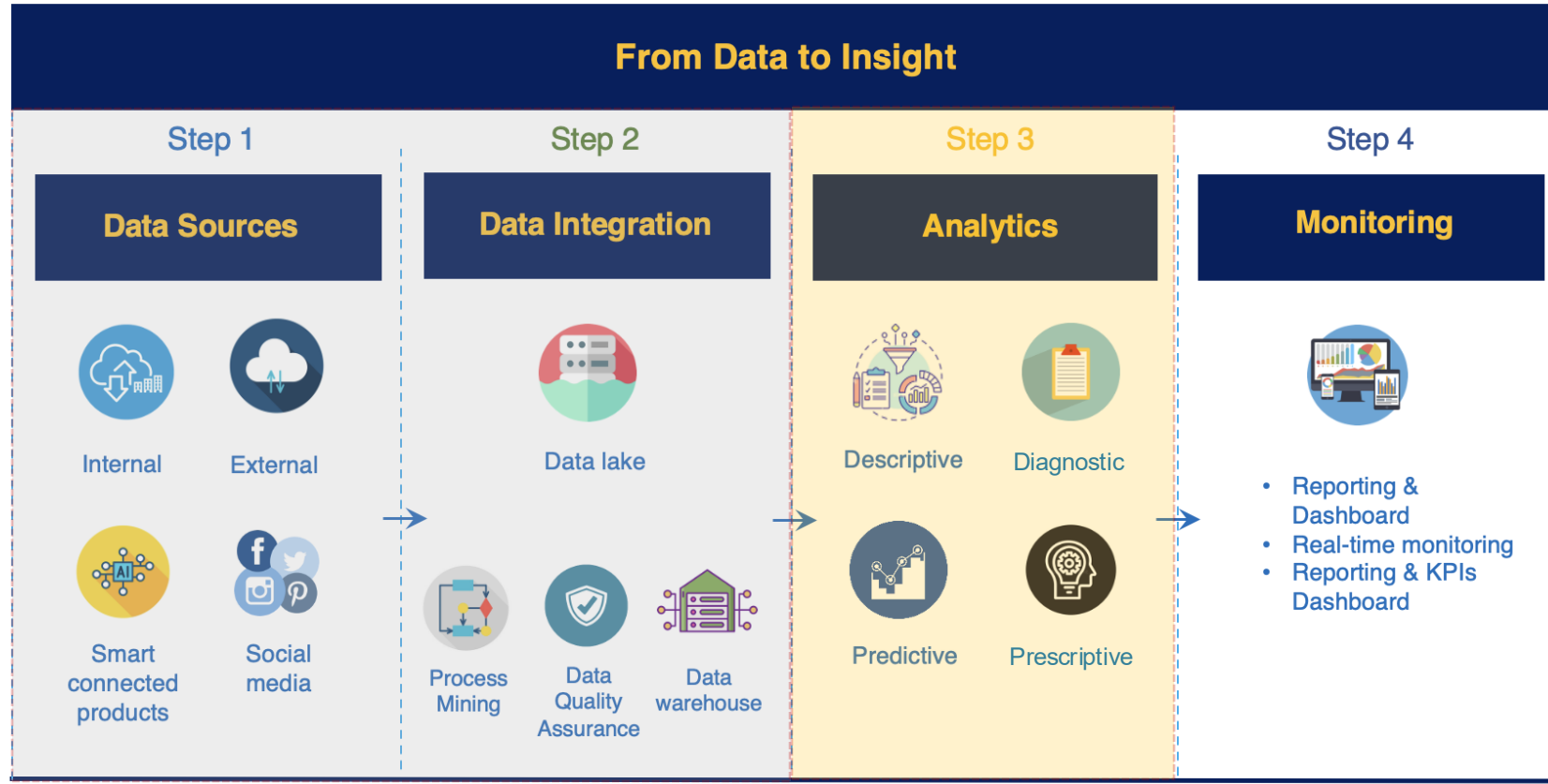


Modeling/Simulation/Optimization



Insights

# Analytics – From Data to Insight



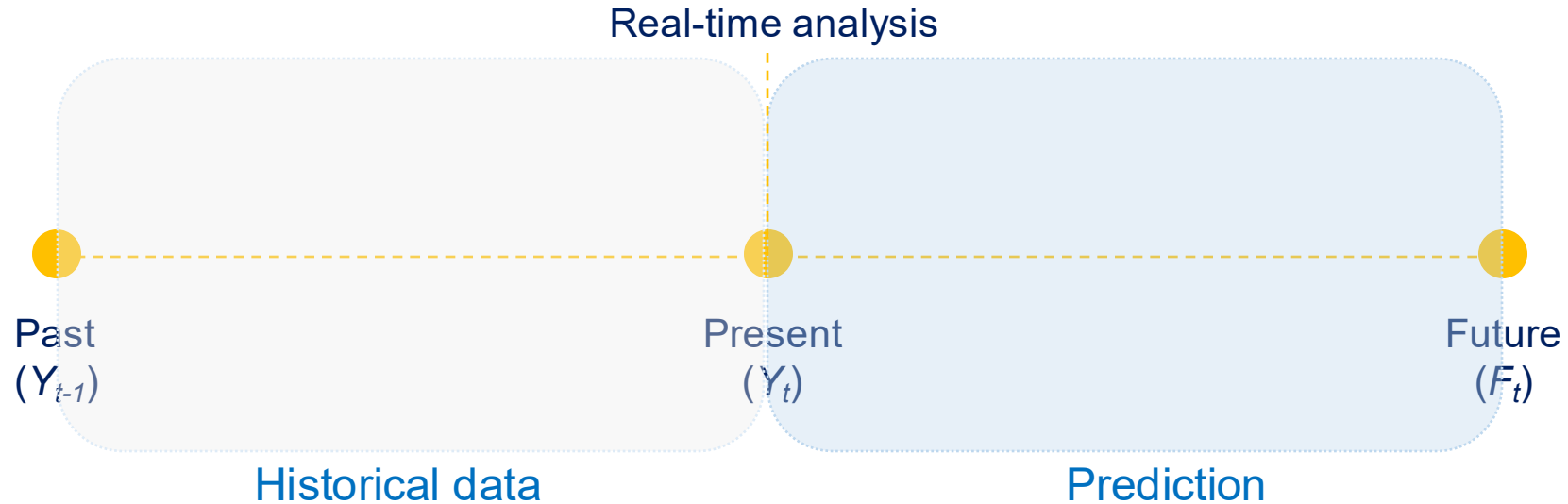
## 1. Data Integration:

The biggest challenge — collecting, cleaning & preparing data takes 70%-80% of project time.

## 2. Analytics:

Where the real value happens — applying models & insights needs technical skills (20%-30% effort).

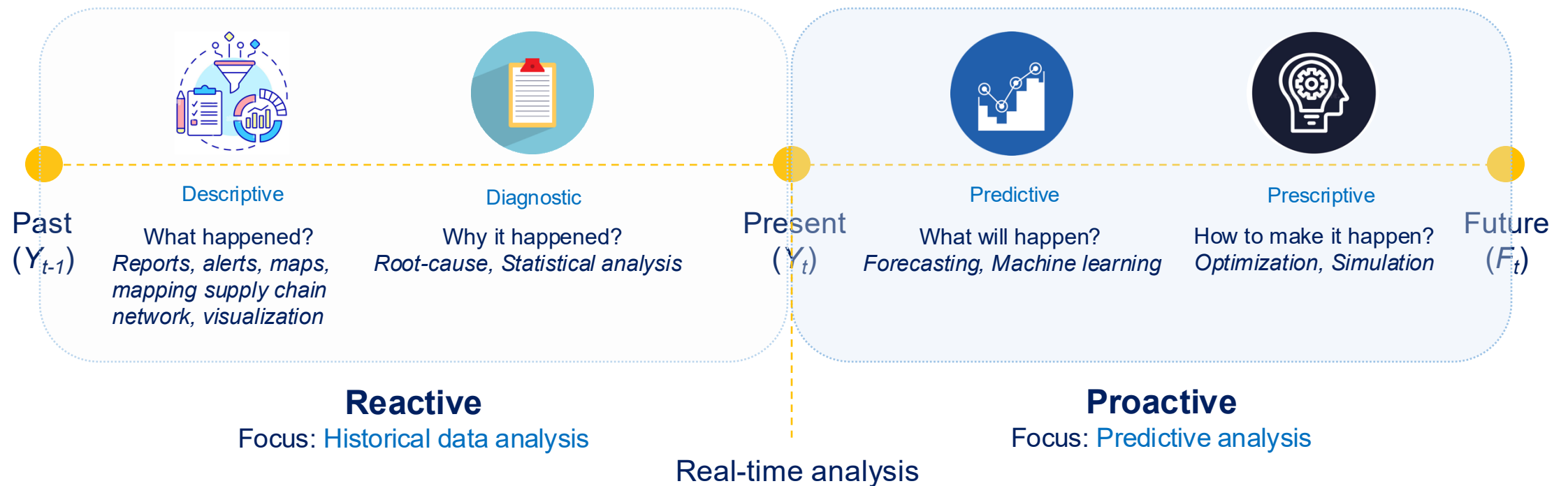
# Analytics – From Data Analytics to Data Science



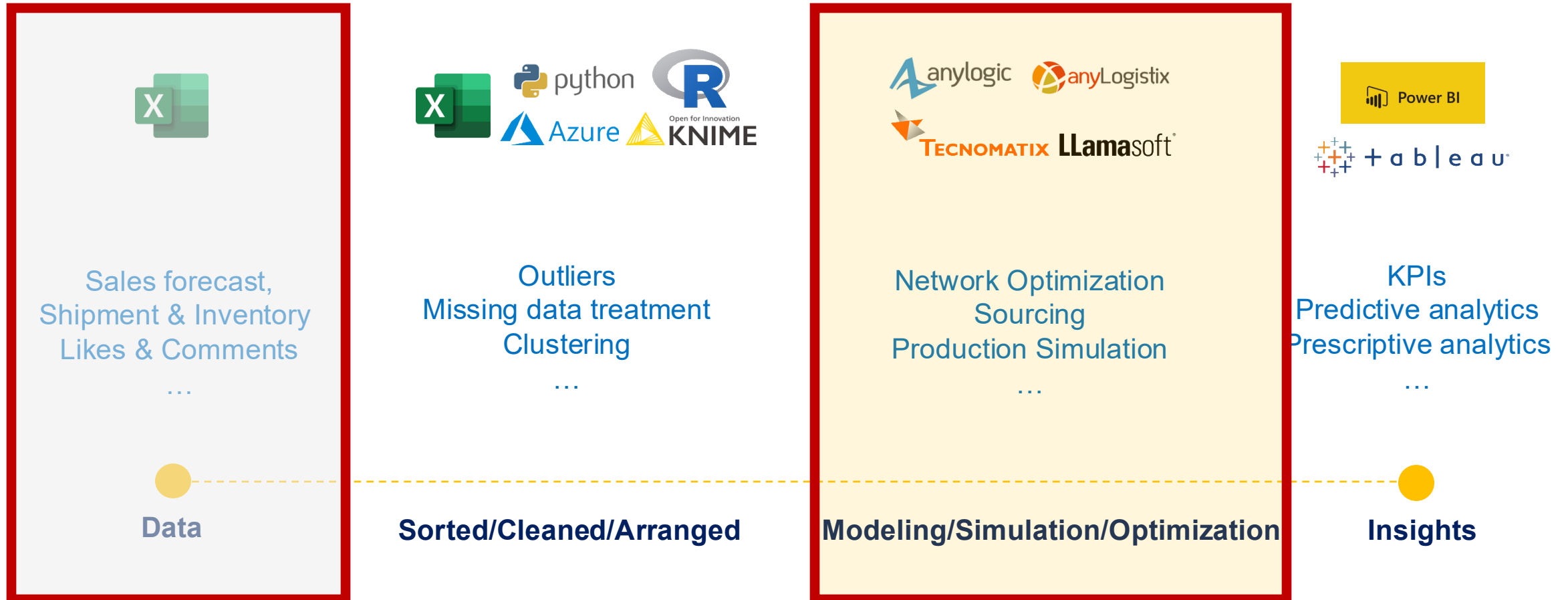
**Assumption:** The future will be the same as the past!

- $F_t$ : demand forecast for period  $t$
- $Y_t$ : actual demand for period  $t$

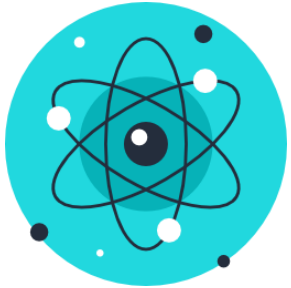
# Analytics – From Reactive to Proactive



# From Data to Insights – Ranges



# Why We Simulate – Testing Design Before Acting



Real-world supply chains are complex: multiple partners, demand shifts, delays, and disruptions.



Answers "what-if" questions:  
- What if demand increases?  
- What if a supplier delayed?  
- What if we reduce inventory?



Analytics shows you patterns; simulation lets you test changes before doing them in real life.



Reduces risk and improve decision-making by showing system-wide impacts in a virtual environment



5 Min

## Group Discussion Question – Simulation Thinking

**Scenario:** "Imagine your company experiences a **30% increase in market demand.**"

**In groups, discuss:**

1. Which parts of your supply chain are impacted first?
2. What risks might emerge (e.g., delays, stockouts, cost increases)?
3. What would you want to test in a simulation tool before making real changes?

**Purpose:** To think like a supply chain designer using simulation as a virtual testing lab.

# Common Production/Supply Chain Simulation Tools



Agent-based, discrete-event & system dynamics modeling.



Discrete-event and agent-based via Anylogic, for supply chain network design & simulation.



Discrete-event and 3D simulation focused on logistics, warehousing, manufacturing.



Discrete-event simulation for process and operations analysis.



(Now Coupa), Discrete-event, optimization and simulation for strategic supply chain network design.

# Supply Chain Simulation – anyLogistix (Professional Version)

## 1. Follow anyLogistix (ALX) access – Process on Moodle

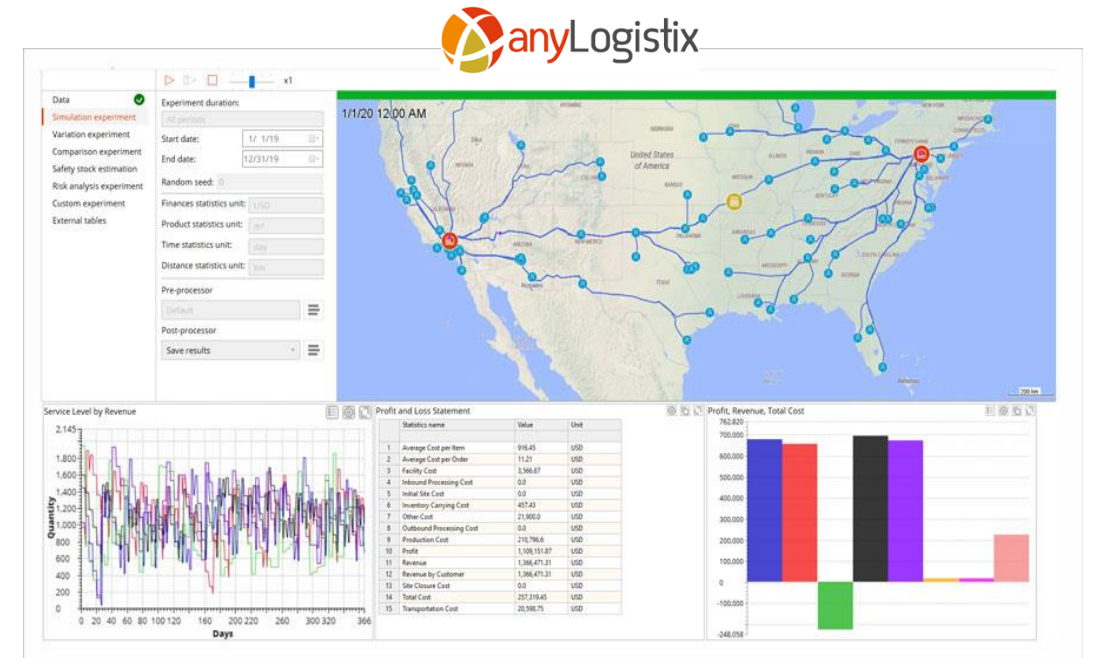
 **Guide 1.** How to use ALX on virtual machine (Professional version)

## 2. Check out the guiding videos before you start

  **Guide 2.** Introduction to anyLogistix

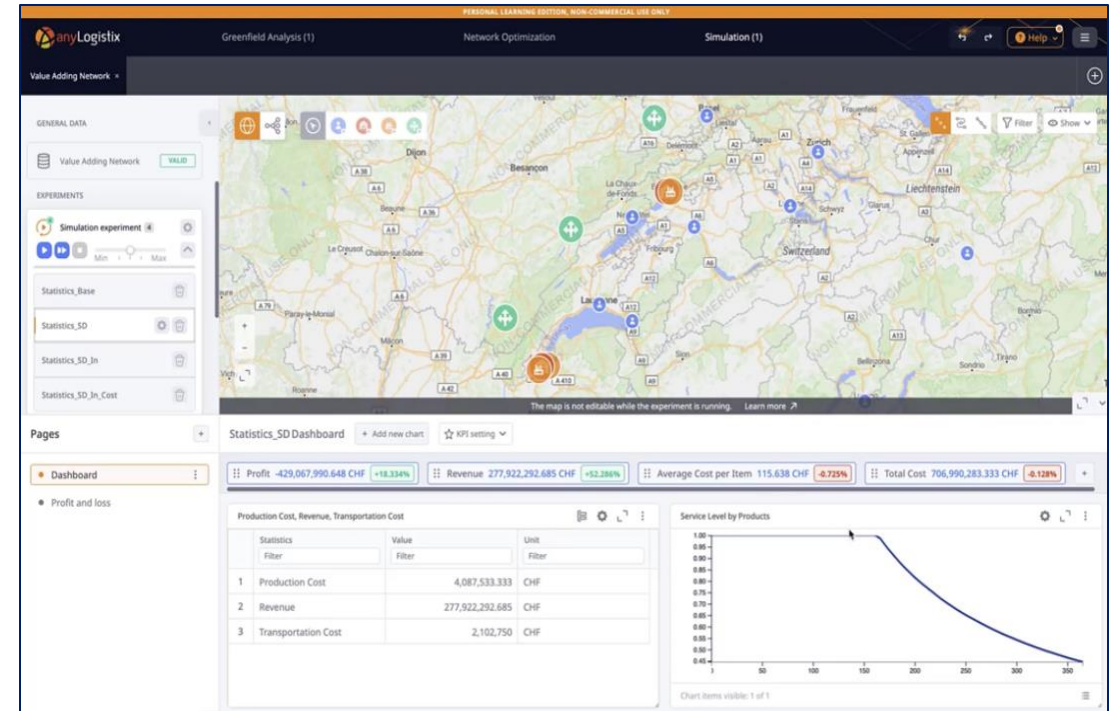
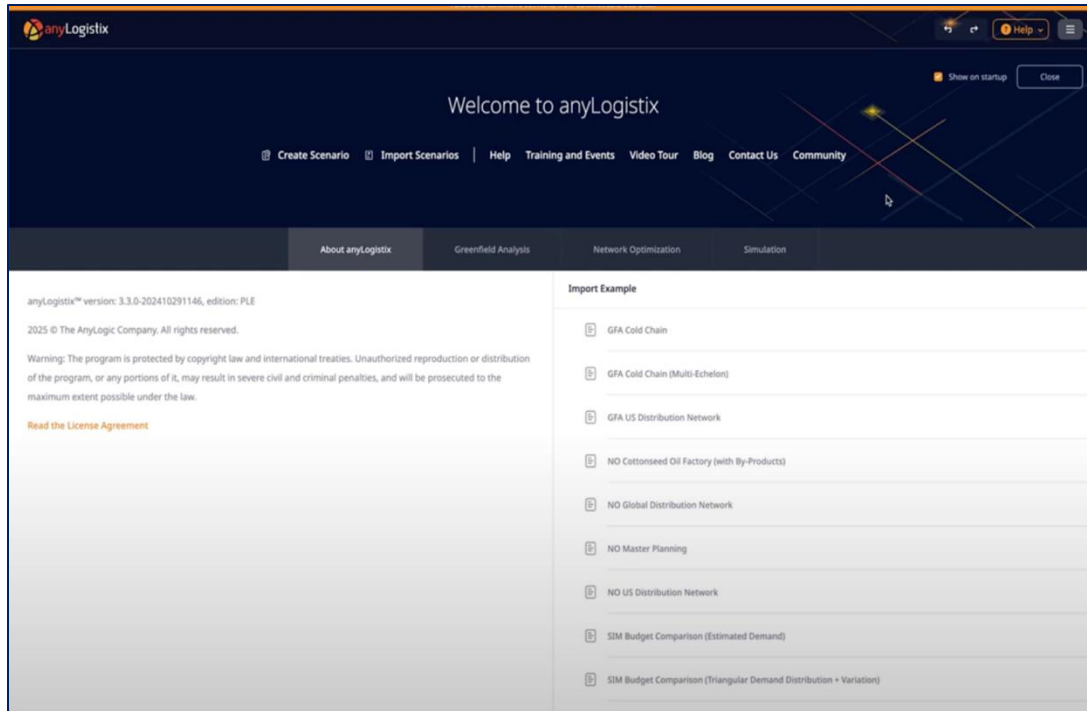
  **Guide 3.** Designing & mapping value adding network

  **Guide 4.** Modeling demand uncertainty



Access to files & videos: <https://moodle.epfl.ch/mod/folder/view.php?id=1333326>

# anyLogistix (PLE Version) – Introduction



Access to files & videos: Moodle

# Required Actions

1. Follow AnyLogisticx access – Process on Moodle



2. Watch and practice this Video and work of ALX assignment 1



# Production Management (ME-419)

## Coaching Rooms

Amin Kaboli

Week 8 – Session 4 – Oct 31<sup>st</sup>, 2025

# The Art of Giving and Receiving Effective Feedback



Feedback is a gift



Feedback/comments are  
always welcome

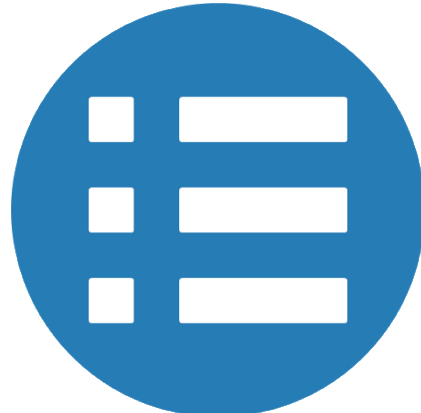
# Giving Effective Feedback



## Respectful

Ask for permission

May I share my observation



## Fact-based

Share facts/ your feelings

What I observed/felt is that ...



## Constructive

Stay focused on growth

What I suggest is that ...



## Concise

Be to-the-point and short

Max three key points



## Open

Be open to any reaction

I respect your feeling ...

# Receiving Effective Feedback



## Receive the gift

**Be open and receptive**

*I appreciate your feedback*



## Listen

**Listen to listen!**

The goal is to listen not to answer, no interruption (zip it)



## Understand

**Focus on THE message**

The goal is to understand, ask questions, clarify, repeat key points, ...



## Decide

**You always have a choice**

*Thank you, I have never seen it this way*  
OR  
*Thank you, let me reflect and get back to you?*



## Follow up

**Reach a common understanding**

There are many ways to follow up: revise the work, set up a meeting, ...