

Continuous Improvement

Module 3 – Process

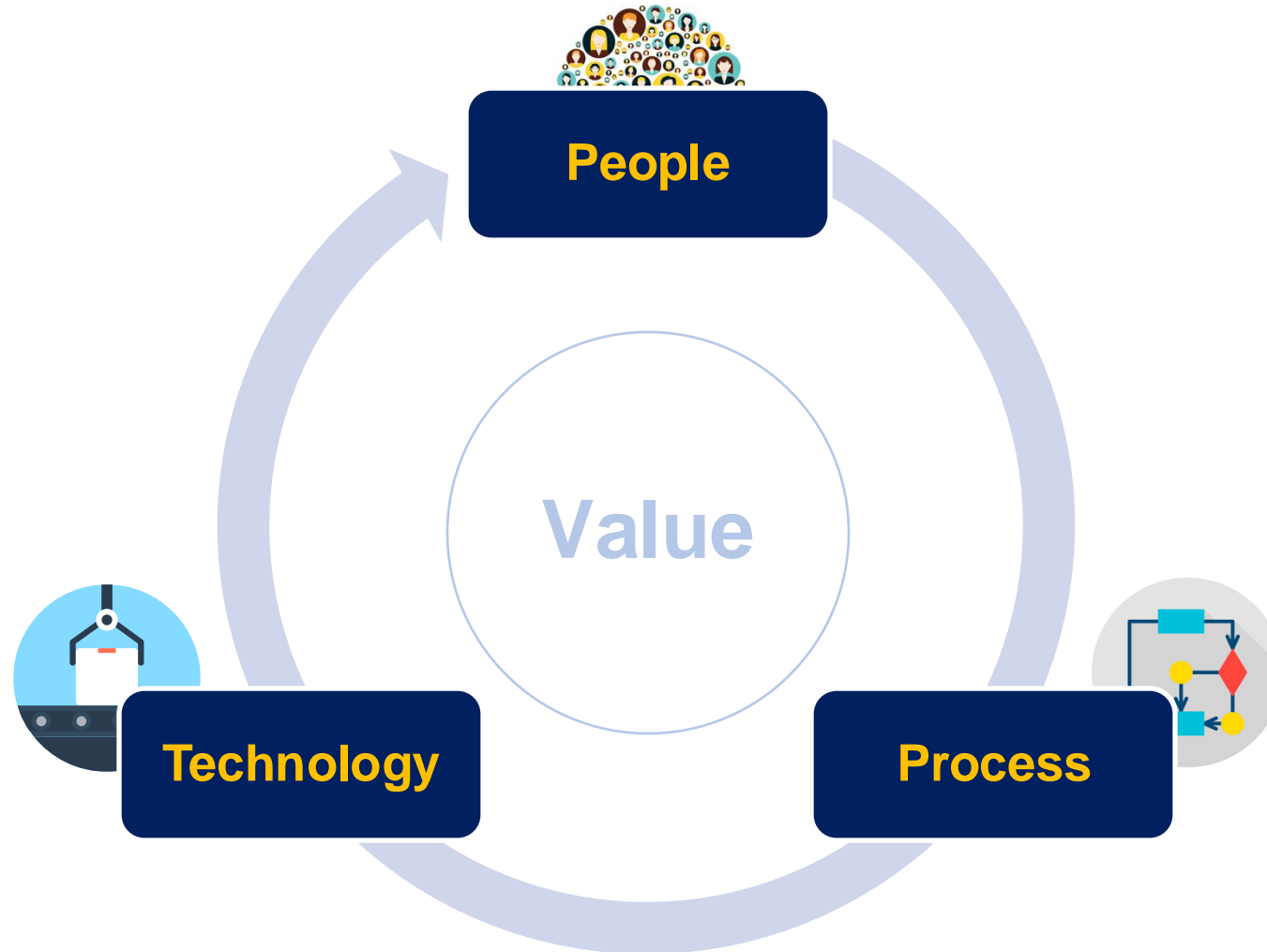
Capacity Planning

Amin Kaboli

Week 2, Session 1&2, Feb 28th, 2025

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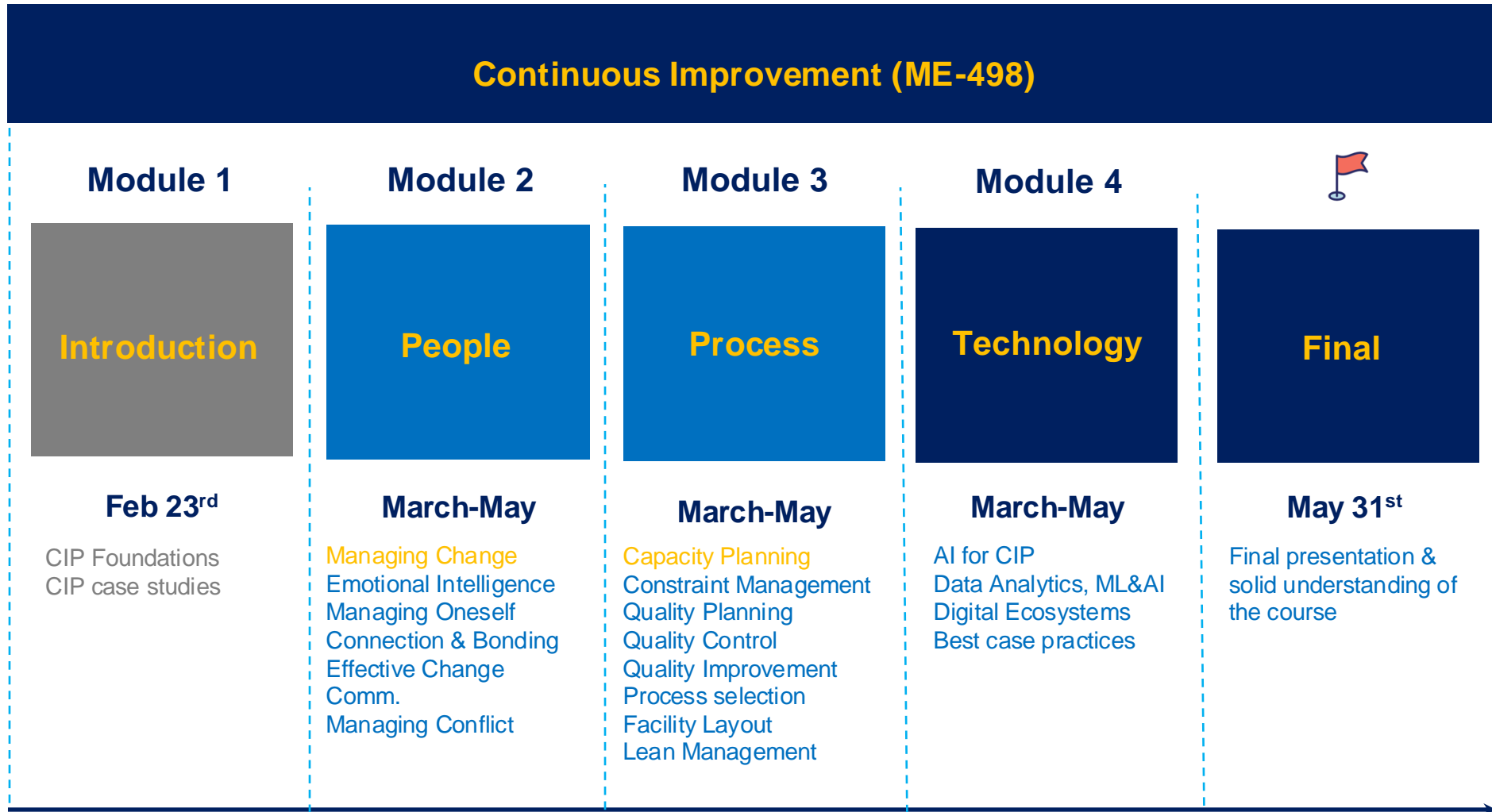
Continuous Improvement – Modules



Course Framework



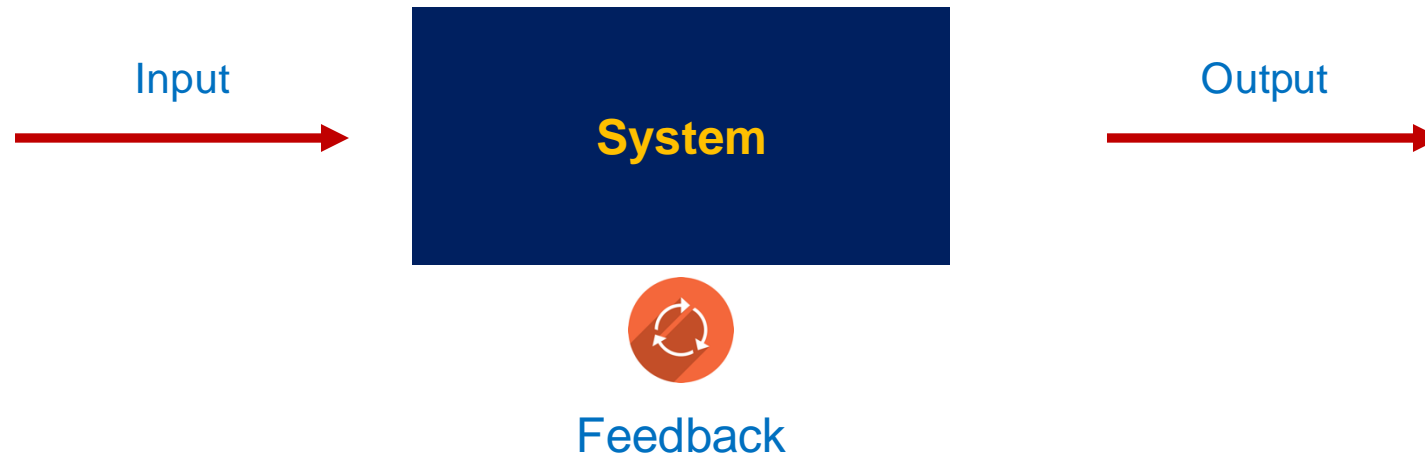
Change Plan
Strategic plan



Agenda of the day

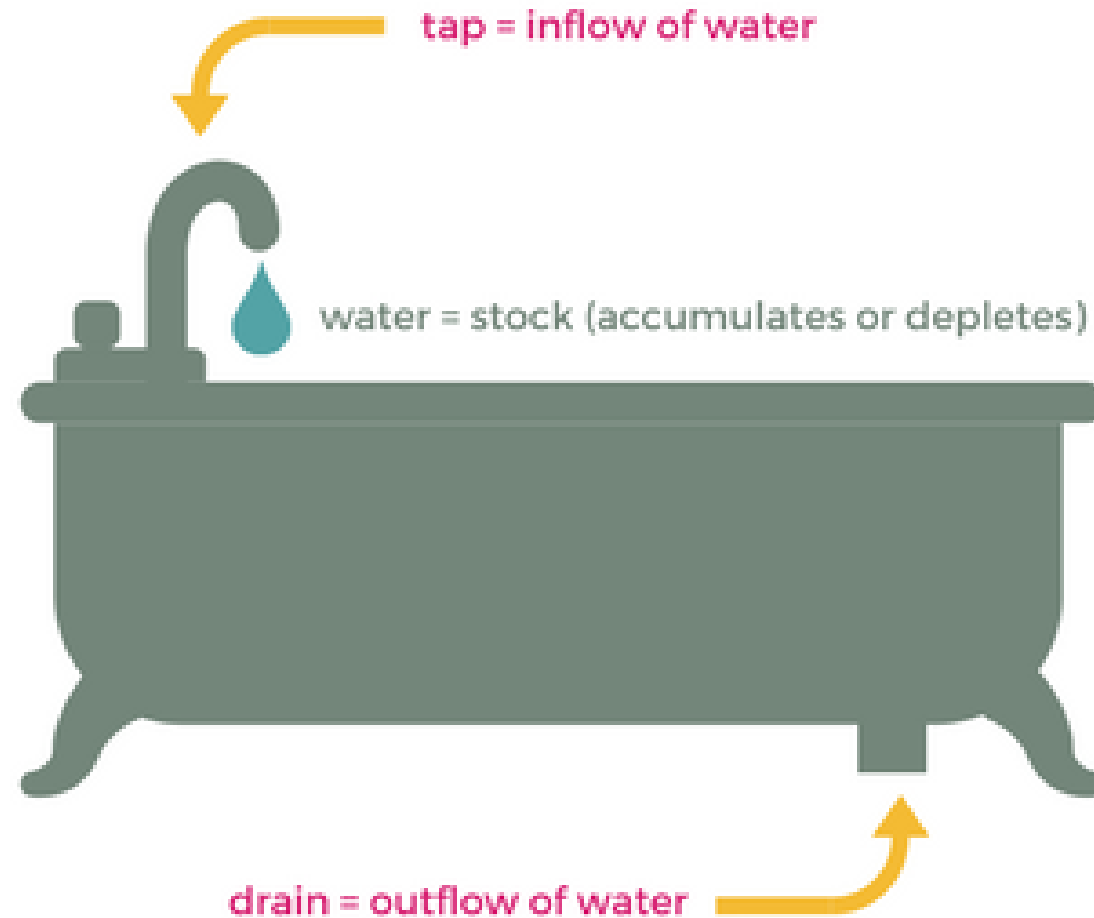
- **13:15 – 14:00** **Module 3 – Process:** Capacity Planning + Play & Practice
- **14:15 – 15:00** **Module 3 – Process:** Capacity Planning + Play & Practice
- **15:15 – 16:00** **Module 1 – People:** Managing Change + Re-Grouping
- **16:15 – 17:00** **Presentation of Assignment 1**

System Dynamics

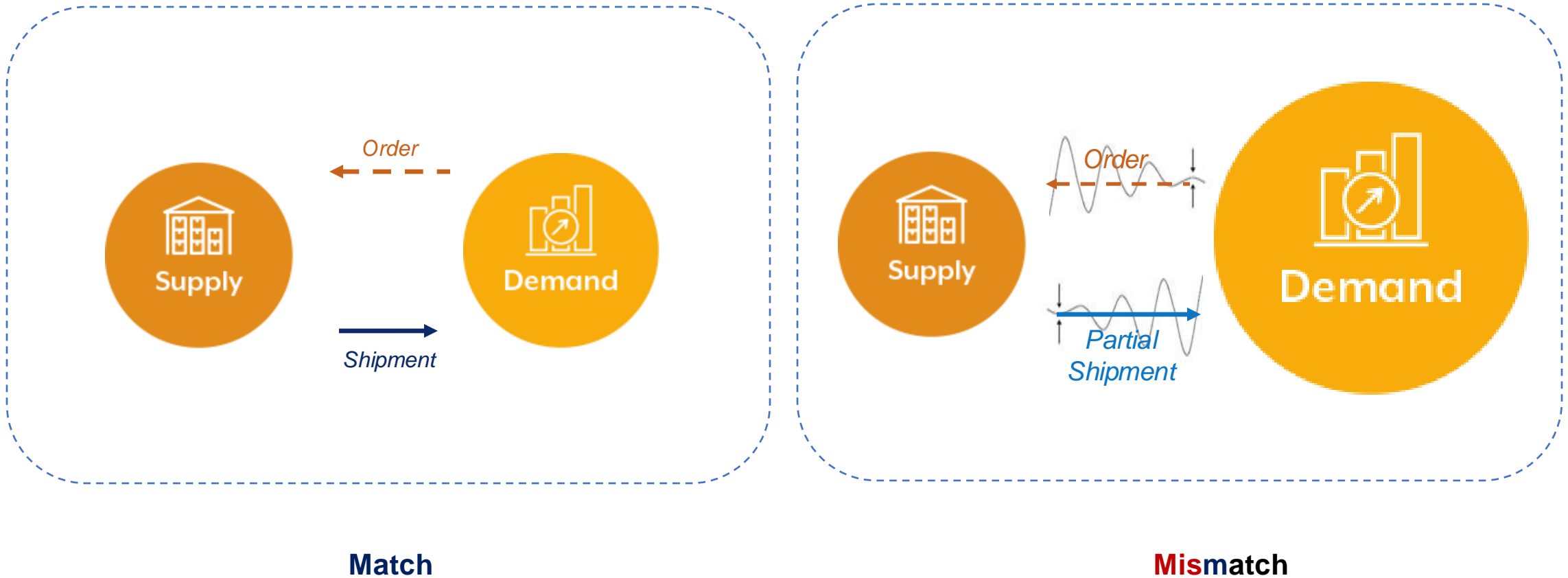


Labor hours, Machine hours	Auto manufacturing	# of Cars/shift
Number of seats	Airline	# of ticket sold/flight
Number of rooms	Hotel	# of rooms booked/night

System Dynamics – Bathtub Metaphor



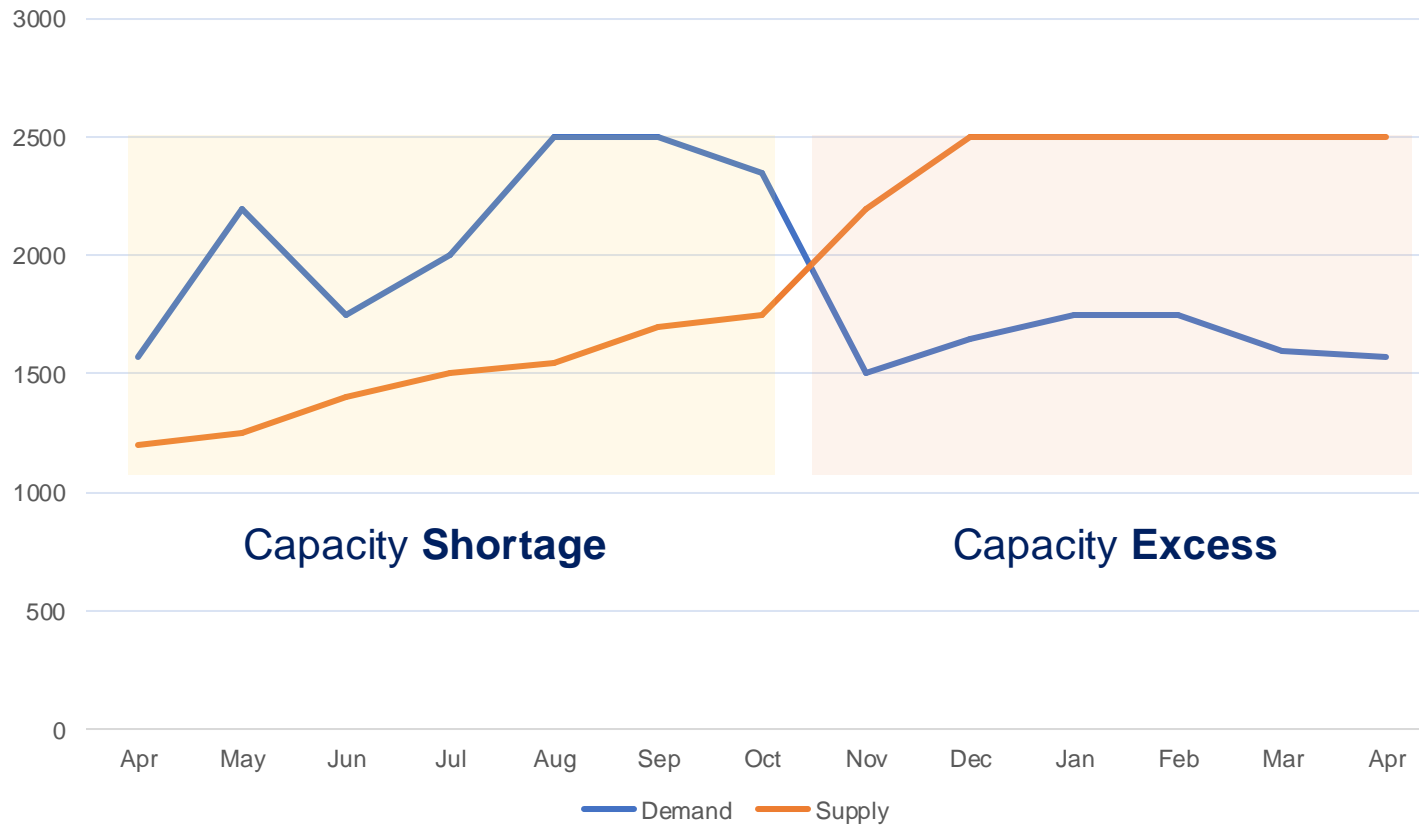
Demand and Supply



Question 1:

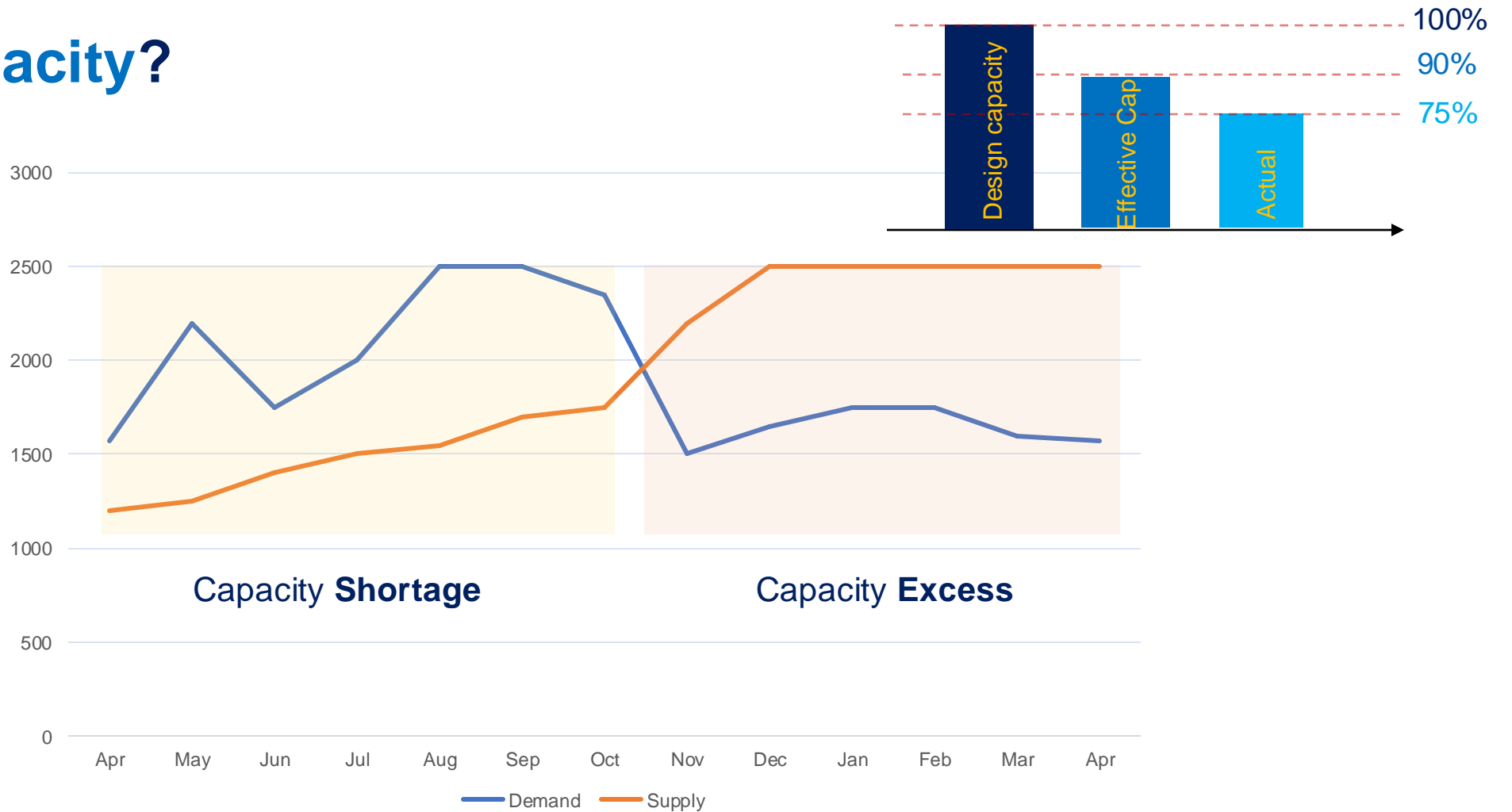
**What is Capacity?
Why is it important?**

What Is Capacity?



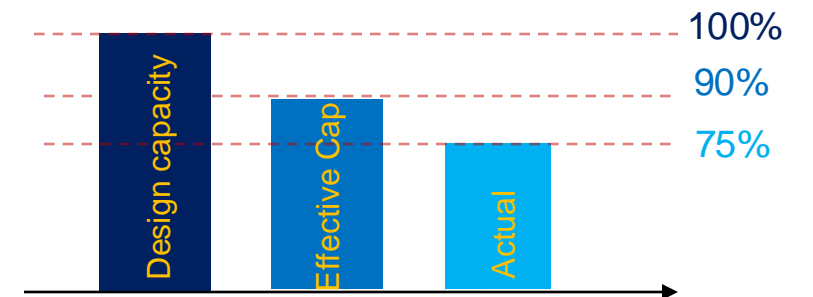
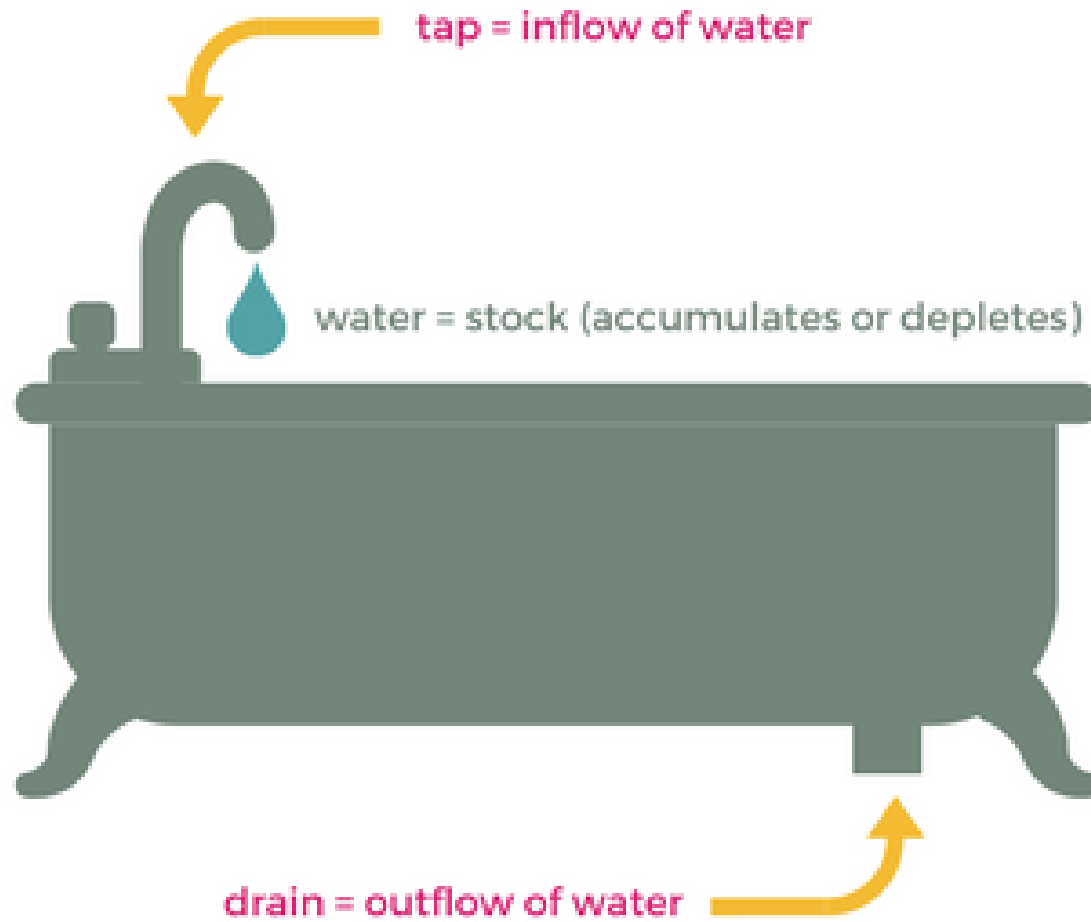
Capacity: The upper limit/ceiling on the load that an operating unit can handle.

What Is Capacity?



Capacity Definition: The upper limit/ceiling on the load that a system (an operating unit) can handle.

Capacity of Bathtub



Why Capacity Is Important?



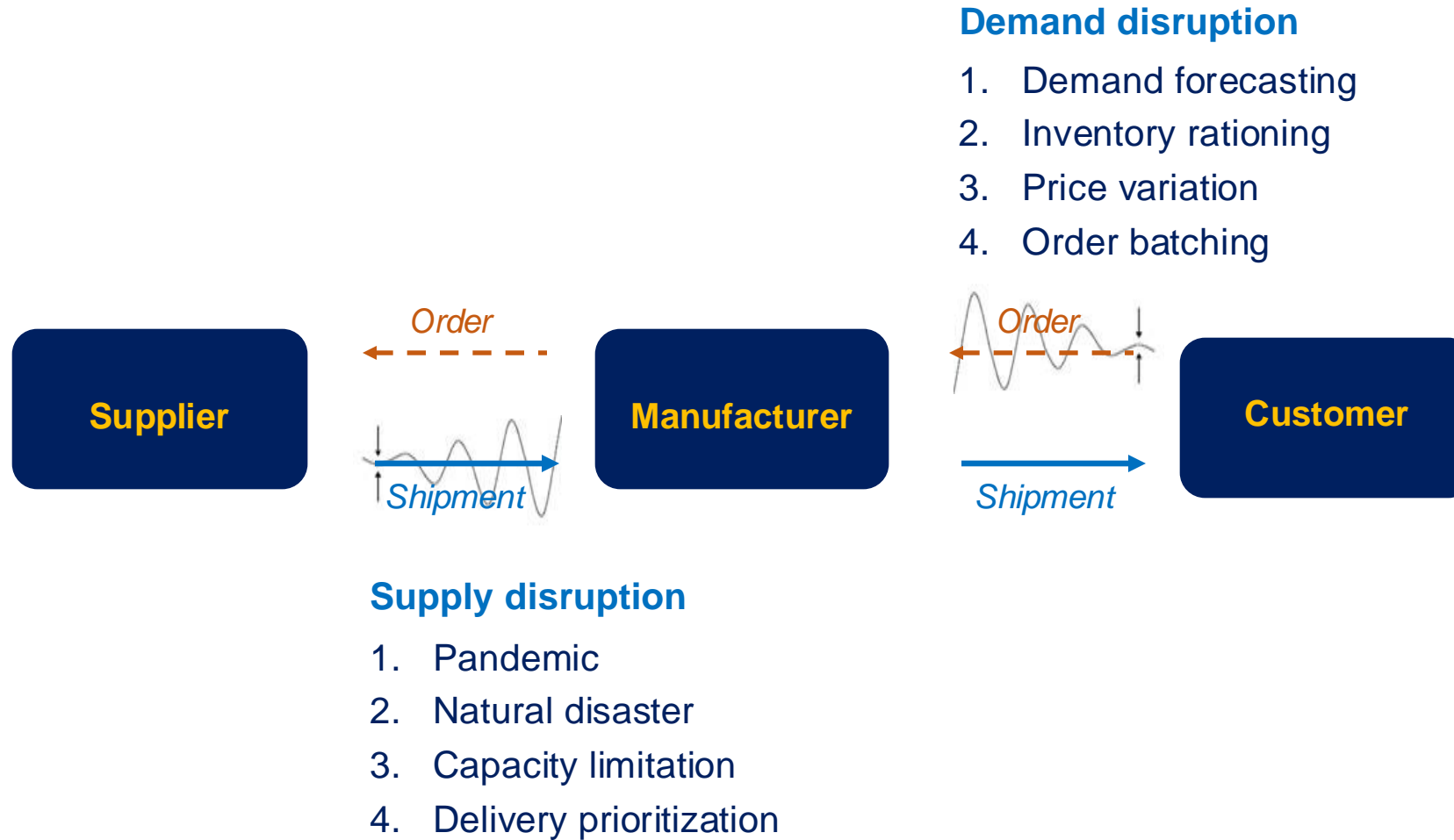
Efficiency, resilience, service level, market share, ...

Source: GettyImage

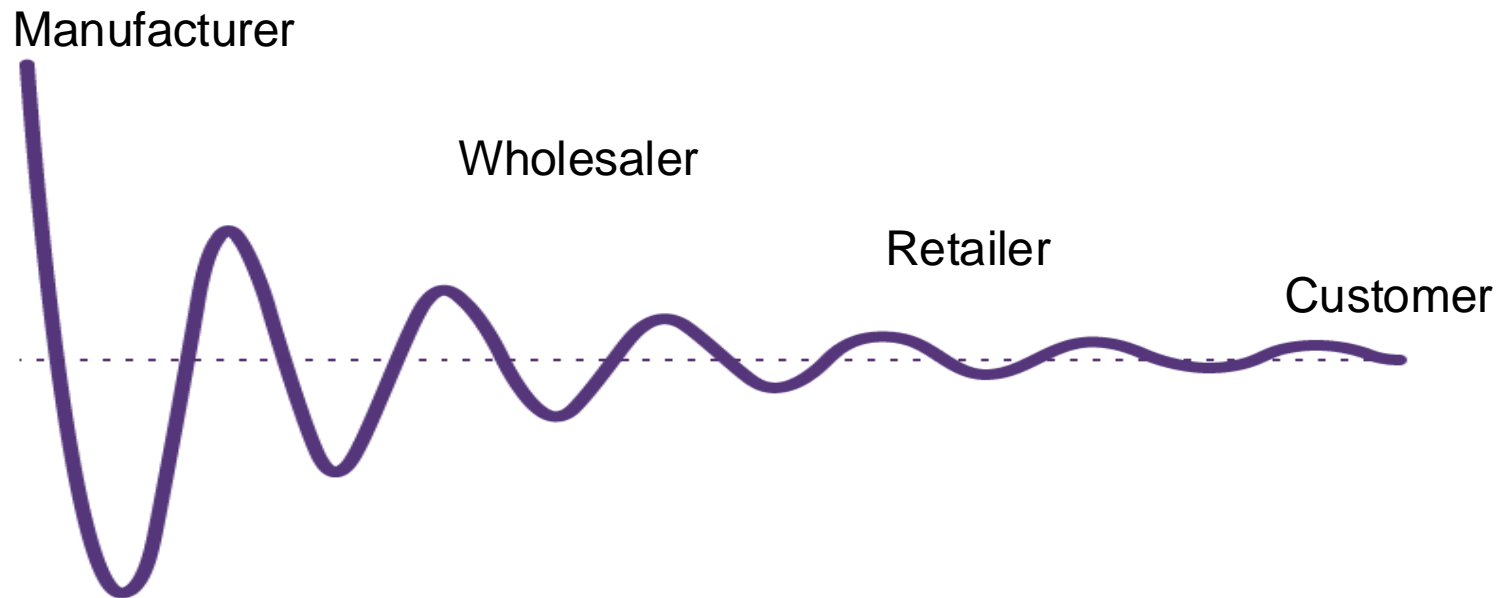
Supply Chain – Simplified network



Supply Chain – Disruptions

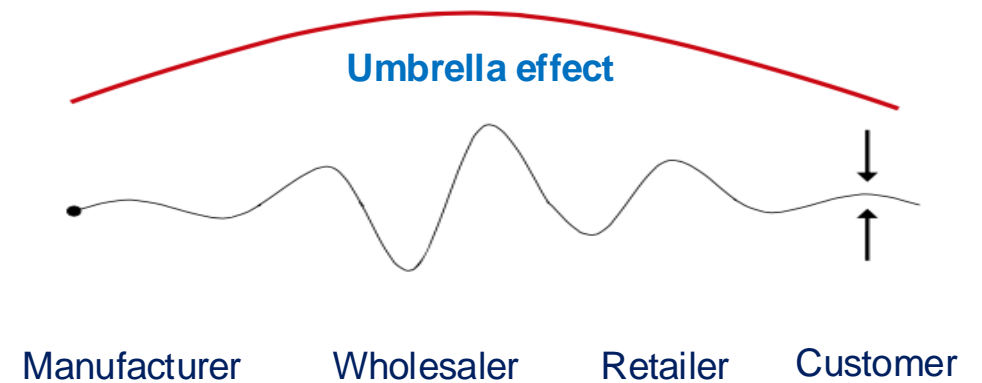
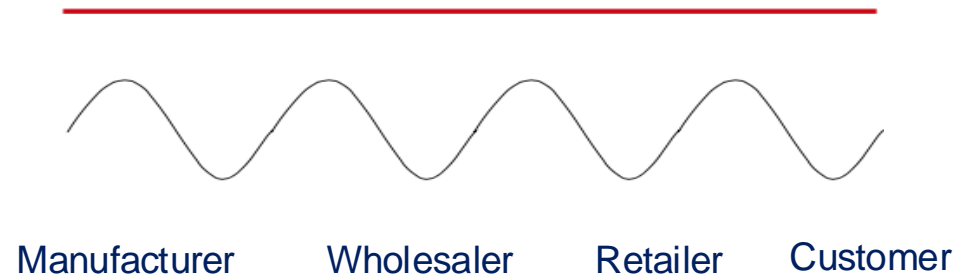


Bullwhip Effect



Bullwhip effect: The demand variabilities (amplification and oscillation) along the supply chain.

Bullwhip Effect – Types



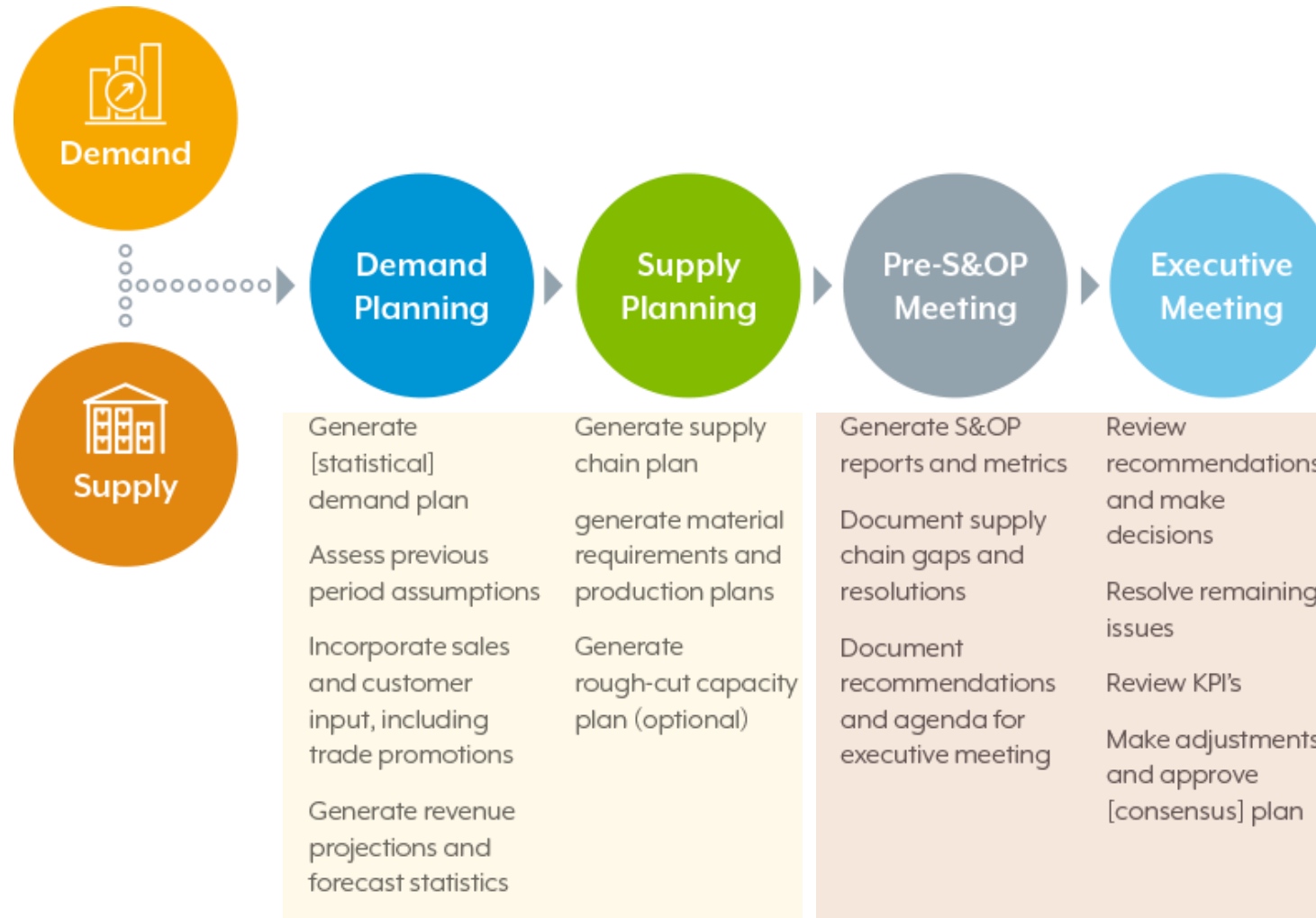
Bullwhip Effect – How to Tame it

- Changing the size of workforce by hiring and firing
- Overtime, idle time, outside subcontracting
- Building up stock
- Planning backorders

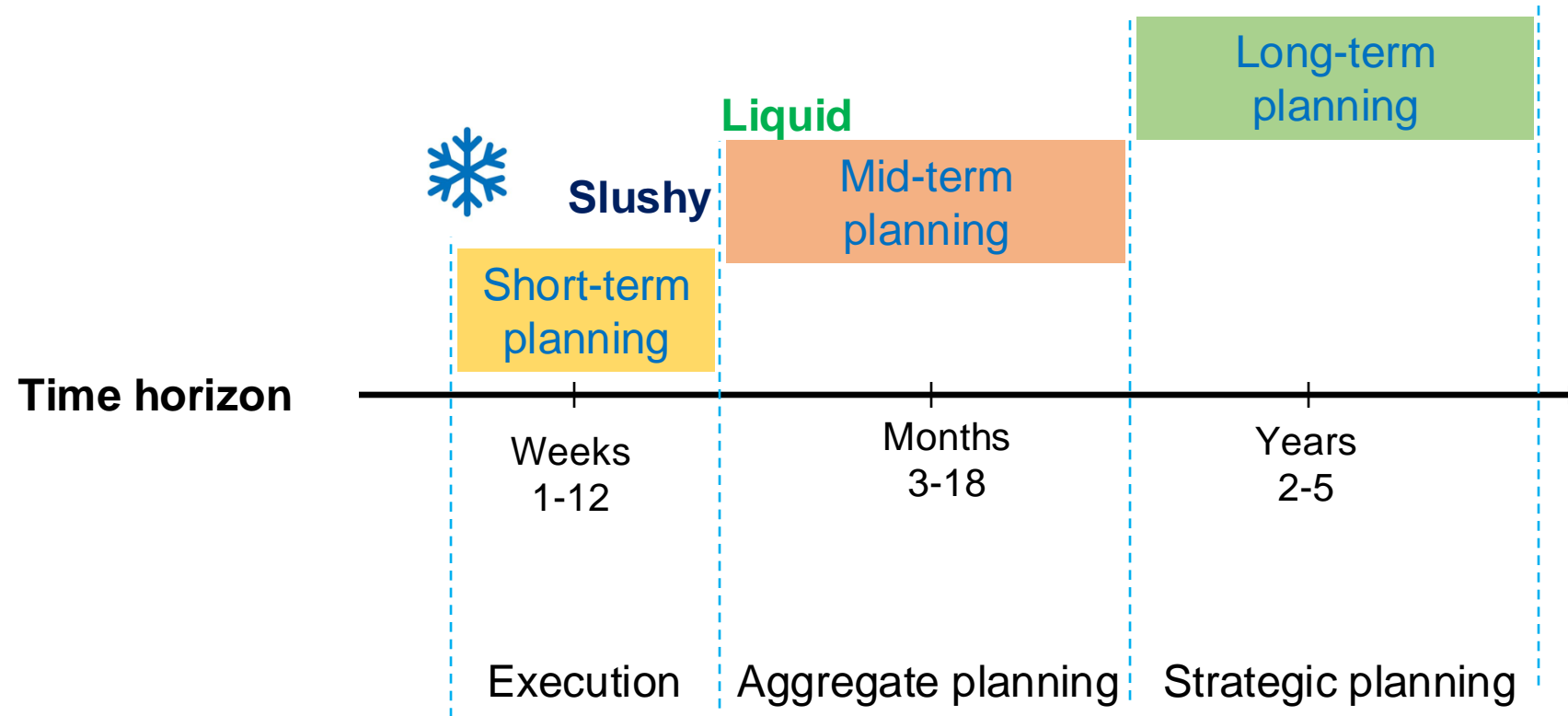
Question 2:

What is Capacity Planning?

Reminder: Sales & Operations Planning Process (S&OP)



What is Capacity Planning?

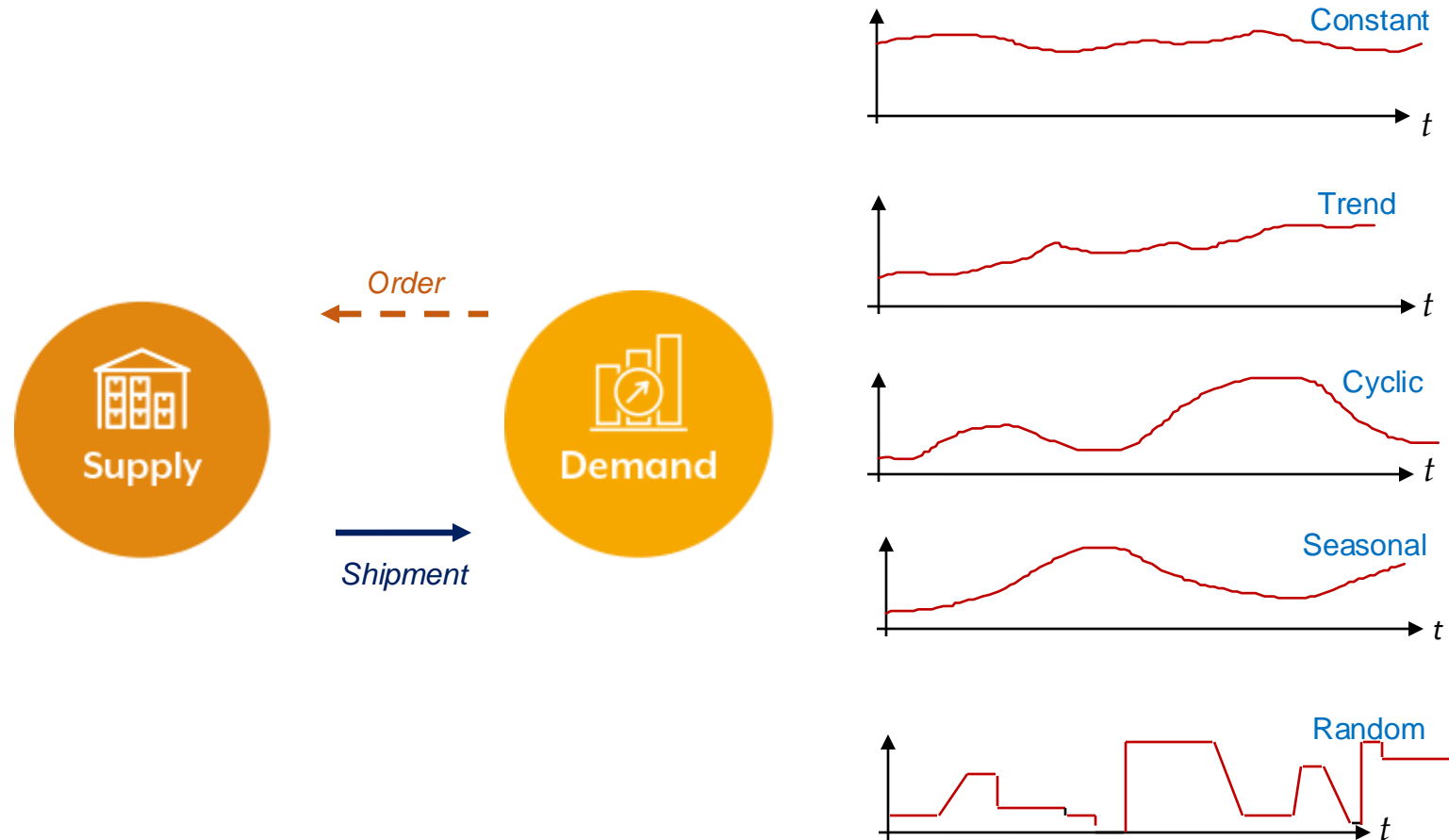


Capacity planning: The process of establishing output rate that can be achieved by a facility.

Question 3:

What is THE Main Driver of Capacity Planning?

Main Driver of Capacity Planning – Demand



Question 4:

How to Match Capacity to Demand?

Tactics for Matching Capacity to Demand



Making staffing changes
(increasing shifts, ...)



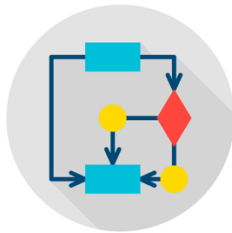
Product redesign



Adjusting equipment
(adding machines, ...)



Adding process flexibility



Improving processes
to increase throughput



Closing facilities

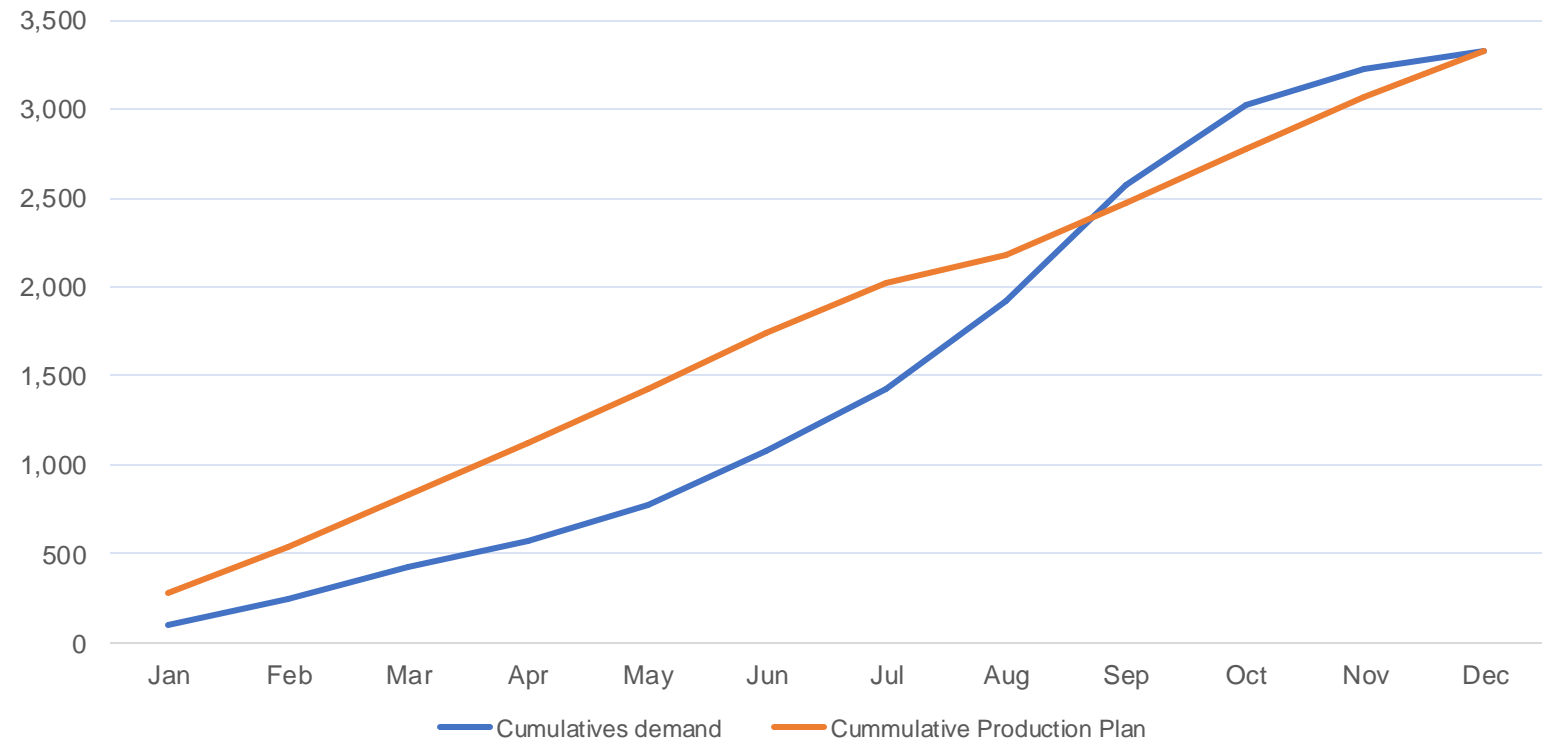
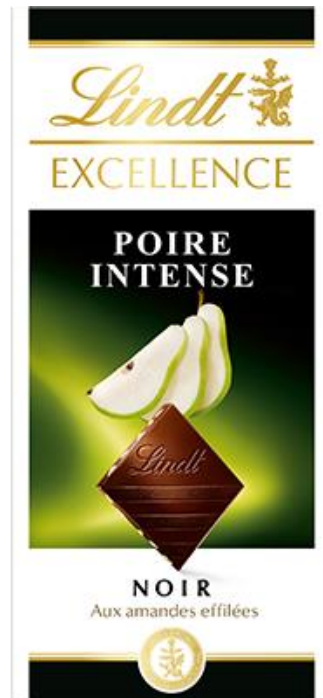
Assumption: there is a demand for your product or service.

Exercise 1 – Improving Lindt-Sprüngli's S&OP



10 min

Here is the production plan and demand of “Poire Intense Dark Chocolate”. What is your proposal to improve this plan?



Question 5:

What Are the Key Questions in Capacity Planning?

Capacity Planning – Key Questions



What kind of capacity is needed?



How much is needed to match demand?



When is it needed?

Calculating Processing Requirements

An operations department works one 8-hour shift, 250 days a year, and has these figures for usage of a machine that is currently used, how many machines are needed?

Product	Annual Demand	Standard Processing Time per Unit (hr)	Processing Time Needed (hr)
1	400	5	2'000
2	300	8	2'400
3	700	2	1'400

$$\text{Unit of capacity needed} = \frac{\text{Processing time needed}}{\text{Processing time capacity per unit}} = \frac{2'000 + 2'400 + 1'400}{8 * 250} = 3 \text{ machines}$$

Exercise 2 – Calculate Processing Requirements



10 min

Your group is asked to support a decision regarding which type of machine to buy: A, B, or C. Machine costs, products forecasts, and processing times on the machines are:

Machine	Cost (CHF)
A	40'000
B	32'500
C	65'000

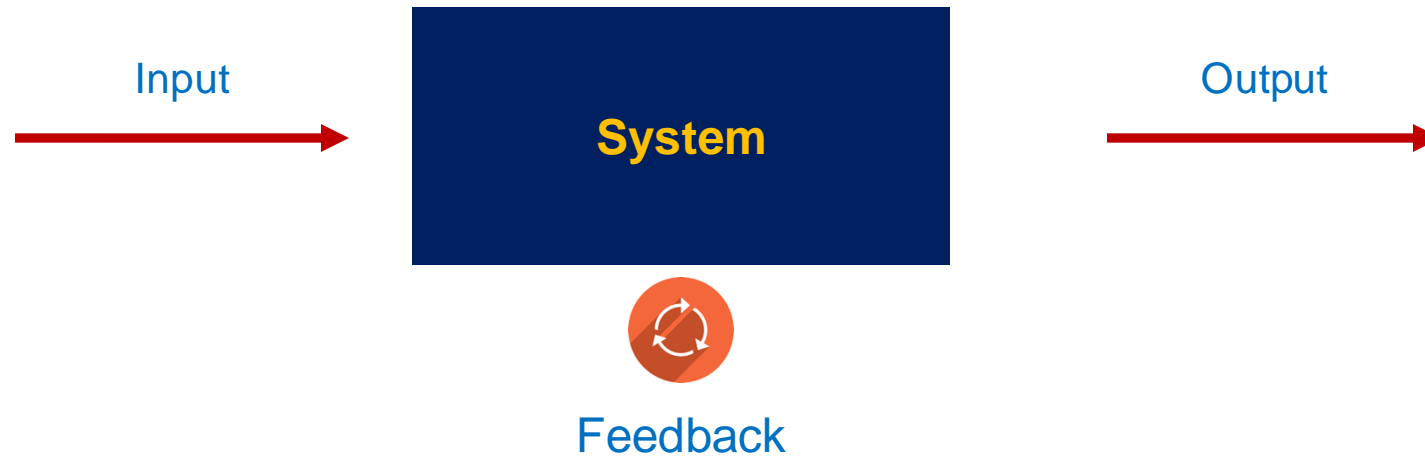
Product	Annual Demand	Processing Time Per Unit (Min)		
		A	B	C
1	16'000	3	3	1
2	12'000	1	4	3
3	6'000	3	3	2
4	30'000	2	2	1

- I. Assume only purchasing costs are being considered: which would have the lowest total cost, how many would be needed? (Operating time: 10 hours, 250 days)
- II. Now Consider: machines differ in terms of hourly operating costs: Machine A: 12 CHF, Machine B: 9 CHF and Machine C: 14 CHF. Which alternative would be selected? How many machines are needed in order to minimize the total cost while still satisfying capacity processing requirements?

Question 6:

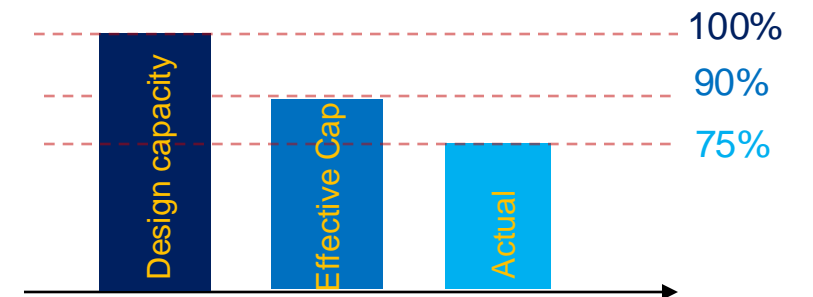
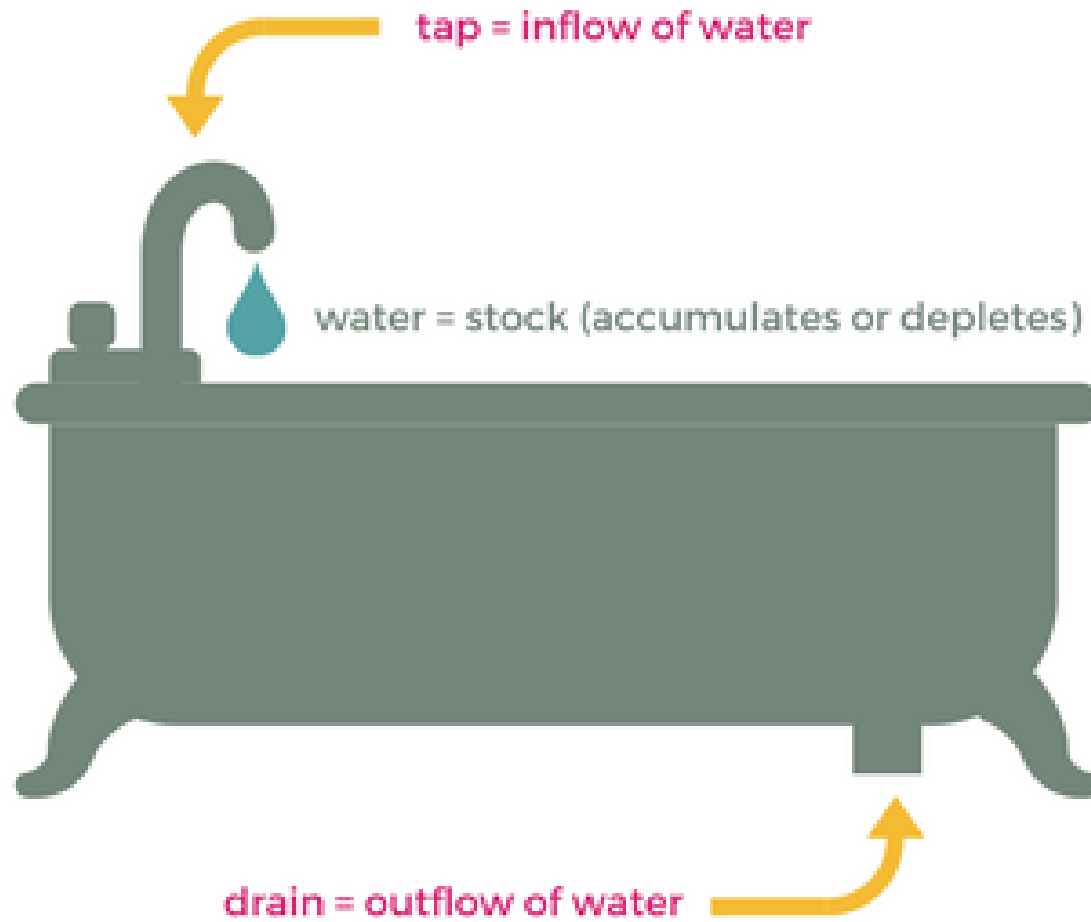
How to Measure Capacity?

System Dynamics



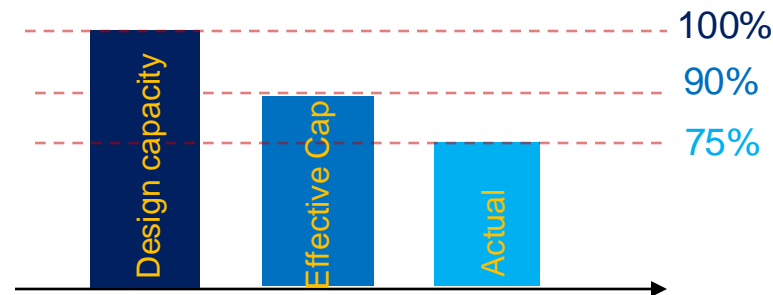
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Capacity of Bathtub



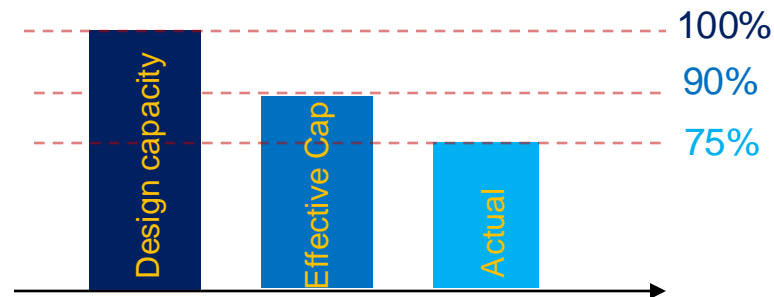
Measuring Capacity

- **Design capacity:** The maximum designed output rate or service capacity.
- **Effective capacity:** Design capacity – allowances*
*: personal time, preventive maintenance, machine setups/changeovers, changes in products, delays
- **Actual capacity:** Effective capacity – lost output during unplanned resource idleness*
*: Absenteeism, machine breakdowns, unavailable parts, quality problems



System Efficiency Measures

- **Utilization:** $(\text{Actual output} / \text{Design capacity}) * 100\%$
- **Efficiency:** $(\text{Actual output} / \text{Effective Capacity}) * 100\%$



Exercise 3 – Capacity Measurement



5 min

Lindt has a plant for processing Deluxe breakfast rolls and wants to better understand its capability. Last week the facility produced 148'000 rolls. The effective capacity is 175'000 rolls. The production line operates 7 days per week, with three 8-hour shifts per day. The line was designed to process the nut-filled, cinnamon-flavored Deluxe roll at a rate of 1'200 per hour. Determine the design capacity, utilization, and efficiency for this plant when producing this Deluxe roll.

Exercise 4 – Capacity Measurement



5 min

The Production Manager now needs to increase production of the increasingly popular Deluxe roll. To meet this demand, she will be adding a second production line. The second line has the same design capacity, 201'600, and effective capacity, 175'000, as the first line; however, new workers will be operating the second line. Quality problems and other inefficiencies stemming from the inexperienced workers are expected to reduce output on the second line to 130'000 (compared to 148'000 on the first). The utilization and efficiency were 73.4% and 84.6%, respectively, on the first line.

Determine the new utilization and efficiency for the Deluxe roll operation after adding the second line.

Assignment 2 – Growth Mindset (Case Study)



An Engineer, Nadella set out to change the human system in Microsoft.

Source: Carol Dweck, The Growth Mindset, Random House, 2016.

Assignment 3 – Capacity Planning

Your group is tasked to change/improve a process;

- 1) Identify a process (product or service oriented) outside of EPFL.
Example: IT help desk, restaurants/coffee shops/bar at EPFL or a nearby carwash.
- 2) What are the main reasons for selecting this process? More specifically;
Why this process and producer/service provider?
What value does this producer/service provider create, deliver, and capture?
- 3) What is the main problem within your selected process?
- 4) How people, process, and technology are involved in the problem?
- 5) What is the estimated demand for this process?
- 6) What is the unit of measure for your analysis? Example: for time (day, week, month, year)
- 7) What is the estimated capacity of this process?
What kind of (extra) capacity is needed?
How much is needed to match demand?
When is needed?
What is the capacity planning (timeline)?

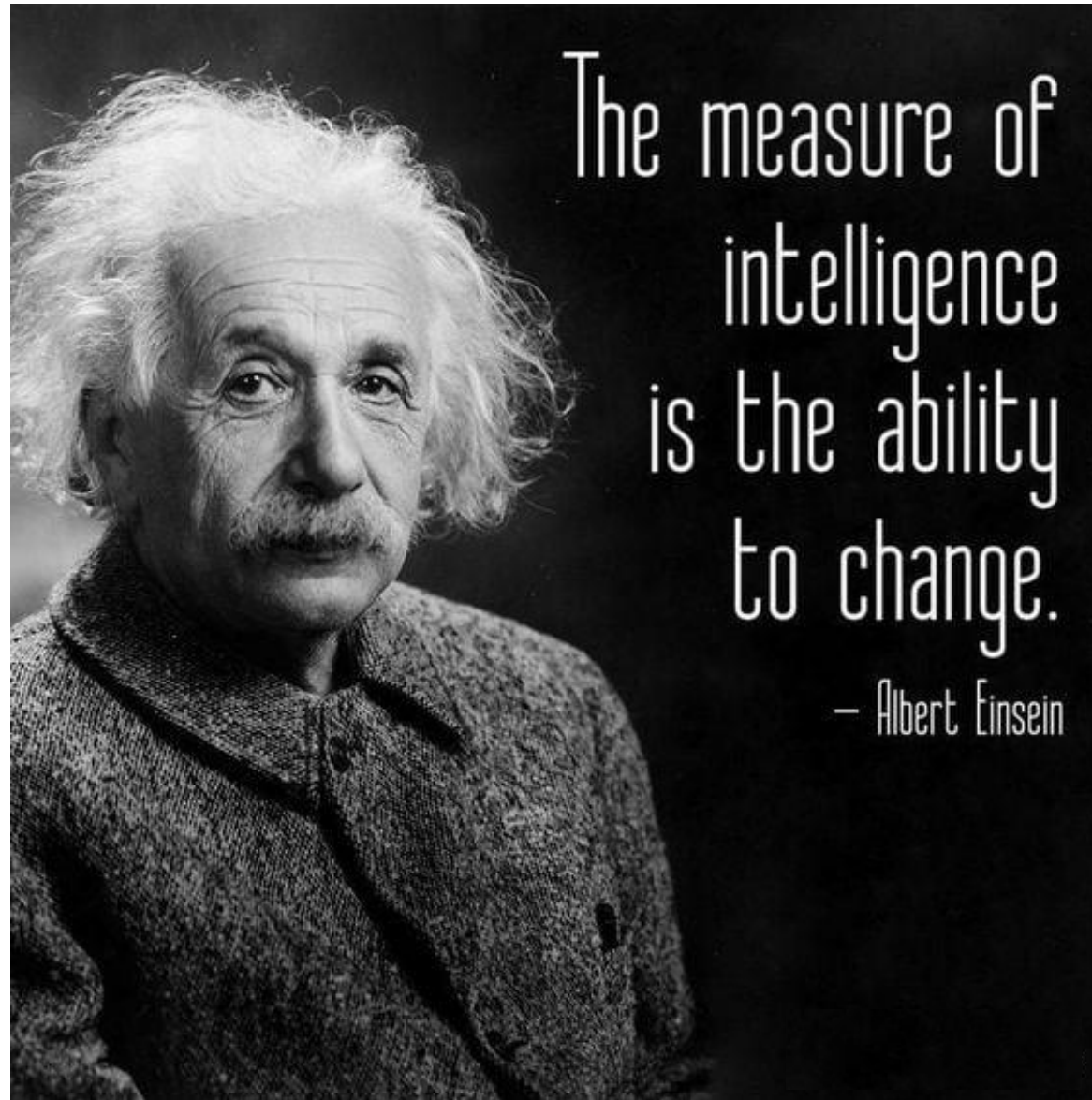
Continuous Improvement

Module 2 – People

Managing Change + Re-grouping

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Week 2, Session 3, Feb 28th, 2025



Lucy & The Chocolate Factory

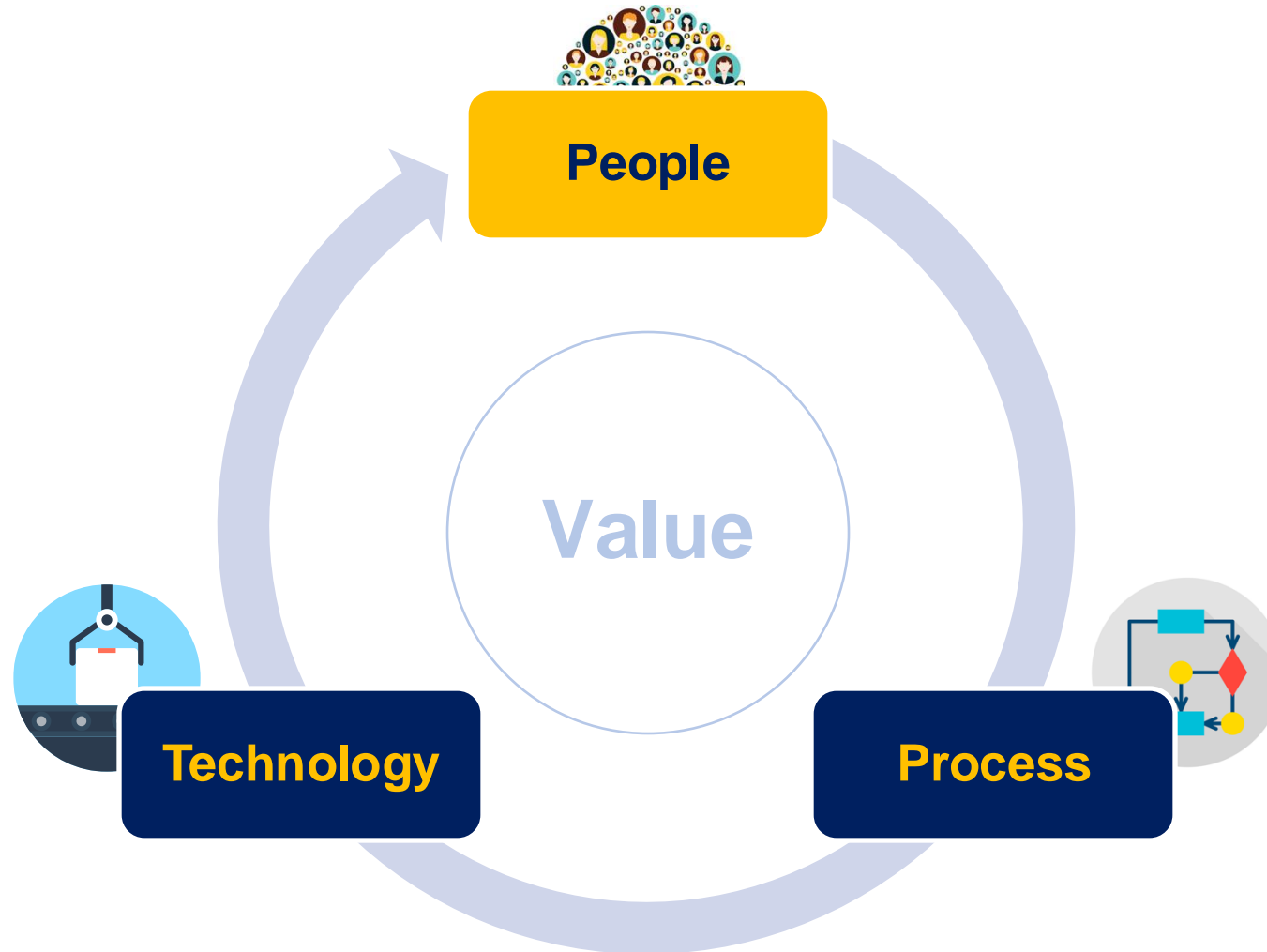


Source: YouTube

Question 1:

What did you observe?

Continuous Improvement – Modules



Question 2:

**What is the failure rate of
improvement/change projects?**

70%

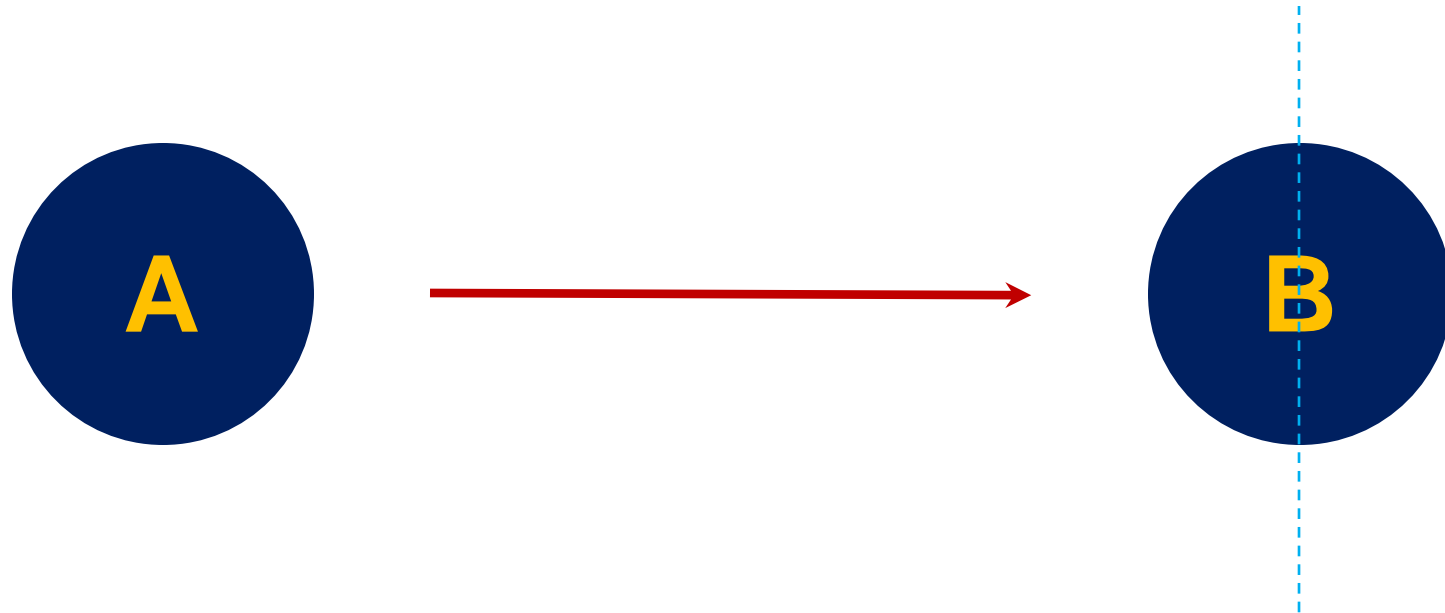
Question 3:

What is the reason?

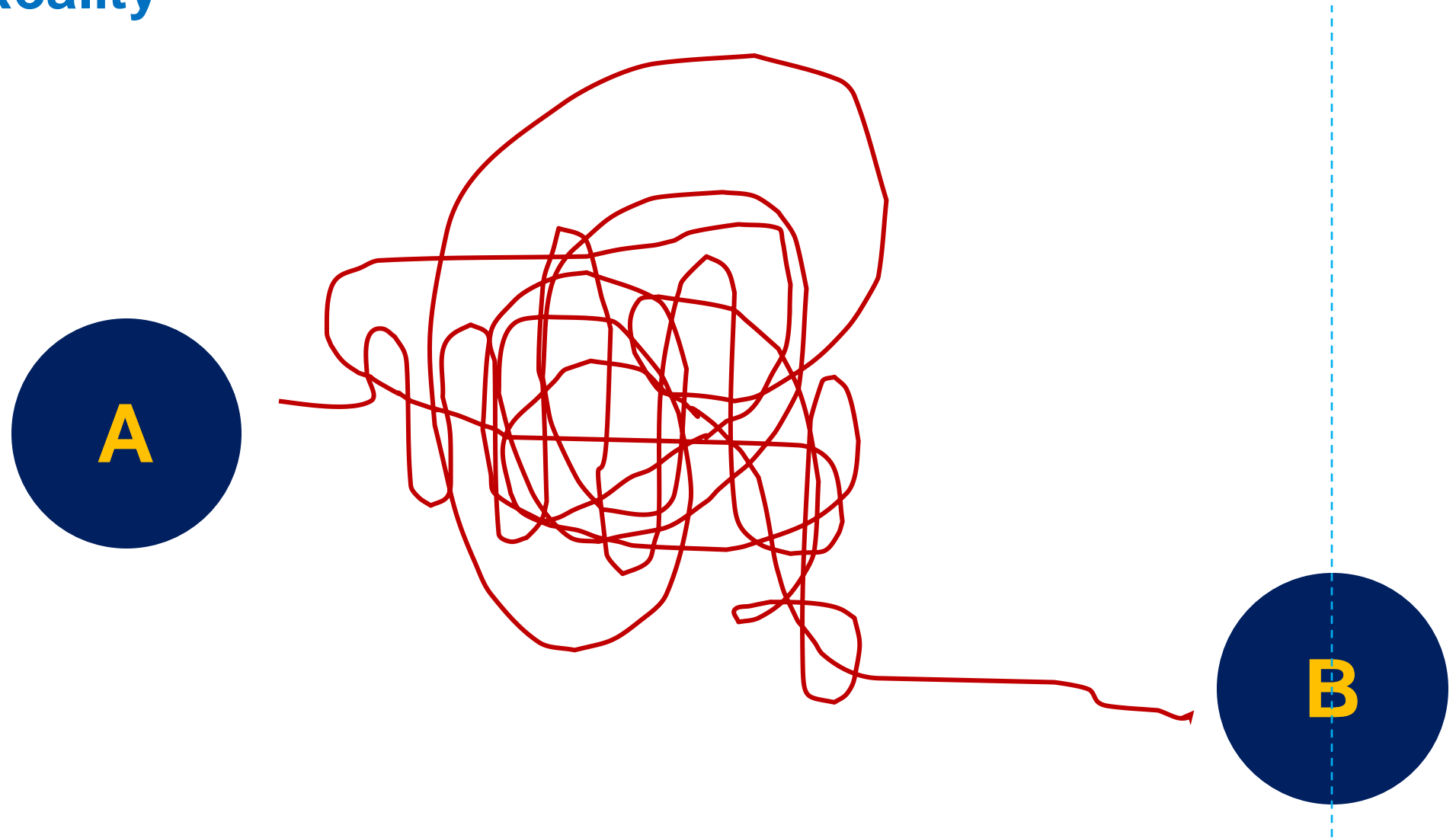
People

Organization, Culture, Communication, lack of engagement, lack of clarity/vision, ...

Change – Plan



Change – Reality



Question 4:

What are the benefits of being skilled in the basic emotional competencies?

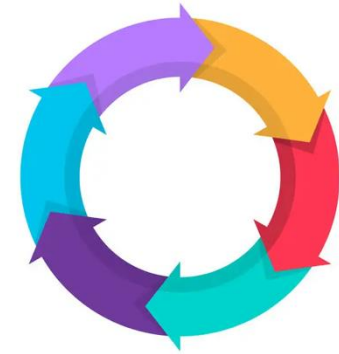
Question 4: What are the benefits of being skilled in the basic emotional competencies?



Being attuned and connected to the feelings of those we deal with



Being able to handle disagreements, so they don't escalate



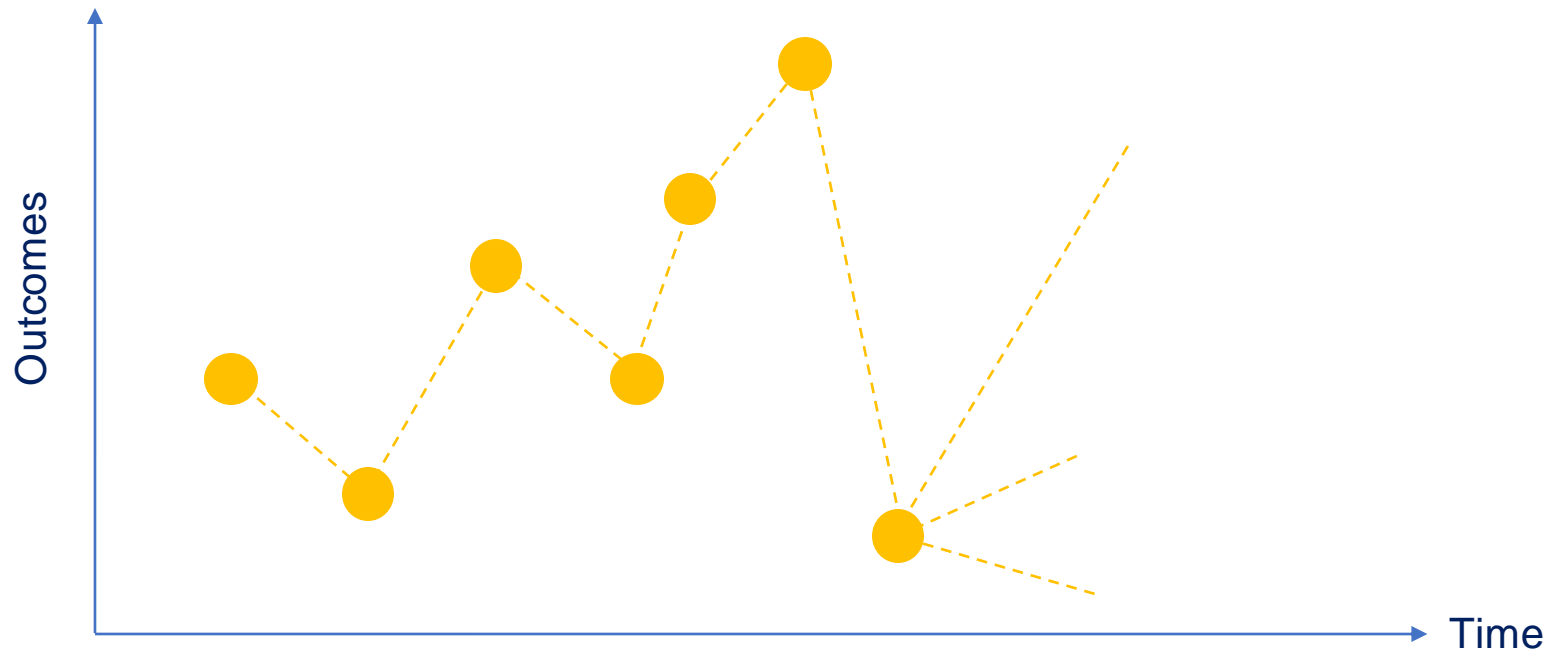
Being able to get into flow states while doing our work

Source: Daniel Goleman, Leadership: The Power of Emotional Intelligence, Selected Writings, 2011

Human vs Machine?

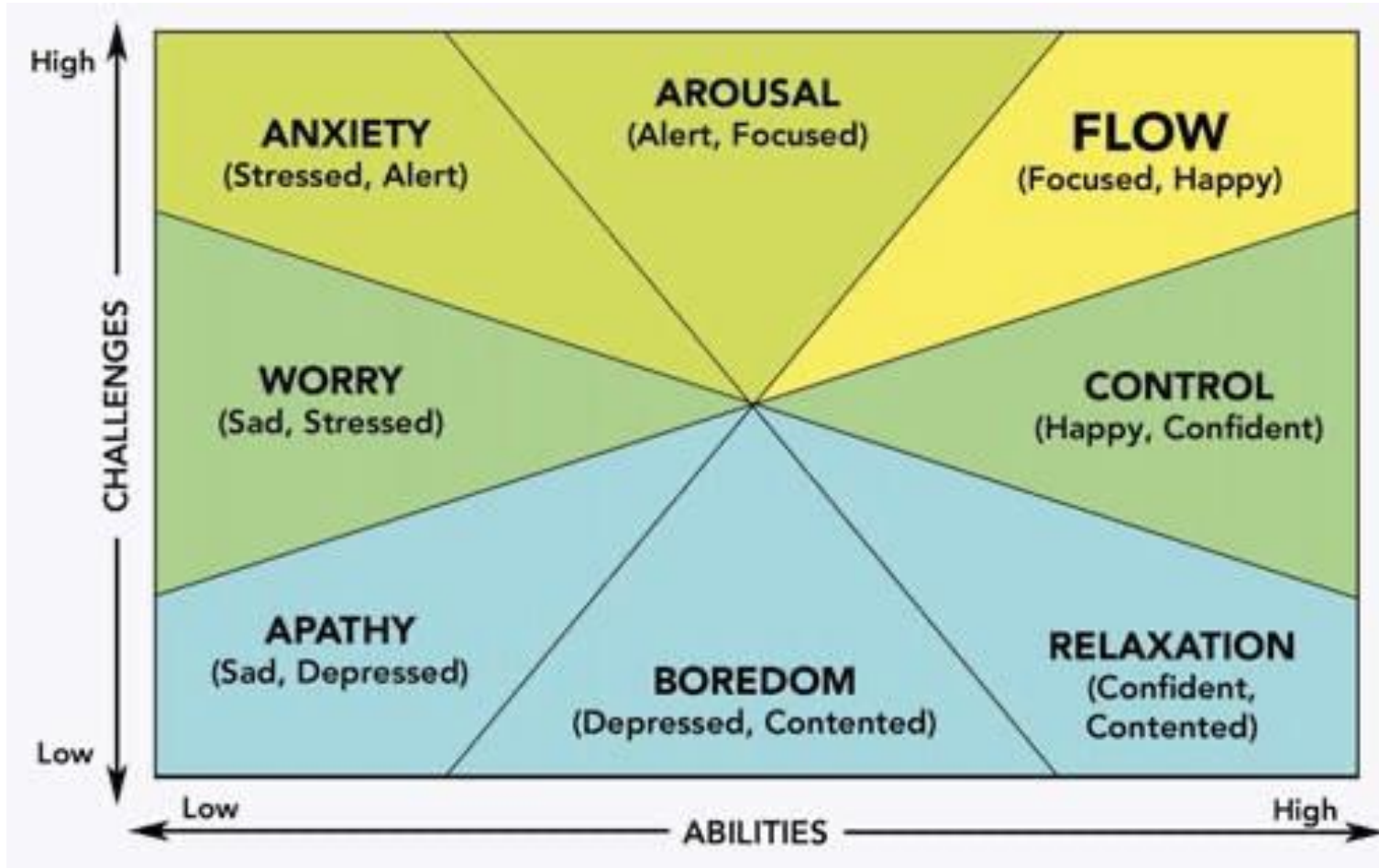


A Data Science Way to Learn



Machine learns by looking for patterns among massive data loads, and when it sees one, it adjusts the program to reflect the “truth” of what it found. The more data you expose the machine to, the “smarter” it gets.

The Map of Everyday Experience

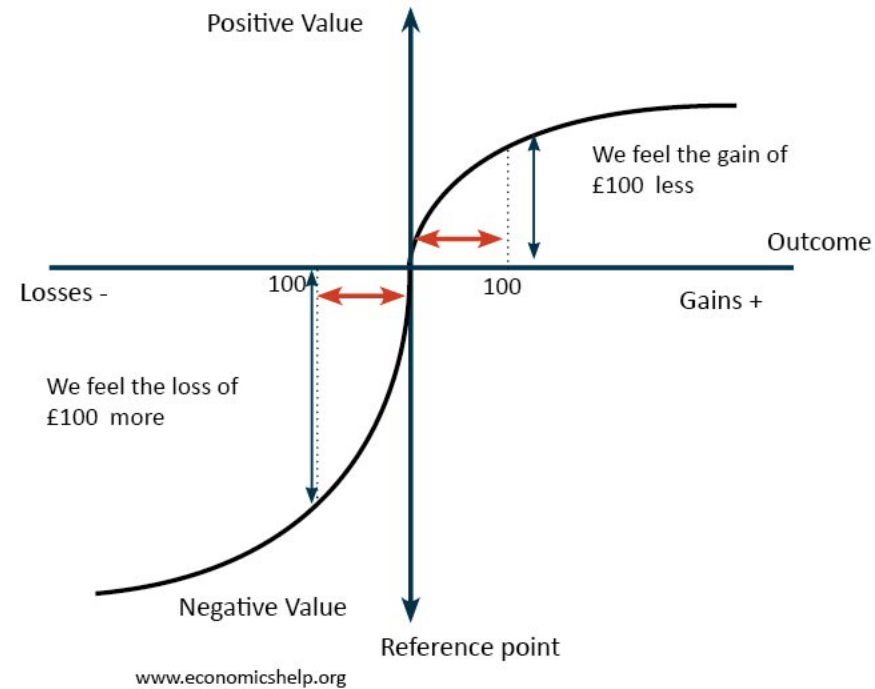


Source: Mihaly Csikszentmihalyi, Good Business, Penguin, 2004.

Question 5:

What makes change so hard?

Avoiding Failure, Mistakes ...



Research shows we are hardwired for negativity.

Survival – we are basically driven by fear, loss, ...

Resisting Change

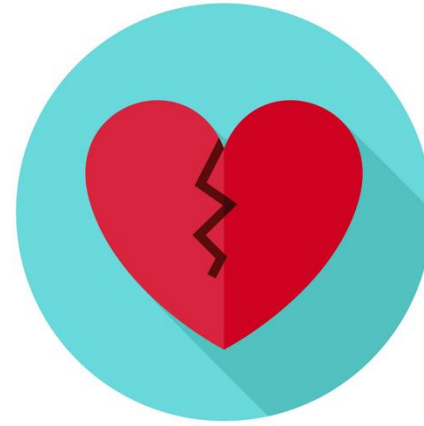


We don't resist to change, we do resist the pain of the change, because we don't want to let go of the known and we fear the unknown!

Emotions of Change



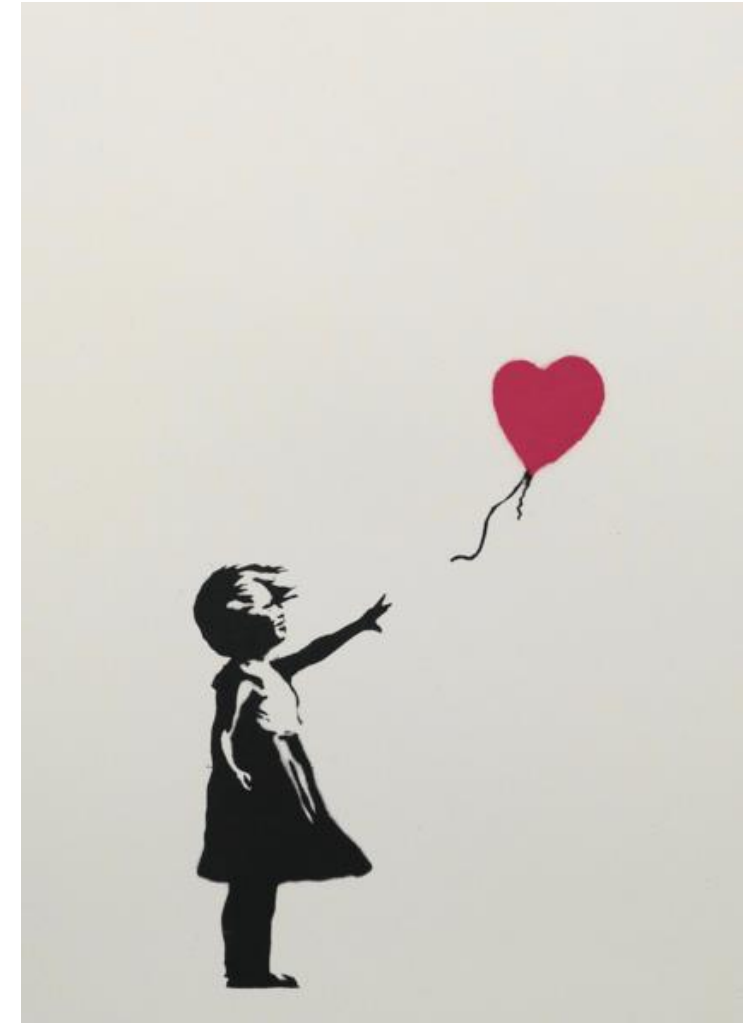
Fear of unknown



Loss & grief

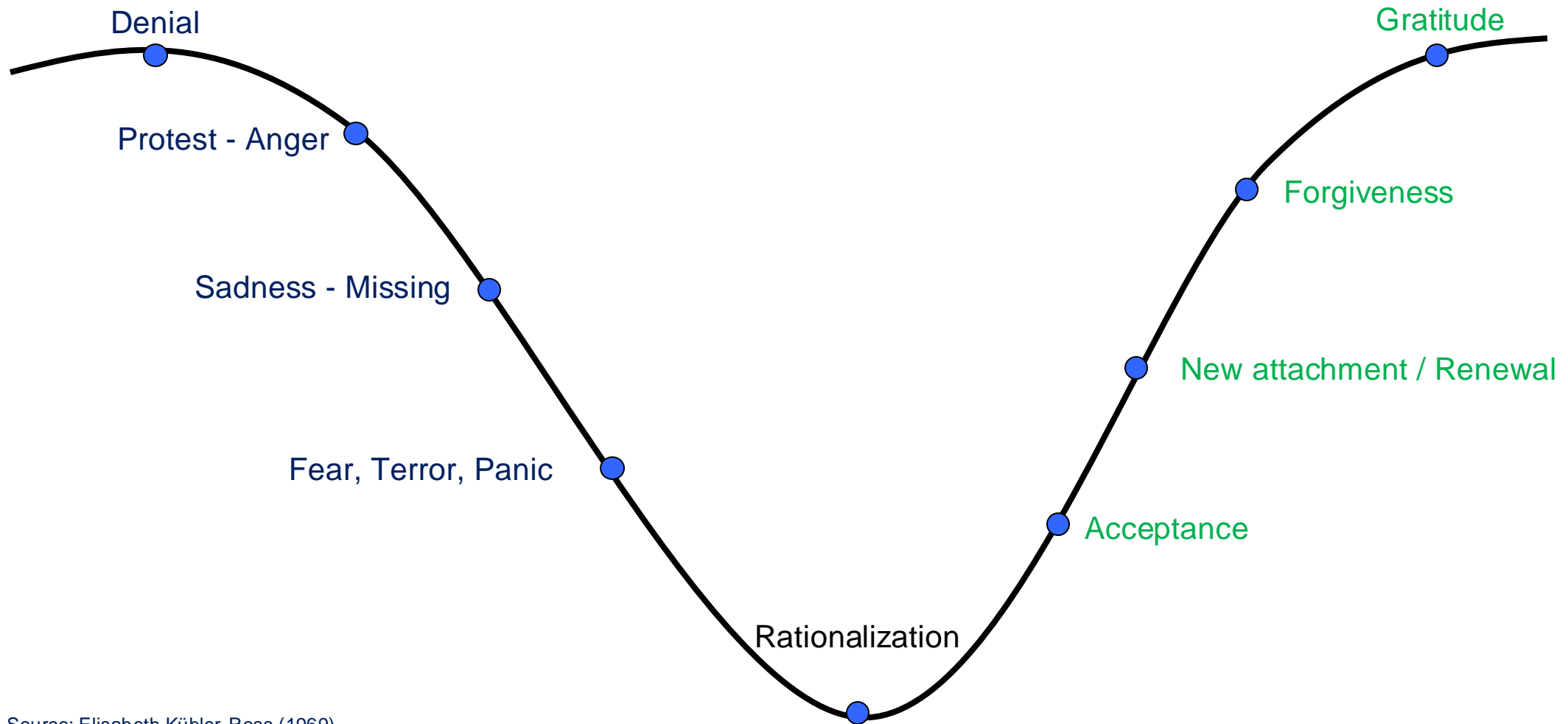
Loss – Definition and Types

- **Loss of attachment** – who am I connected to?
- **Loss of territory** – where do I belong?
- **Loss of structure** – what is my role?
- **Loss of identity** – who am I?
- **Loss of future** – where am I going?
- **Loss of meaning** – what is the point?
- **Loss of control** – I feel overwhelmed



Reference: G. Kohlrieser, Hostage at The Table, Jossey-Bass; 1st edition (June 16, 2006)

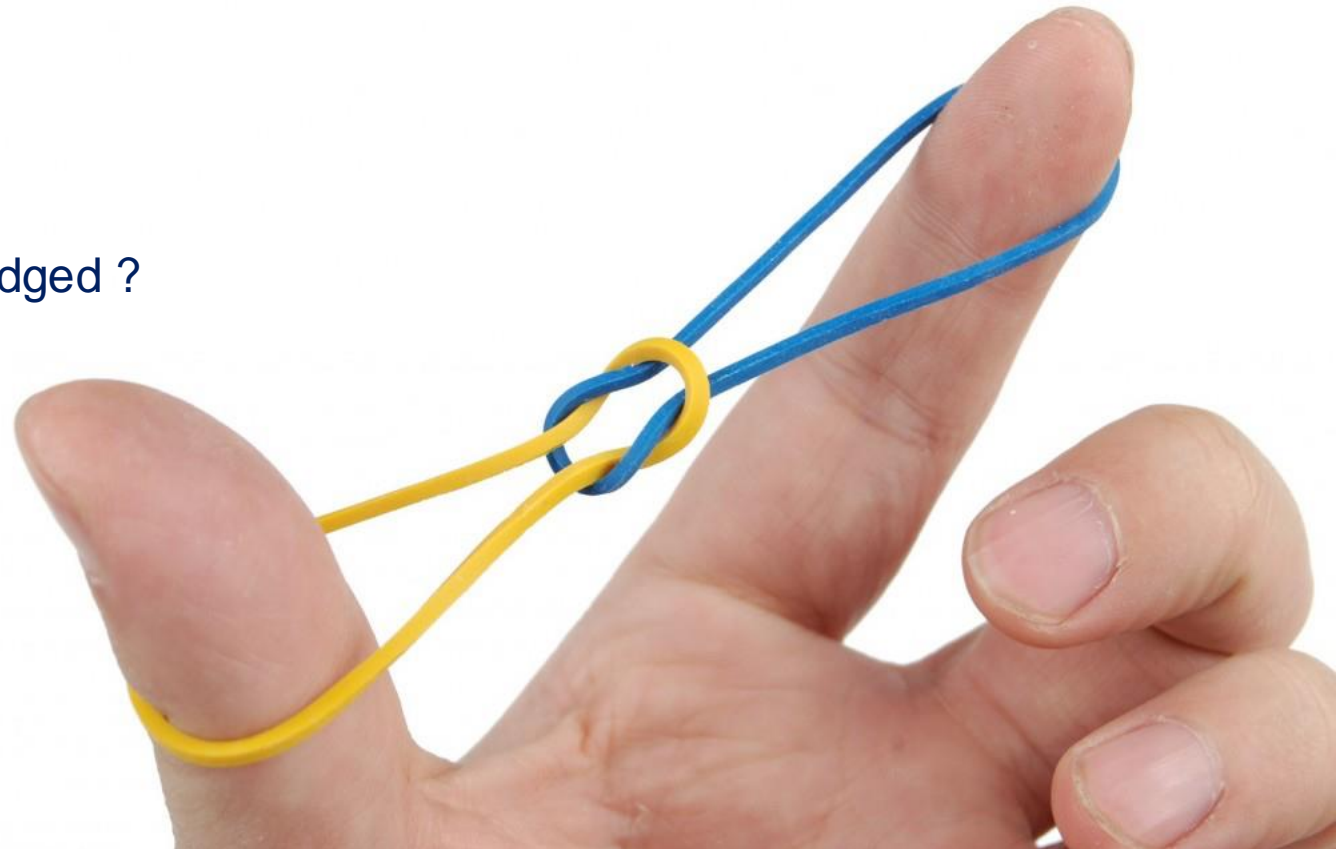
Emotions of Loss



Source: Elisabeth Kübler-Ross (1969)

Dealing With The Past

- Research shows unresolved **pain/loss/grieves** of the past impact on the way we feel and on the way we perceive the world around us!
- **Question:** What holds you back?
Do you lead not to lose and not being judged ?
Or you lead to learn and win?



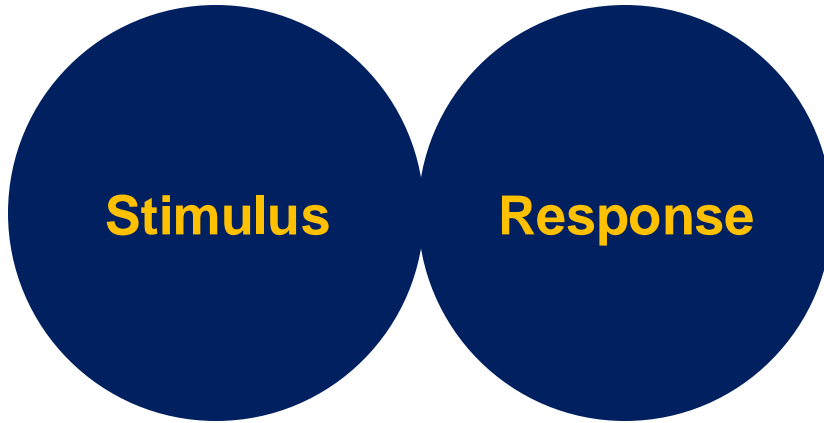
Knowing Yourself



Playing safe or playing to win?

What holds you back?

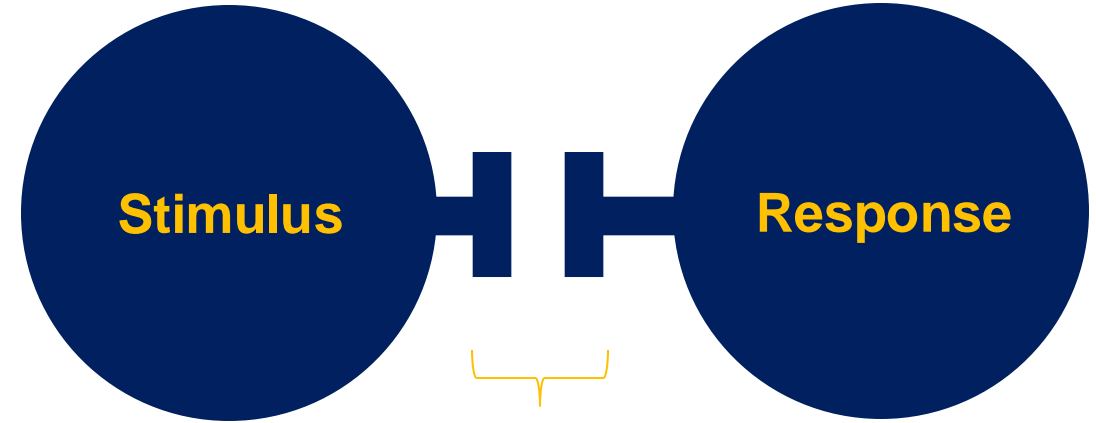
Change – Stimulus & Response



Reactive

No Space

following old patterns



Proactive

Space (choice)

Open to observe, alter, change

“Between stimulus and response there is a **space**.
In that space is our **power to choose** our response.
In our response lies our **growth and our freedom**”.

Source: Man Search for Meaning – Viktor Frankl

Continuous Improvement Coaching Session

Amin Kaboli

Week 2, Session 3, Feb 28th, 2025