

Production Management (ME-419)

Module 1: Introduction

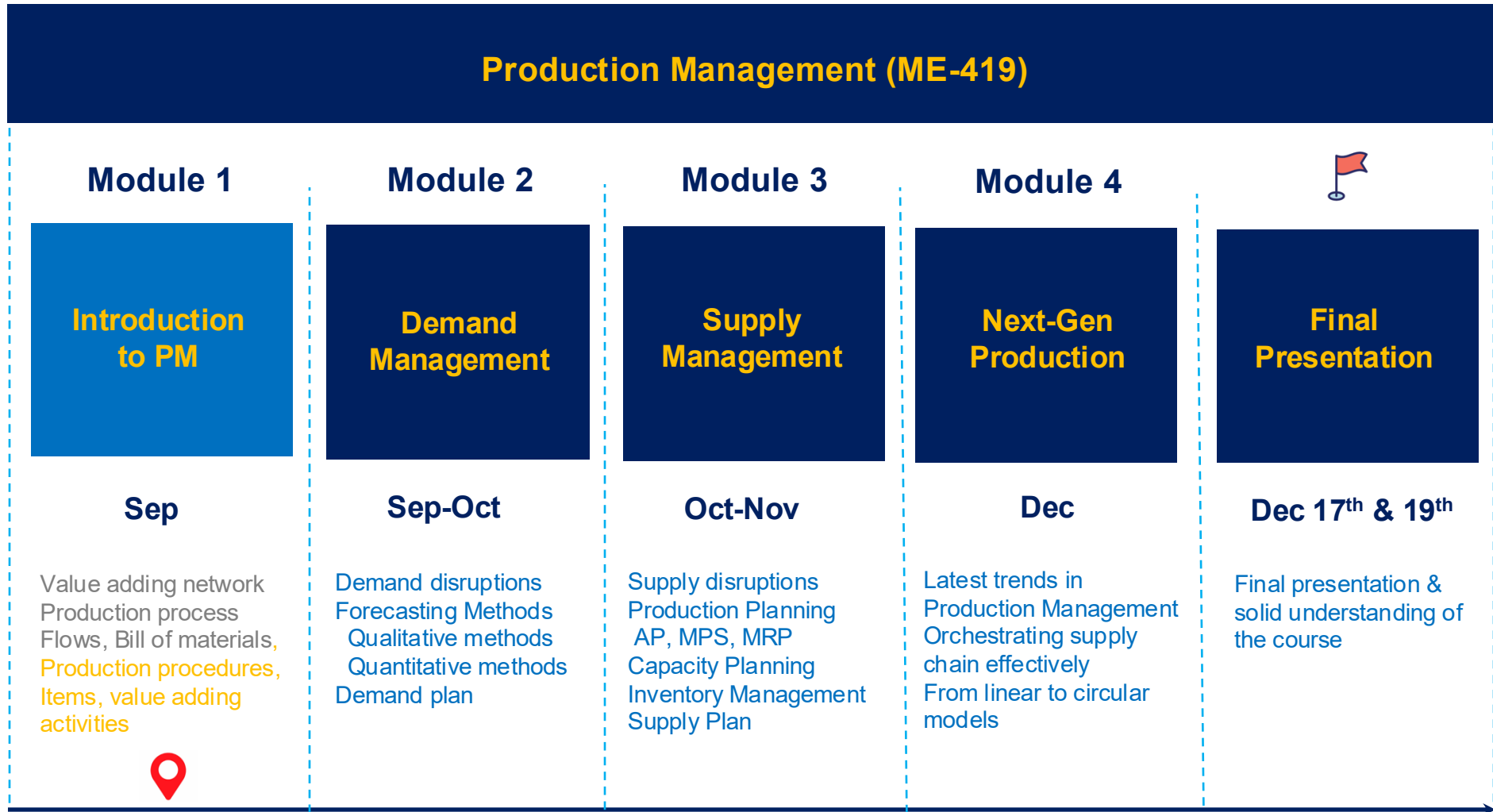
Amin Kaboli

Week 2 – Session 1 – September 20th, 2024

Course Framework



Business plan
Strategic plan
Financial plan



Seven Agreements – Summary



Cultivate Growth mindset



Stay connected off-class (Moodle)



Disconnect to connect



Report Professionally



Give and receive effective feedback

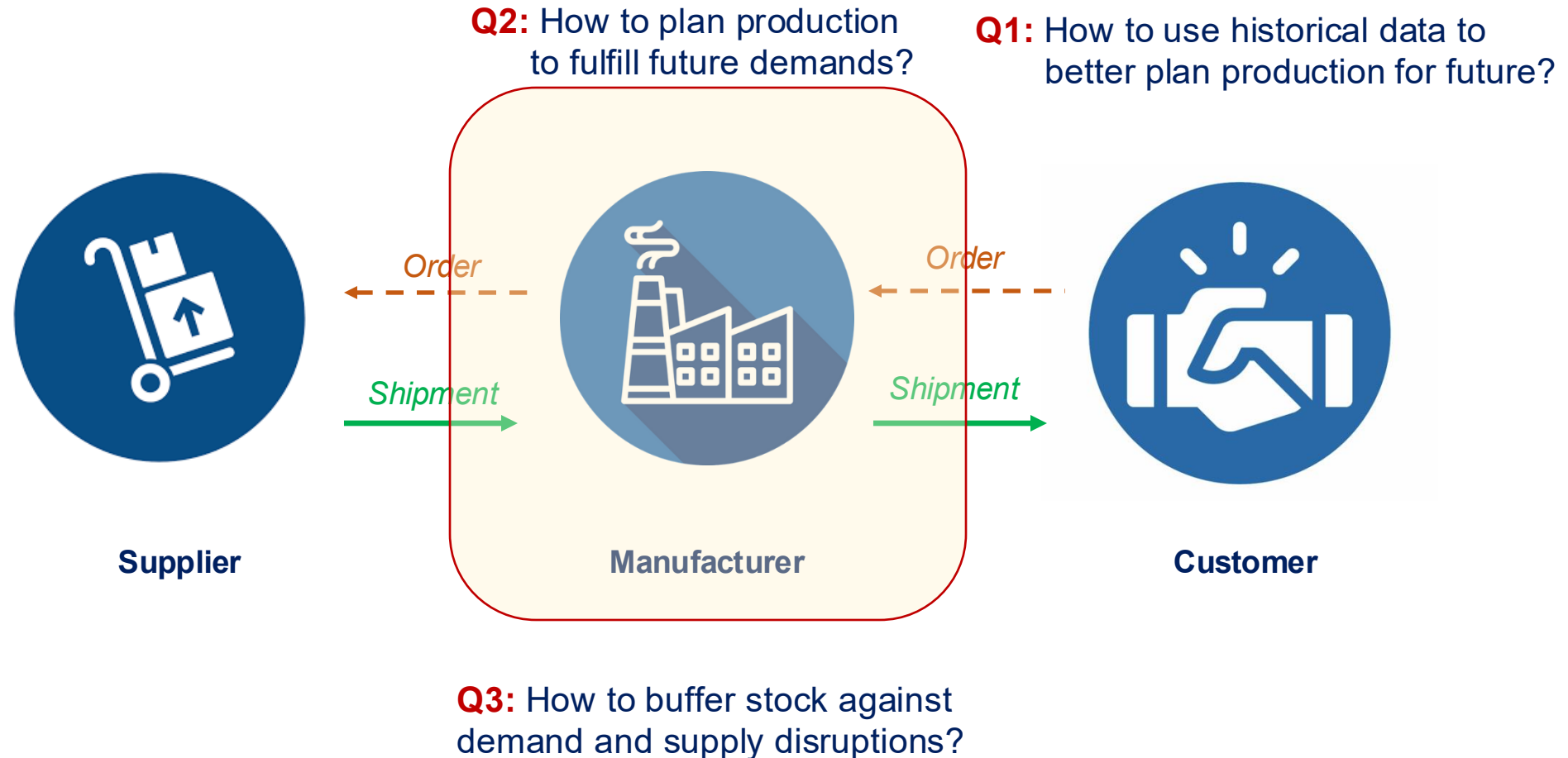


Connect and bond with your team, coaches, class

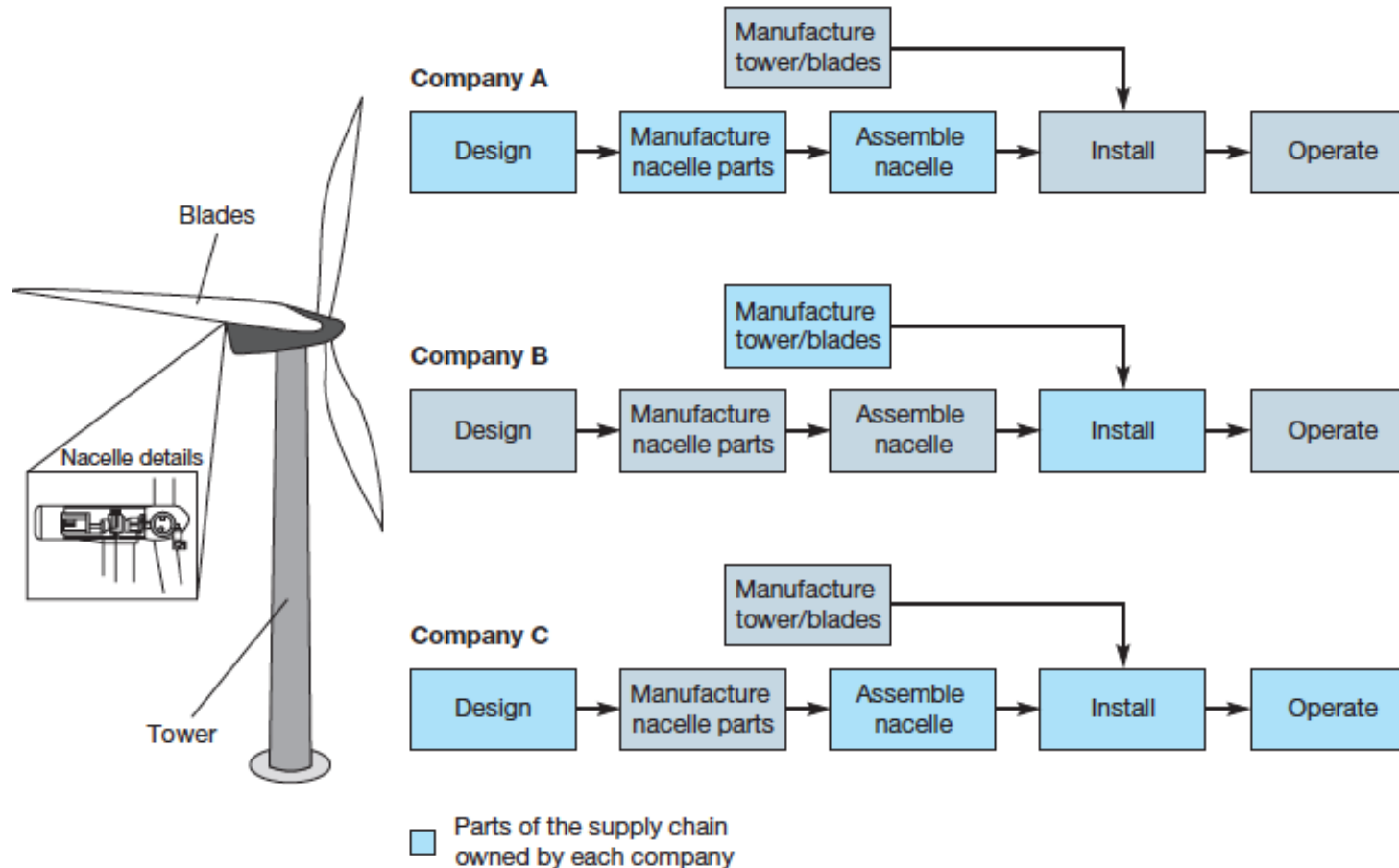


Present Professionally

Material & Information Dynamics & Flows – The Focus of PM

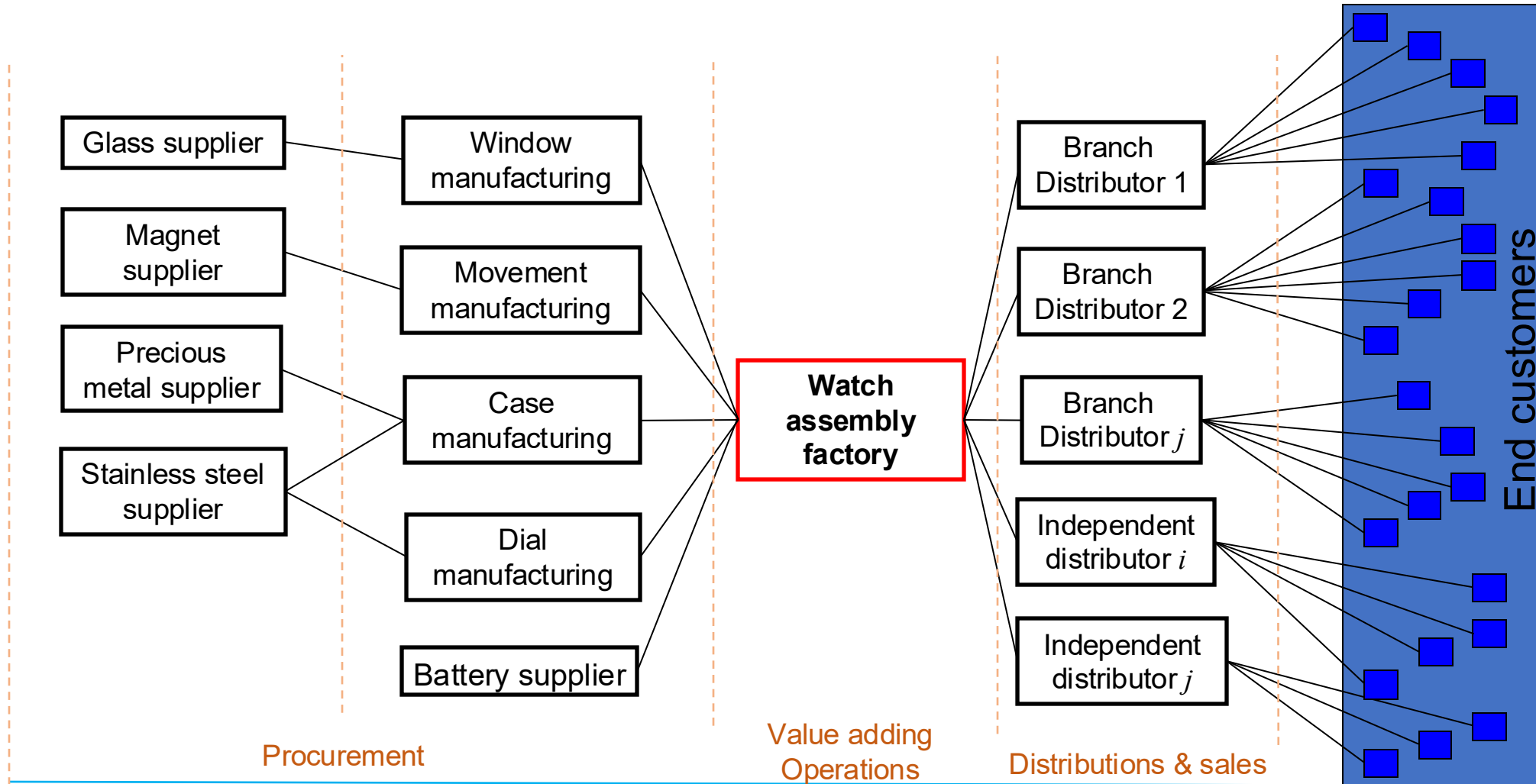


Supply Chain Network – Vertical Integration

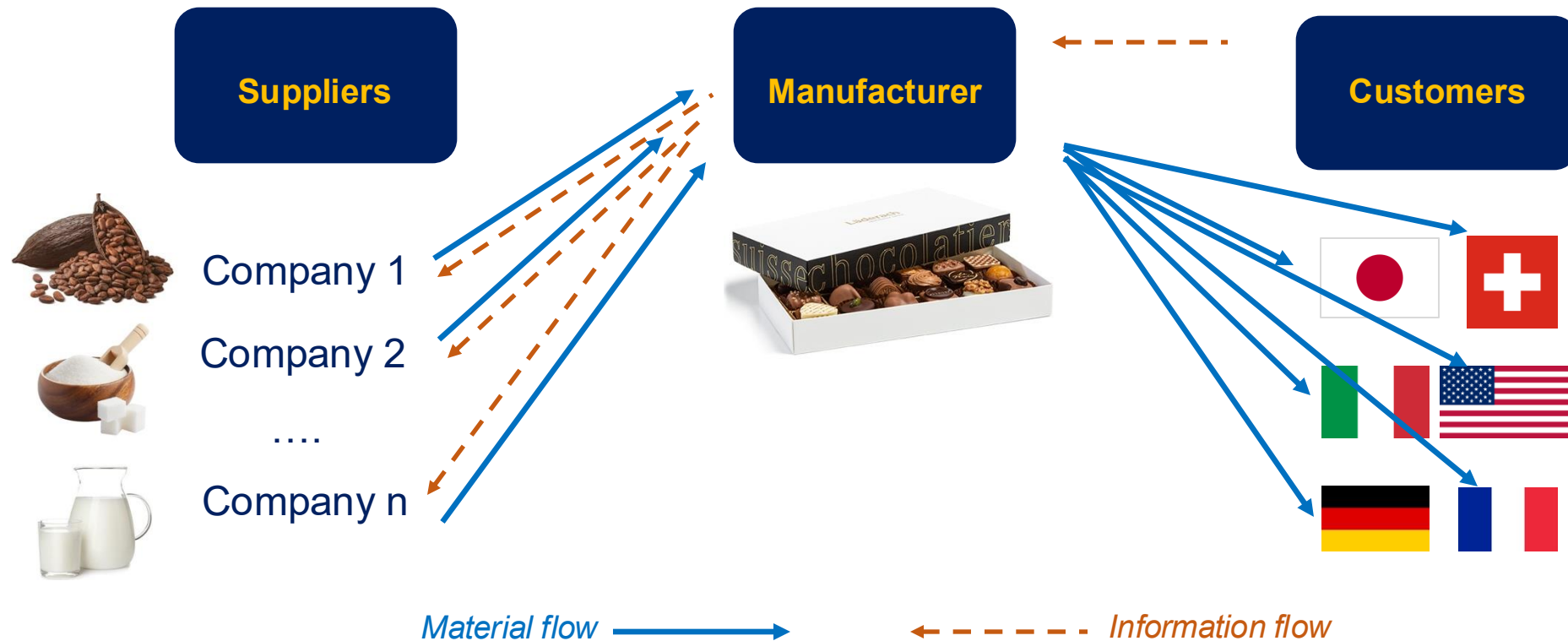


Three companies operating in the wind power generation industry **with different vertical integration positions.**

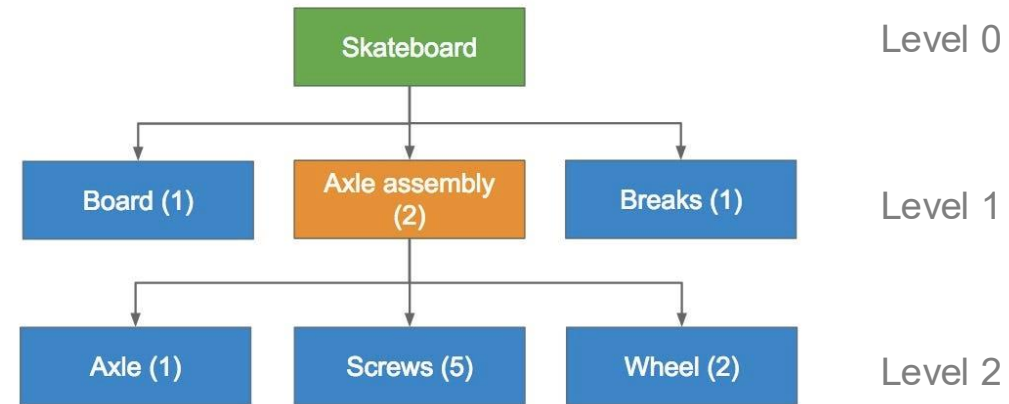
Value Adding Network (VAN) – Watch Manufacturer



Example: Material & Information Flow – Schematic Representation



Bill of Materials (BoM) – Definition



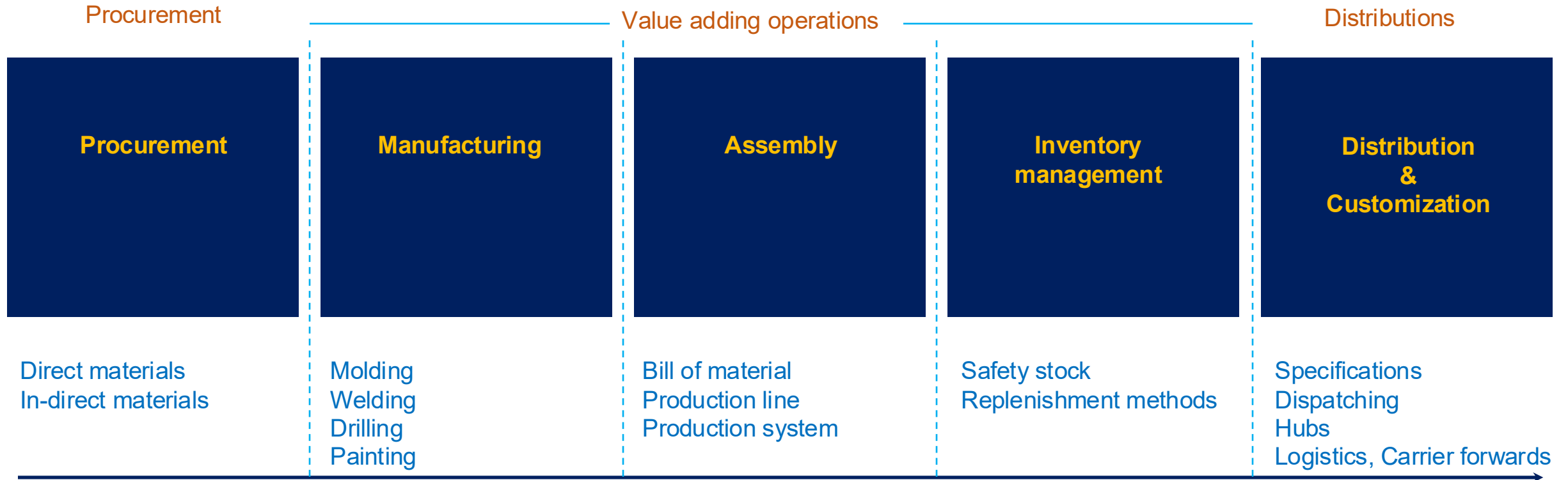
An extensive list of raw materials, components, and instructions required to construct, manufacture, or repair a product or service. It lists the **finished product at the top, followed by individual components and materials**. Engineering BOMs are used in the design process while manufacturing BOMs are used in the assembly process.

Source: <https://www.investopedia.com/terms/b/bill-of-materials.asp>

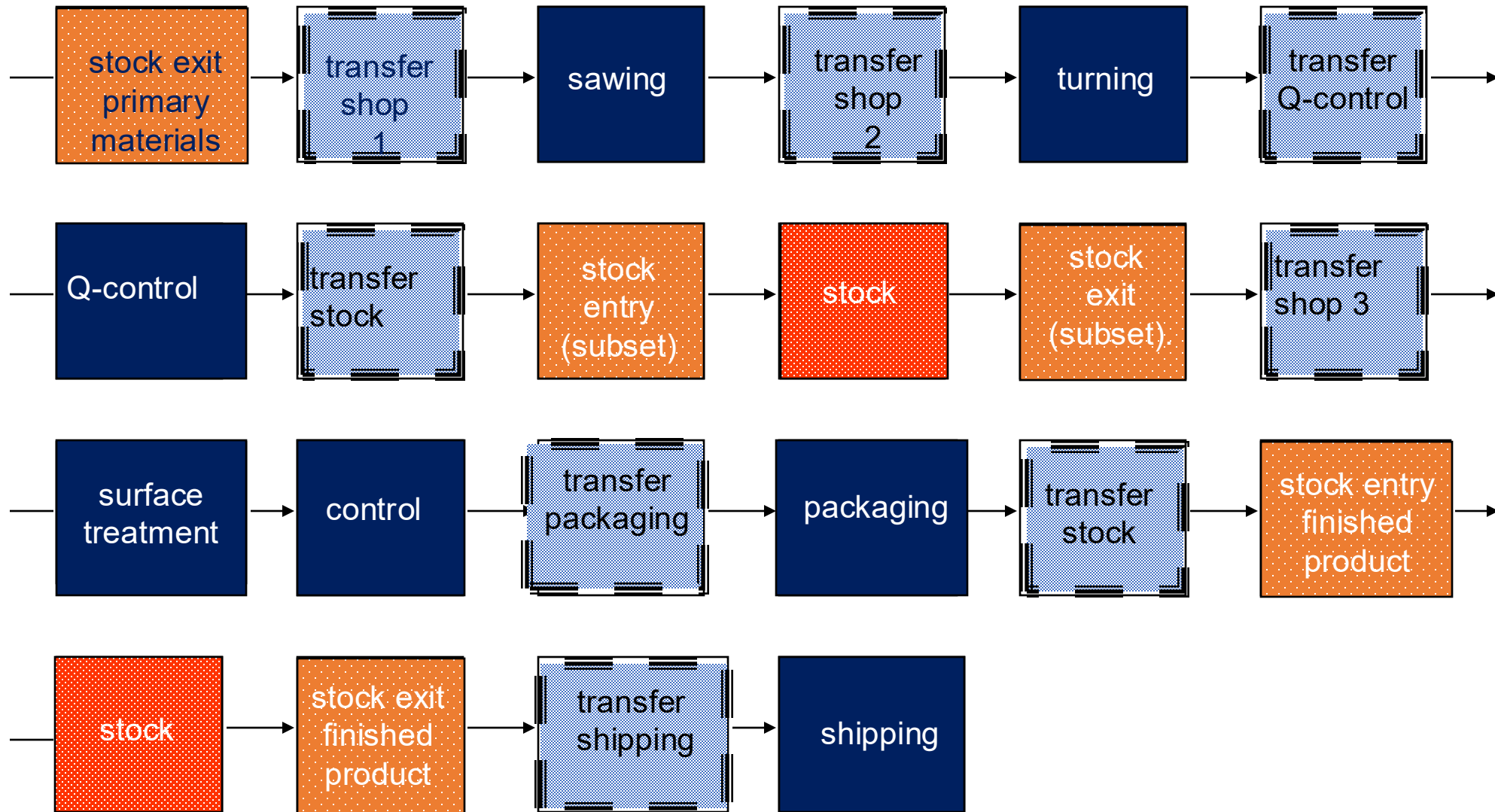
Agenda of the session

- **13:15 – 14:00** Introduction to Production Management (PM)
 - Production Procedure
 - Value Adding Activities

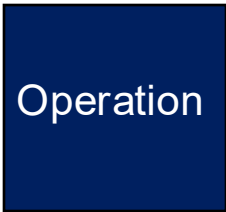
Production Procedure – Value Adding Activities



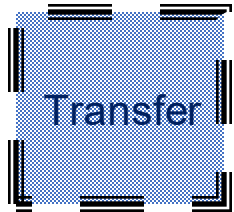
Production Procedure – Series of Activities



Production Procedure – Value Adding Activities



Transformation activity, adding value and modifying the material characteristics.



Transportation activity, not adding any value but modifying the location of the material.

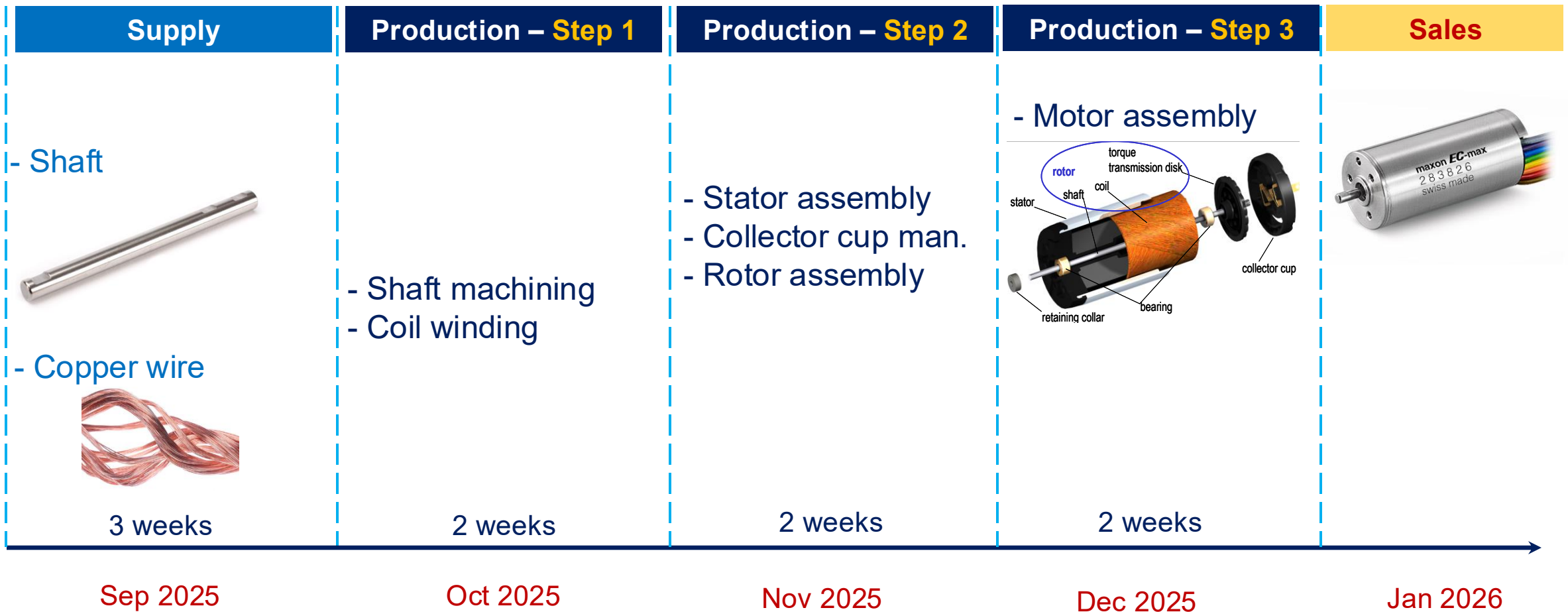


Data modification activity, not adding any value but acting on the administrative status of the material.

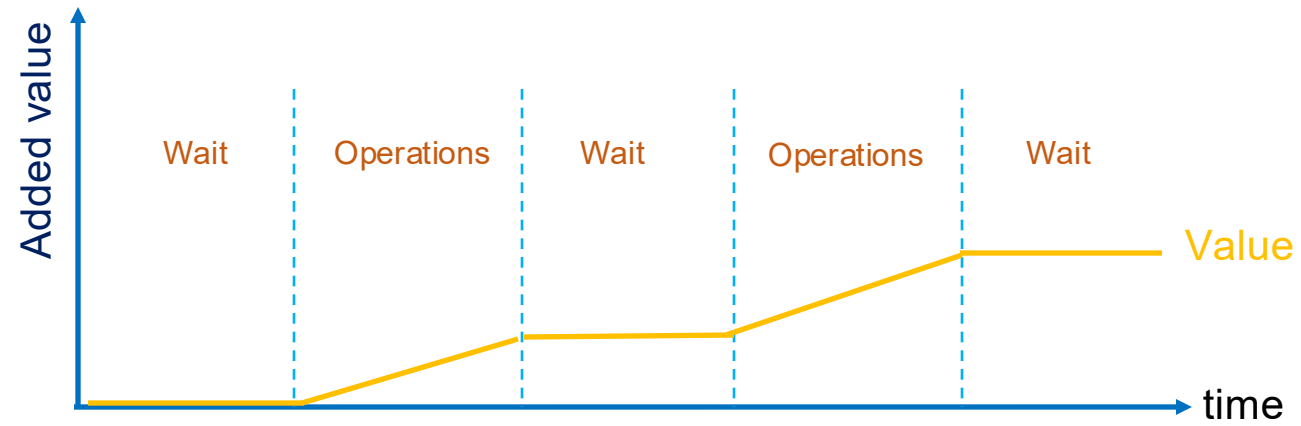


Waiting activity, not adding any value; no modification of the material characteristics, location or administrative status.

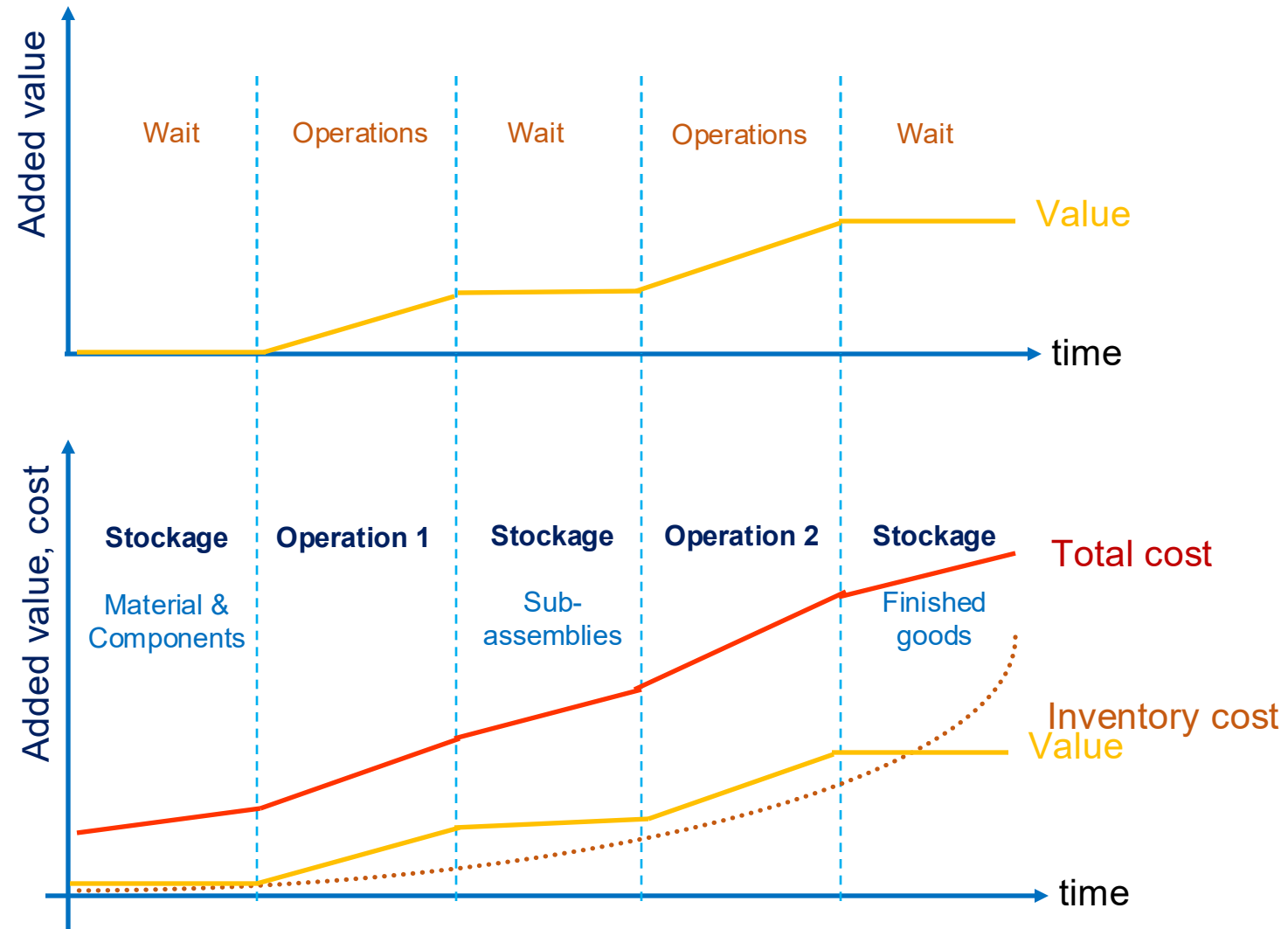
Production Procedure – Micro Motor



Production Procedure – Value Adding Activities



Production Procedure – Value Adding Activities



Exercise 2: Cold-pressed Juicing Production Process



5 Min

What would be the production process diagram (value adding activities) of cold-pressed juicing production based on added value and time?

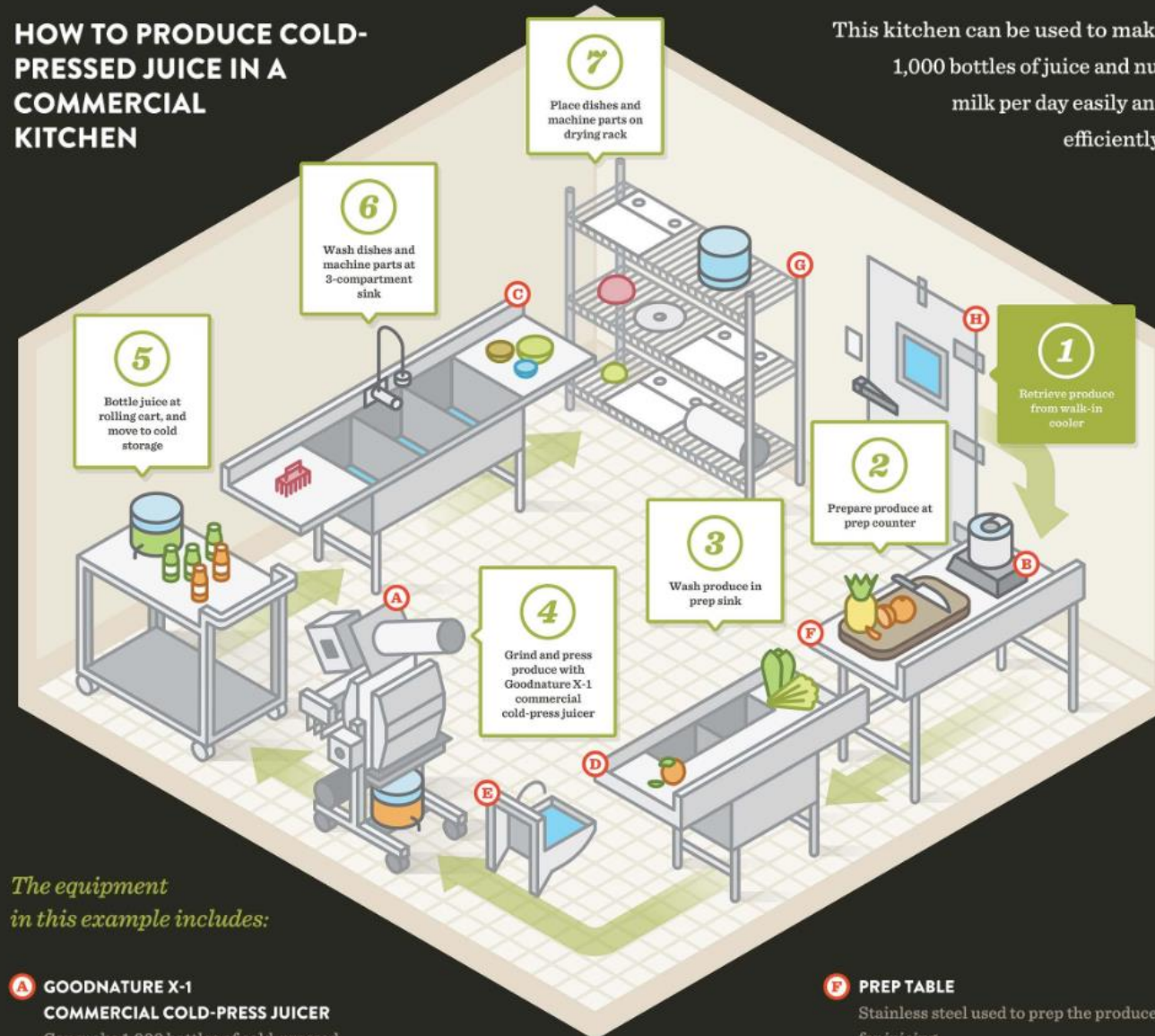
Hint: production steps are marked on the photo.



Exercise 2:

HOW TO PRODUCE COLD-PRESSED JUICE IN A COMMERCIAL KITCHEN

This kitchen can be used to make 1,000 bottles of juice and nut milk per day easily and efficiently.



The equipment in this example includes:

A GOODNATURE X-1 COMMERCIAL COLD-PRESS JUICER
Can make 1,000 bottles of cold-pressed juice per day.

B SAMMIC CKE-8 FOOD PROCESSOR
Food processor used to grind nuts to press

D PREP SINK FOR PRODUCE
It's nice to have a separate sink for washing

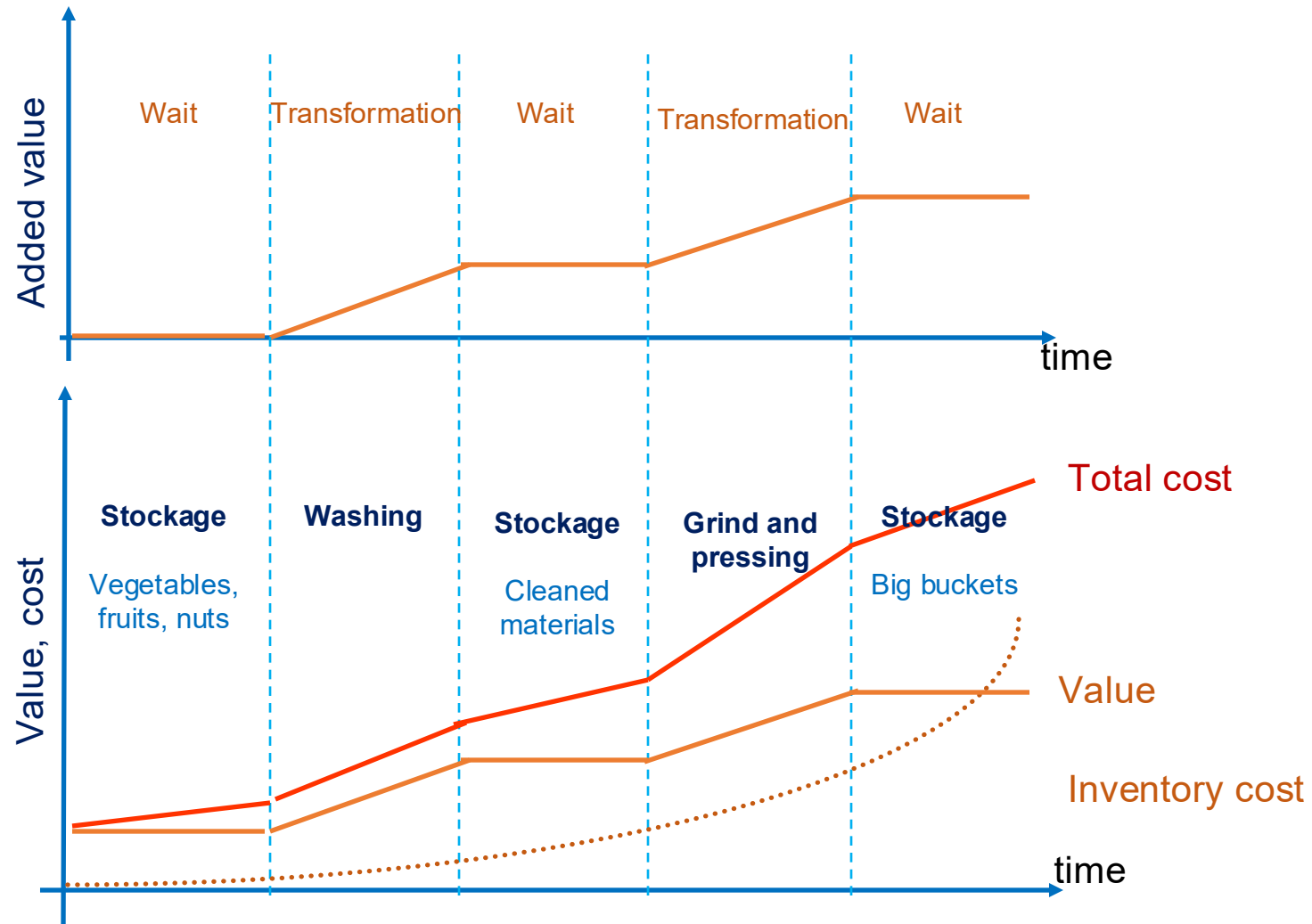
F PREP TABLE
Stainless steel used to prep the produce for juicing.

G DRYING RACK
This rack is used to air-dry dishes, machine parts, and press bags.



5 Min

Cold Press Juicing – Value Adding Activities



Learning Points – Summary

- Value Adding Network
 - Big picture
 - From product to system of systems
 - Supply Chain Network Design
 - Dynamics & Flows (material and information)
- Product development
 - Production Procedure
 - Bill of Materials (BOM)
 - Value Adding Activities

Assignment 2 – Your Case Study + Complimentary Information

Module I: Introduction to Production Management

- Production Management (Definition and examples)
- Value Adding Network, Value adding activities, Bill of Materials, ...

  Assignment 1: Your Company and Case Study

1) Download the Assignment 2 from Moodle

2) Work within your group

*** Submission deadline (report):** Sep 26th; 11:55 AM.

Review of Assignment 2 – Goal & Tasks



10 Min

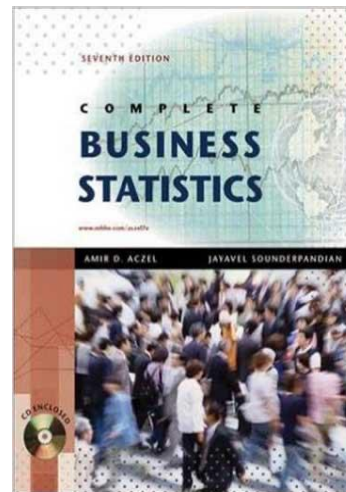
Goal: To better

- Understand your company, the value that it generates and captures, the range of products, and more specifically the product you manage and produce during the next months (Sep-Dec 2022).
- implement feedback and comments of your coach on your report 1, and update your next report based on provided information by your coach.
- use the complimentary information that your coaches will provide to update your report 2.

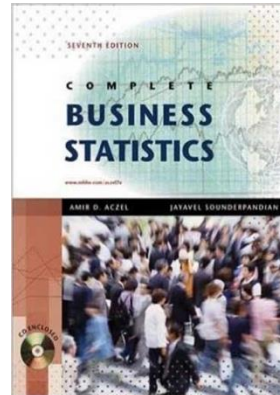
Learning Prerequisites – Required Courses

Required Courses

Probability & Statistics



Learning Prerequisites – Basic Statistics



Chapter 1

Descriptive
Statistics

Chapter 3

Random
Variable

Chapter 4

Normal
Distribution

Chapter 5

Sampling &
Distribution

Chapter 6

Confidence
Intervals

Chapter 10

Regression &
Correlation

Chapters are shared on Moodle

Closed-book exam, consisting of 12–15 multiple-choice questions

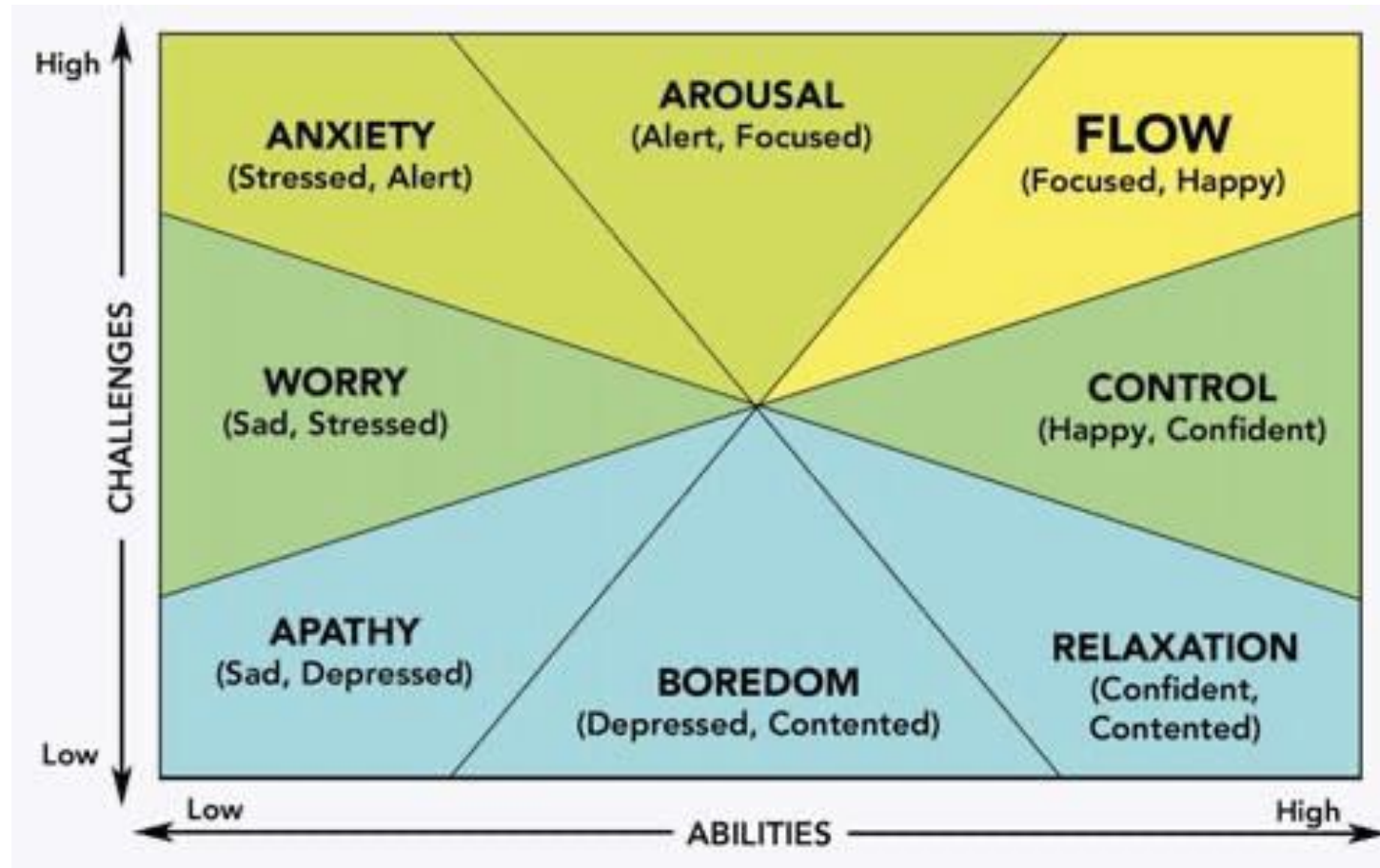
Production Management (ME-419)

Groups & Re-grouping

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Week 2 – Session 2 – September 20th, 2024

The Map of Everyday Experience



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

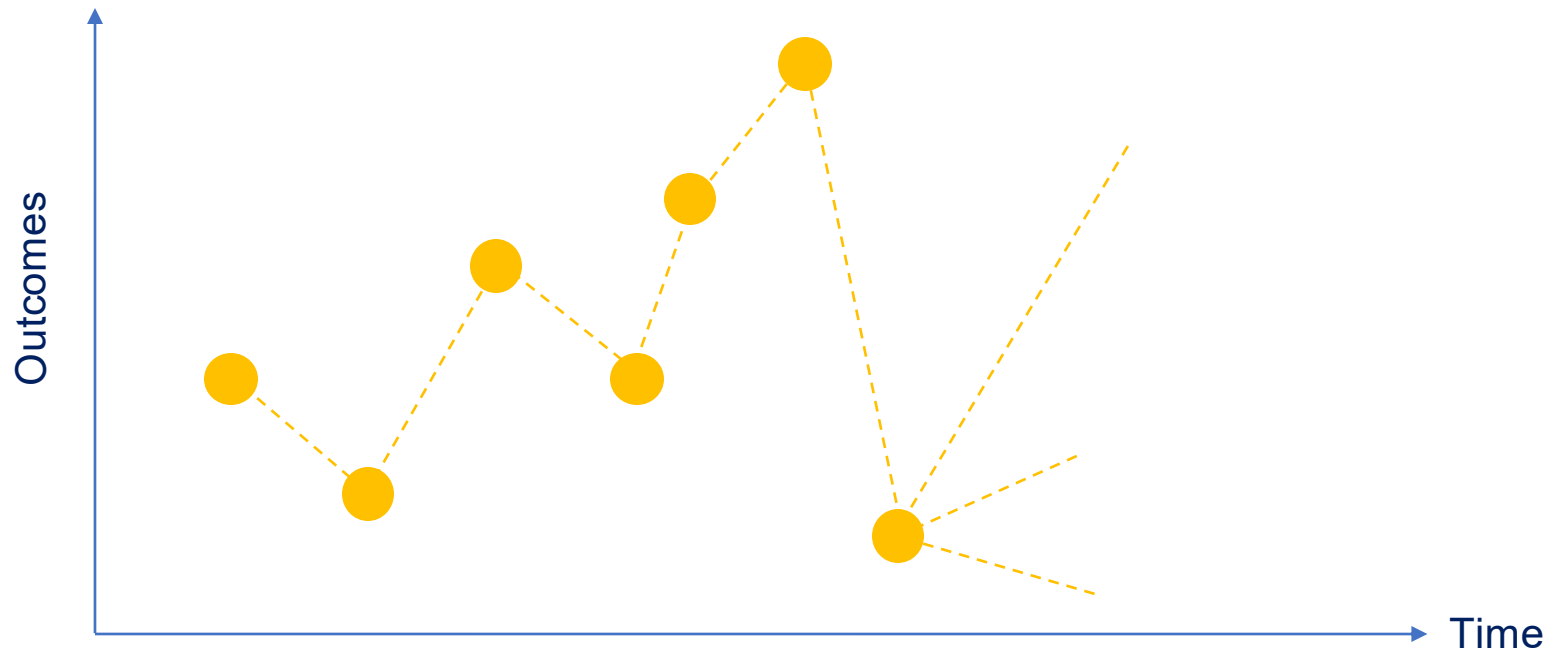
The Experience of Flow



In positive psychology, a **flow state**, also known as **being in the zone**, is the mental state in which a person performing some activity is fully immersed in a feeling of energized focus, full involvement, and **enjoyment** in the process of the activity.

Source: Mihaly Csikszentmihalyi, *Flow: The Psychology of Optimal Experience*, Harper and Row, 1990.

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.

Emotional Intelligence (EI)



“The ability to perceive emotions, to access and generate emotions so as to assist thought, to understand emotions and emotional meanings, and to reflectively regulate emotions in ways that promote emotional and intellectual growth” — Salovey & Mayer (1990)

Source: Salovey, P. & Mayer, J. (1990). Emotional intelligence, *Imagination, Cognition, and Personality* 9: 185-211.

Emotional Intelligence – Main Elements



**Self-
awareness**



**Self-
regulation**



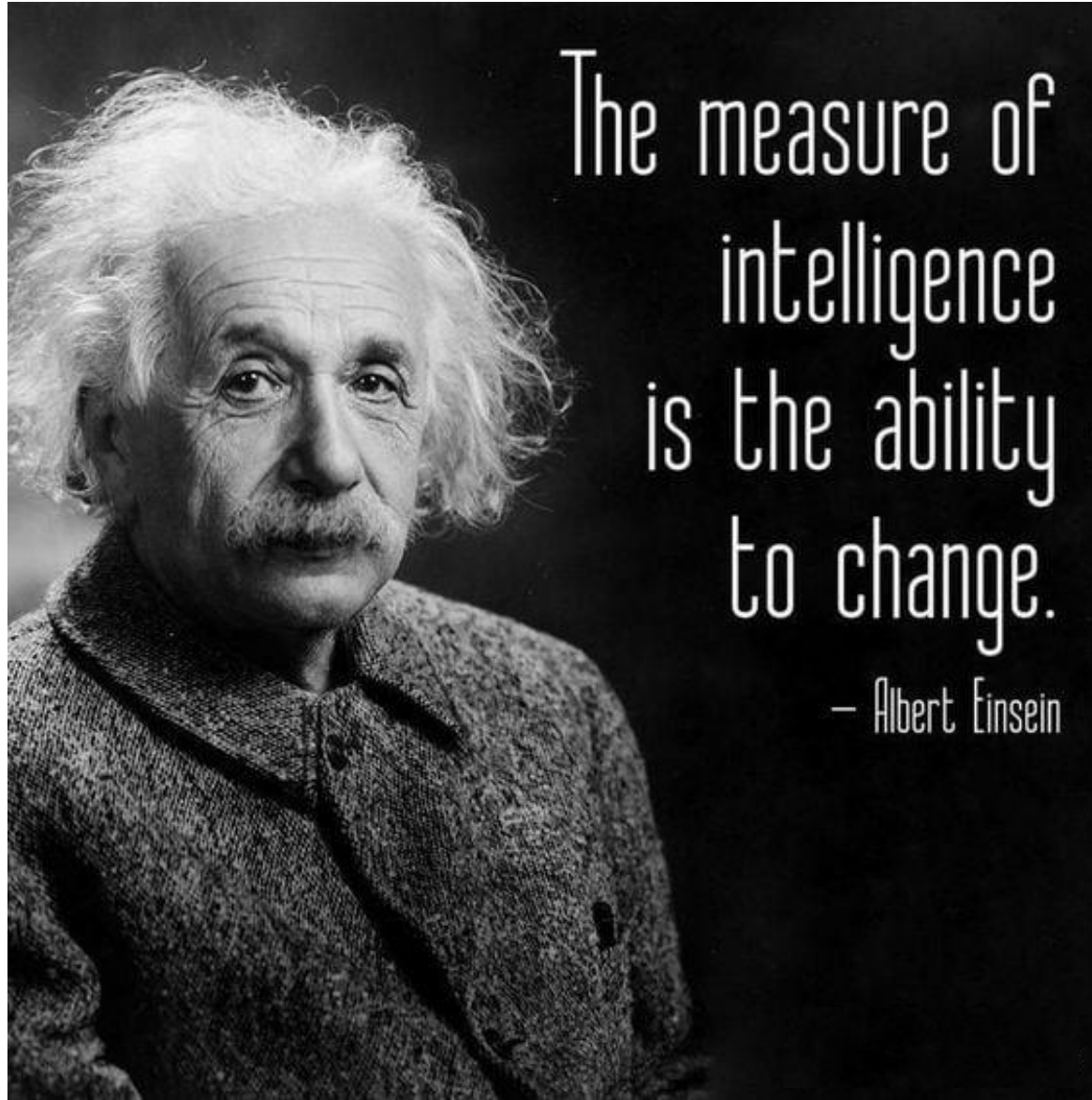
Motivation



Empathy



**Social
skill**



Re-Grouping



20 Min



Review of Assignment 2 – Goal & Tasks



10 Min

Goal: To better

- Understand your company, the value that it generates and captures, the range of products, and more specifically the product you manage and produce during the next months (Sep-Dec 2022).
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- use the complimentary information that your coaches will provide to update your report 2.

Production Management (ME-419)

Module 2: Demand Management

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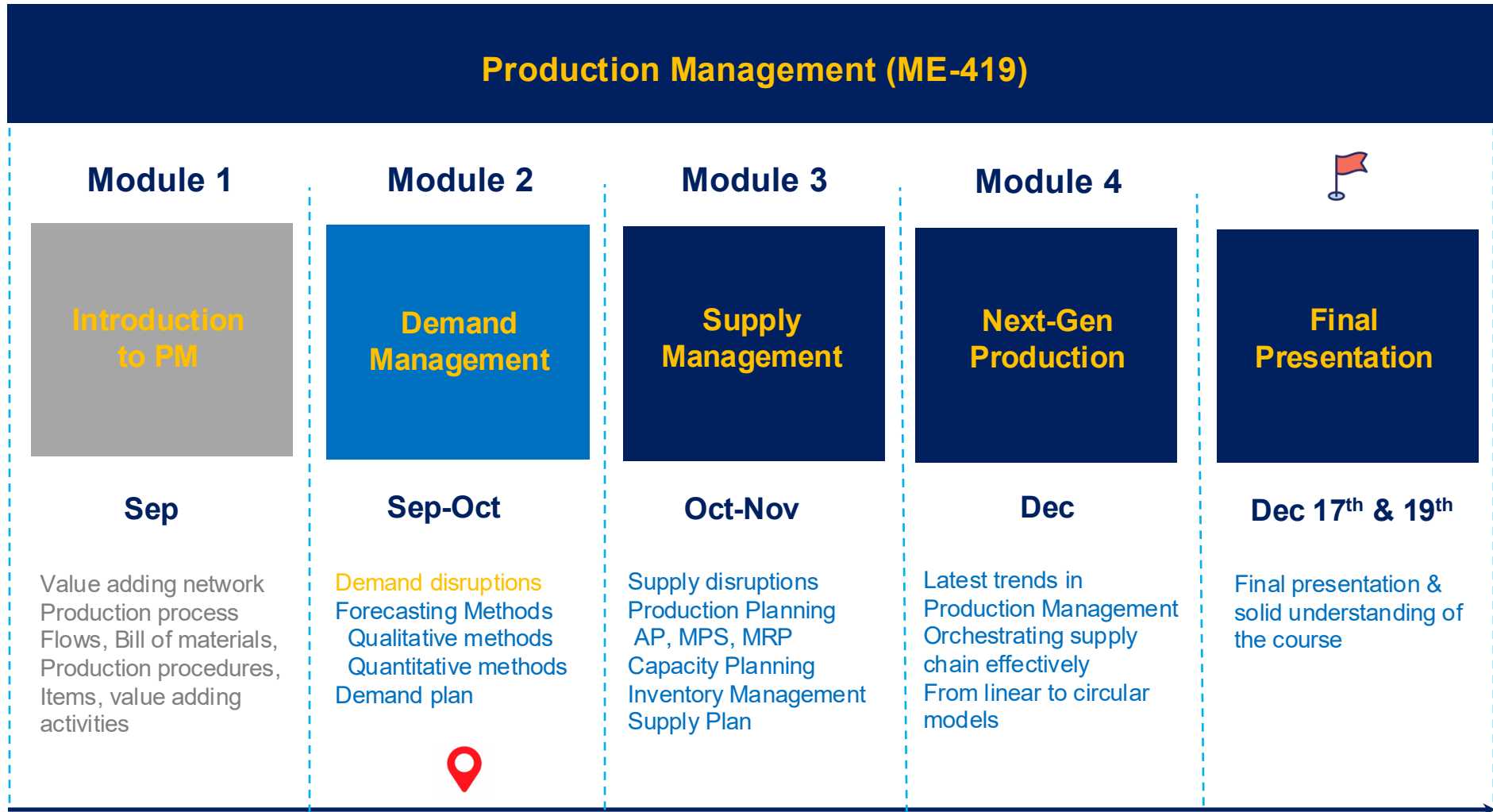
Week 2 – Session 3 – September 20th, 2024

Course Framework



Business plan

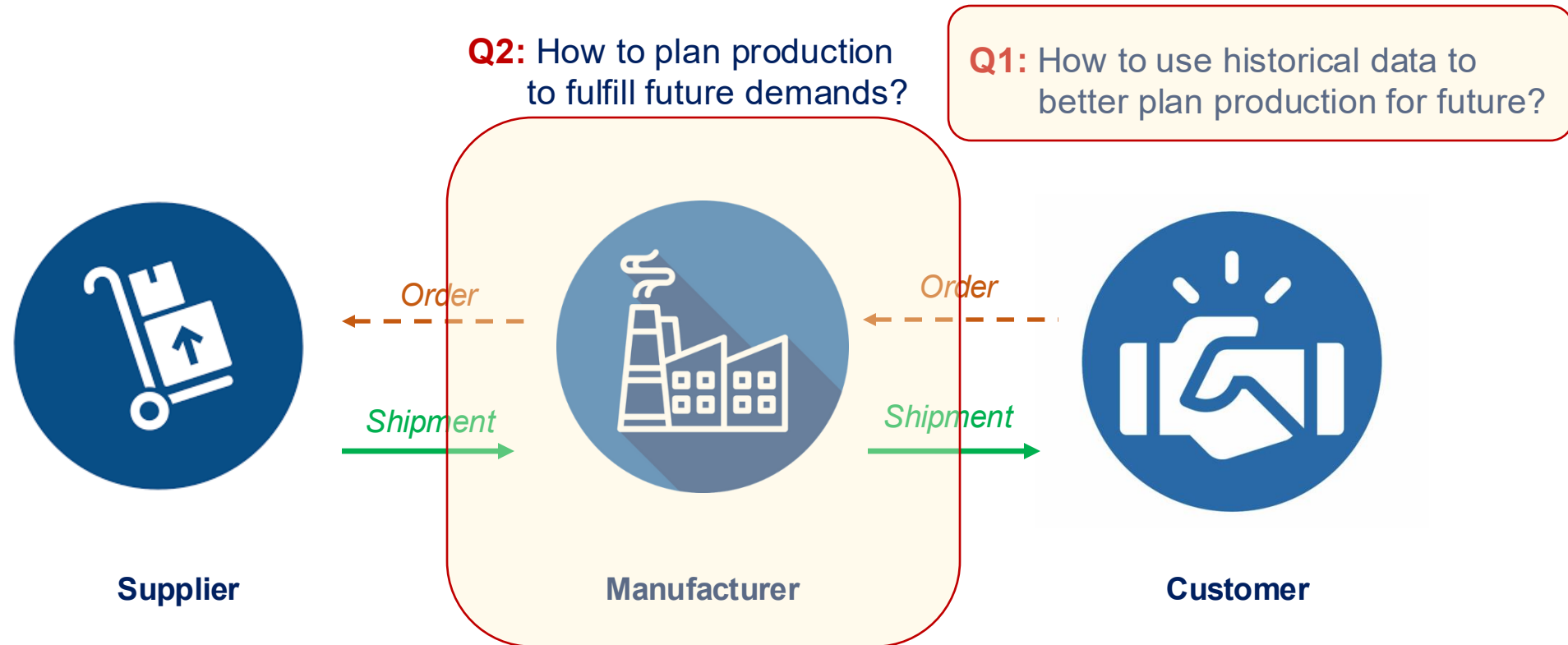
Strategic plan
Financial plan



Agenda

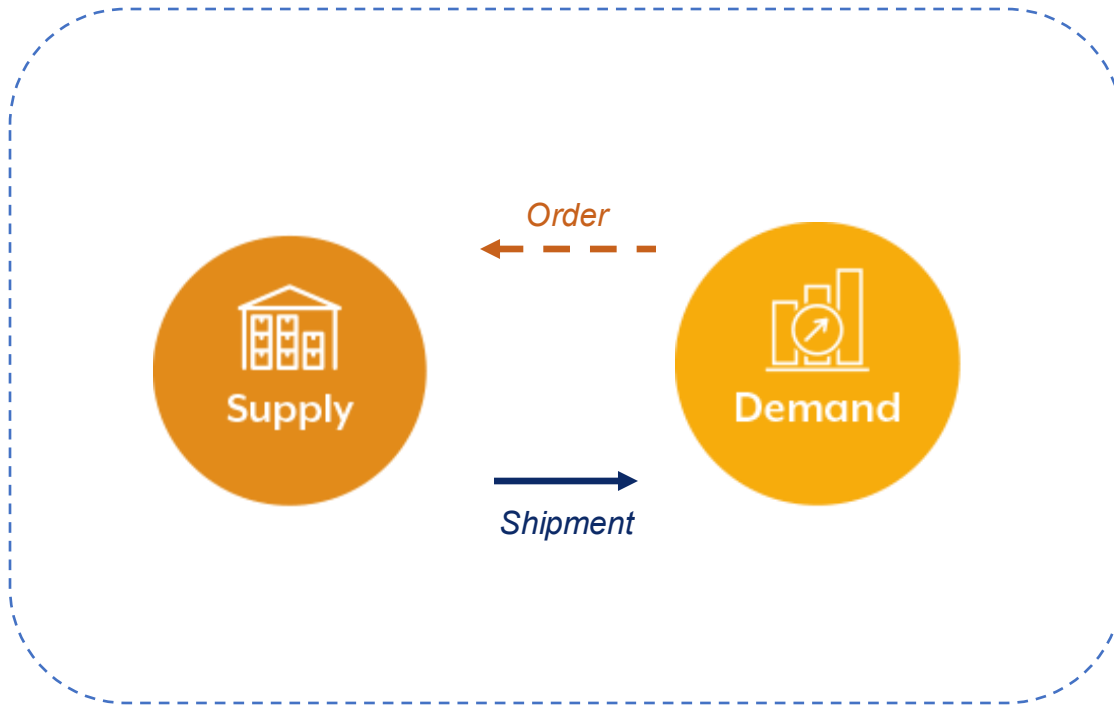
- **15:15 – 16:00** Module 2: Demand Management
 - Demand Disruptions
 - Forecasting methods
 - Demand plan

Material & Information Dynamics & Flows – The Focus of PM

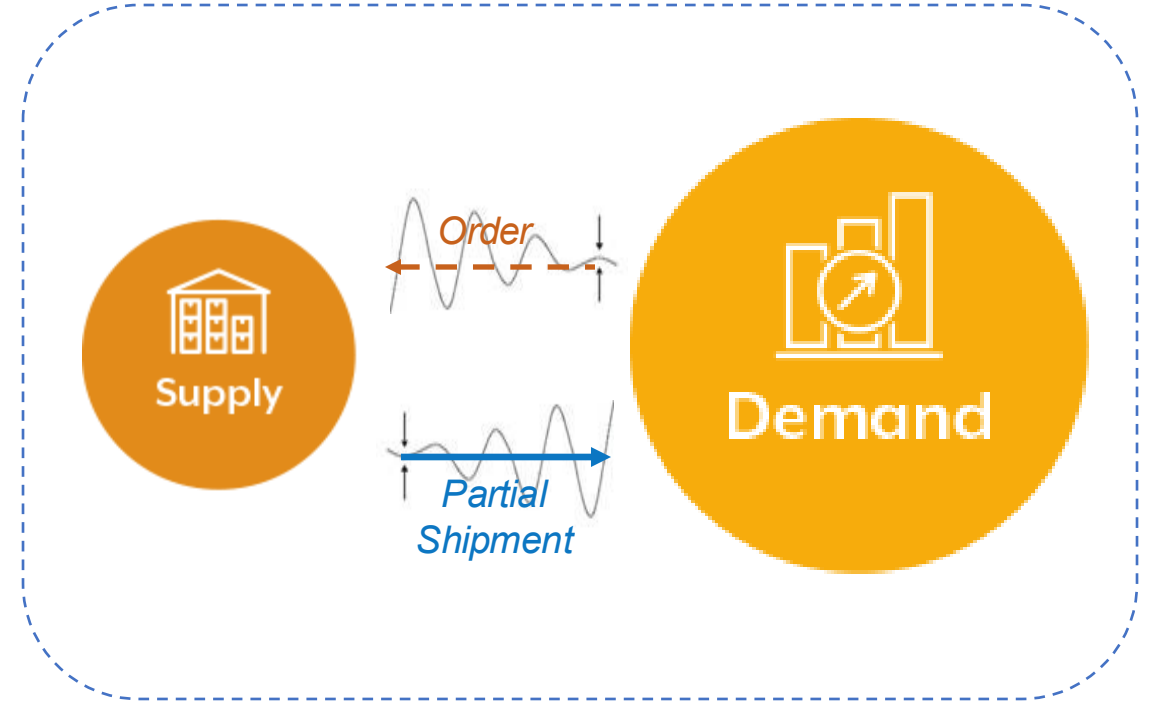


Q3: How to buffer stock against demand and supply disruptions?

Demand and Supply



Match

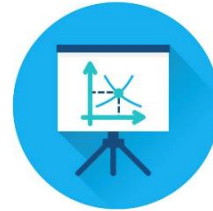


Mismatch

The New Normal – High Uncertainties & Complexities



High **geopolitical** uncertainty



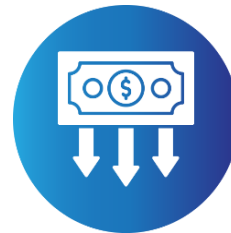
Post-Covid changes



Rising **Tech** advancements



Supply **shortage** and procurement



Highest **inflation** in 40 years



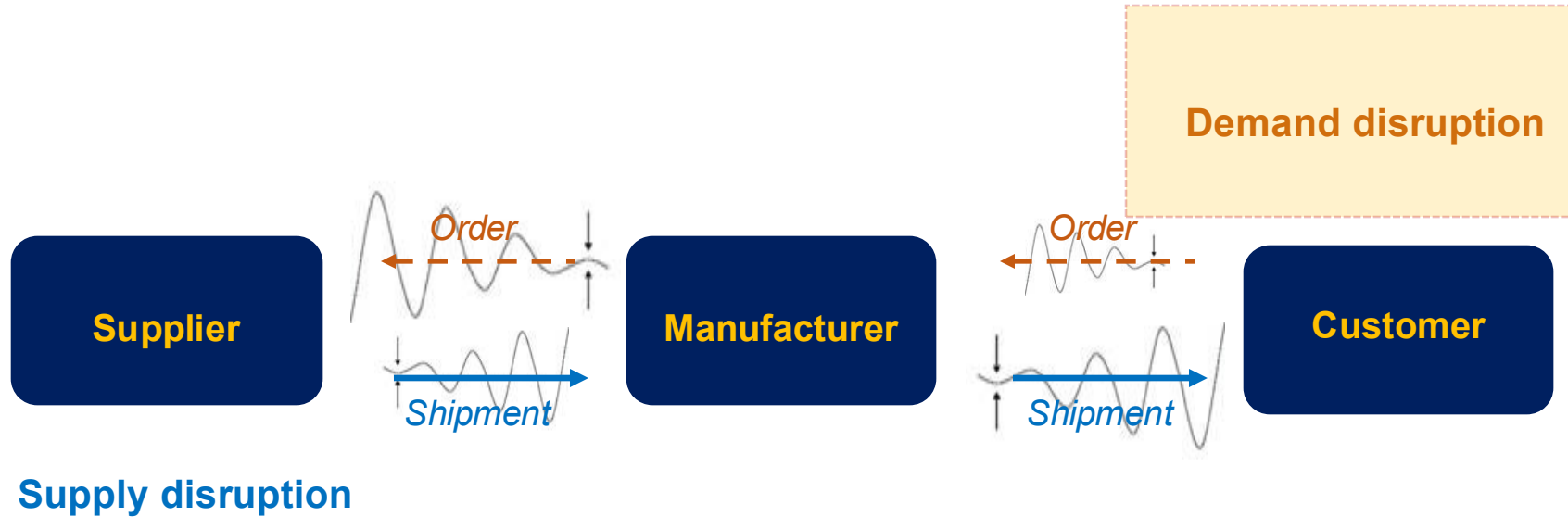
Increasing **data** volumes

Demand and Supply – Mismatch



Source: GettyImage

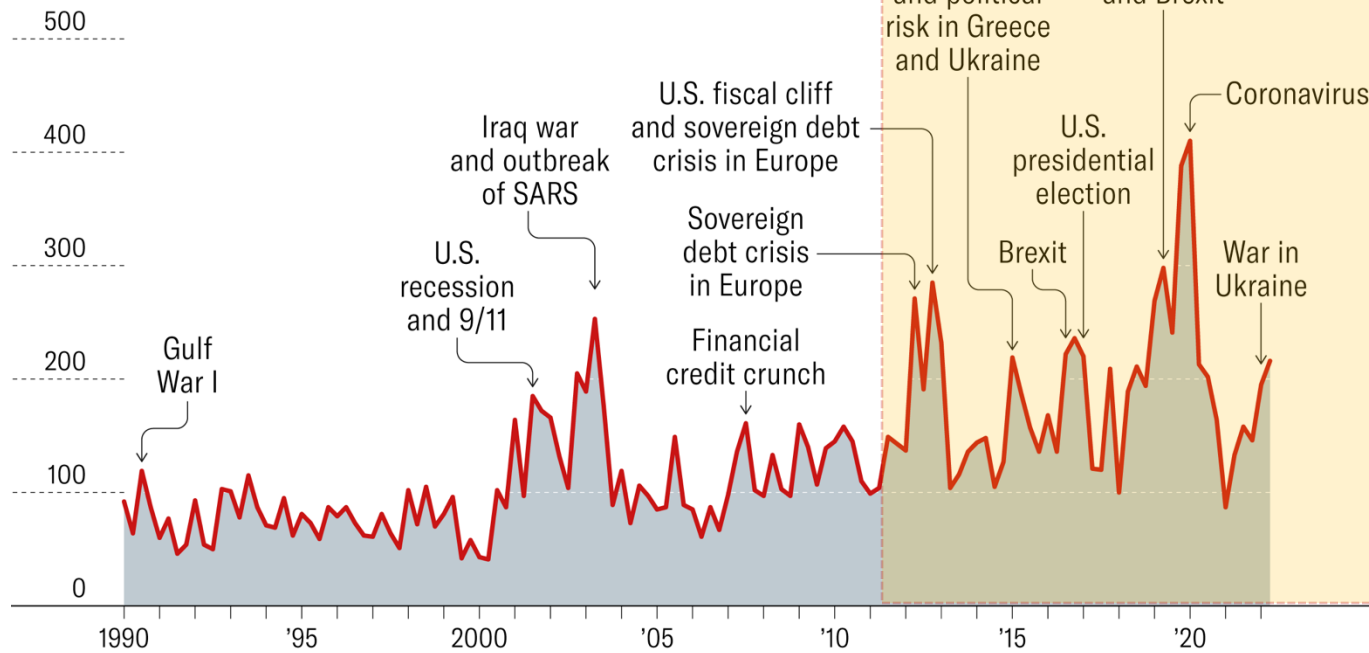
Simplified Supply Chain – Disruptions



The Rise of Economic Uncertainty – The World Uncertainty Index

World Uncertainty Index

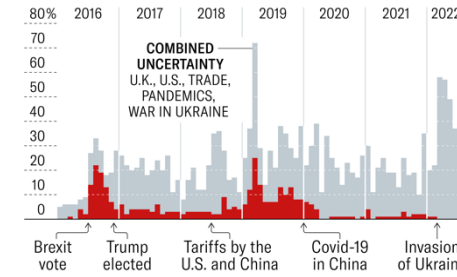
Normalized, 1990-2010 is 100 on average



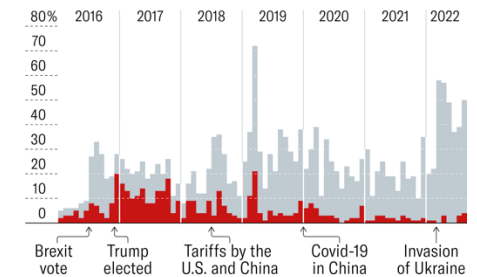
Source: Hites Ahir, Nicholas Bloom, and Davide Furceri, "World Uncertainty Index," Stanford mimeo, 2018



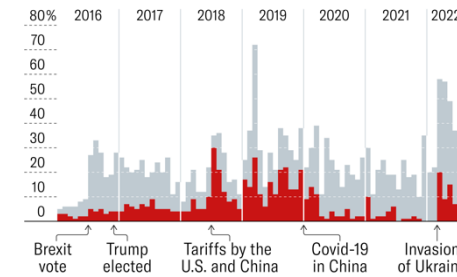
1. The U.K.



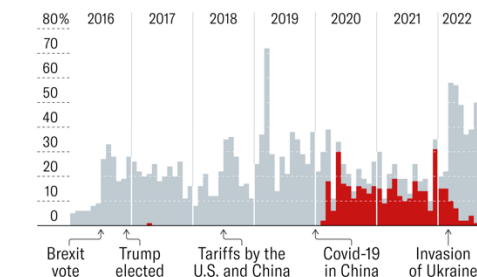
2. The U.S.



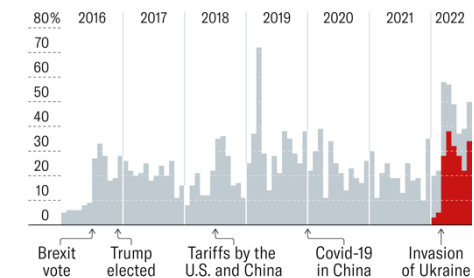
3. Trade



4. Pandemics



5. The war in Ukraine



Source: Hites Ahir, Nicholas Bloom, and Davide Furceri, "World Uncertainty Index," Stanford mimeo, 2018



Source: Harvard Business Review, 2022 (<https://hbr.org/2022/09/visualizing-the-rise-of-global-economic-uncertainty>)

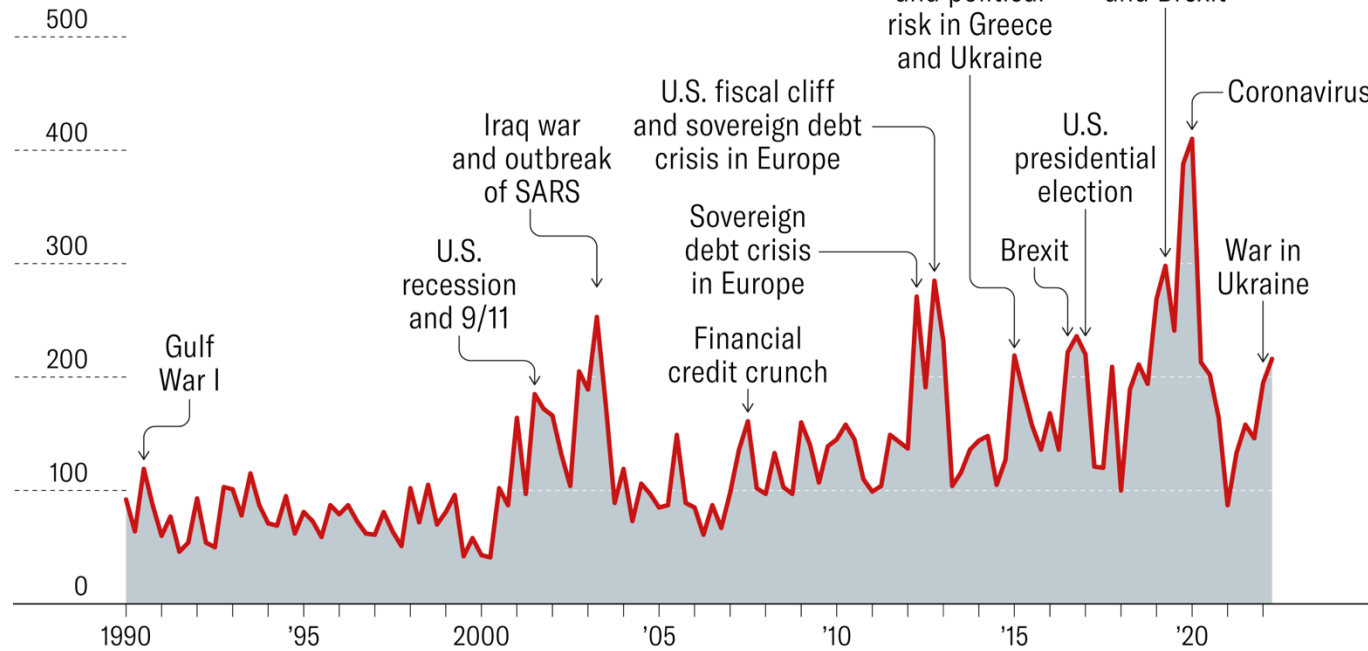
Case 1:

COVID-19 & Swiss Watch Industry

The Rise of Economic Uncertainty – The World Uncertainty Index

World Uncertainty Index

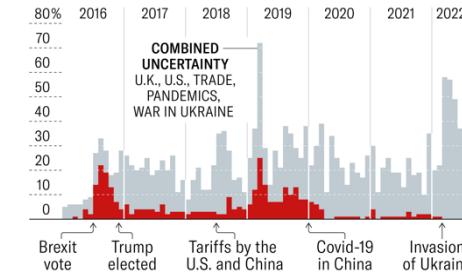
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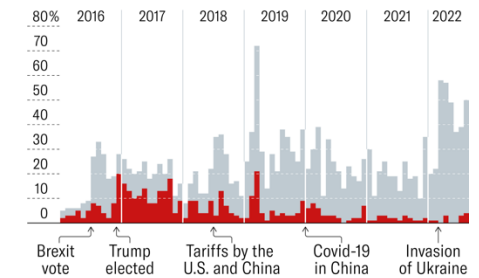
Source: Hites Ahir, Nicholas Bloom, and Davide Furceri, "World Uncertainty Index," Stanford mimeo, 2018



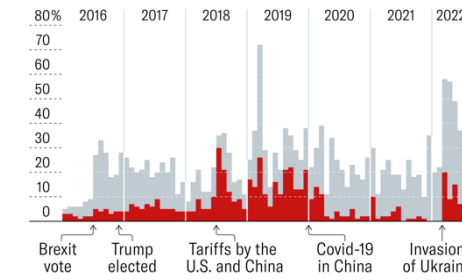
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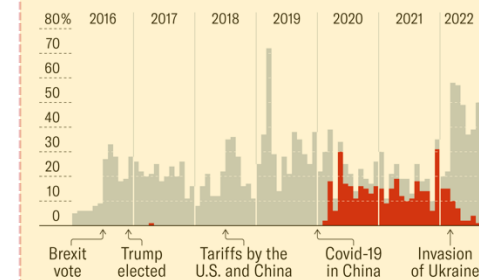
2. The U.S.



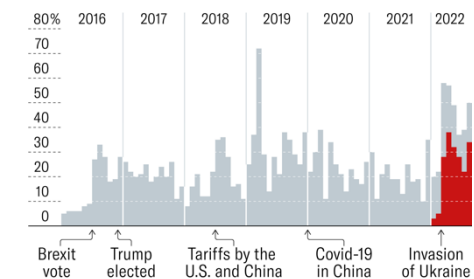
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4. Pandemics



5. The war in Ukraine

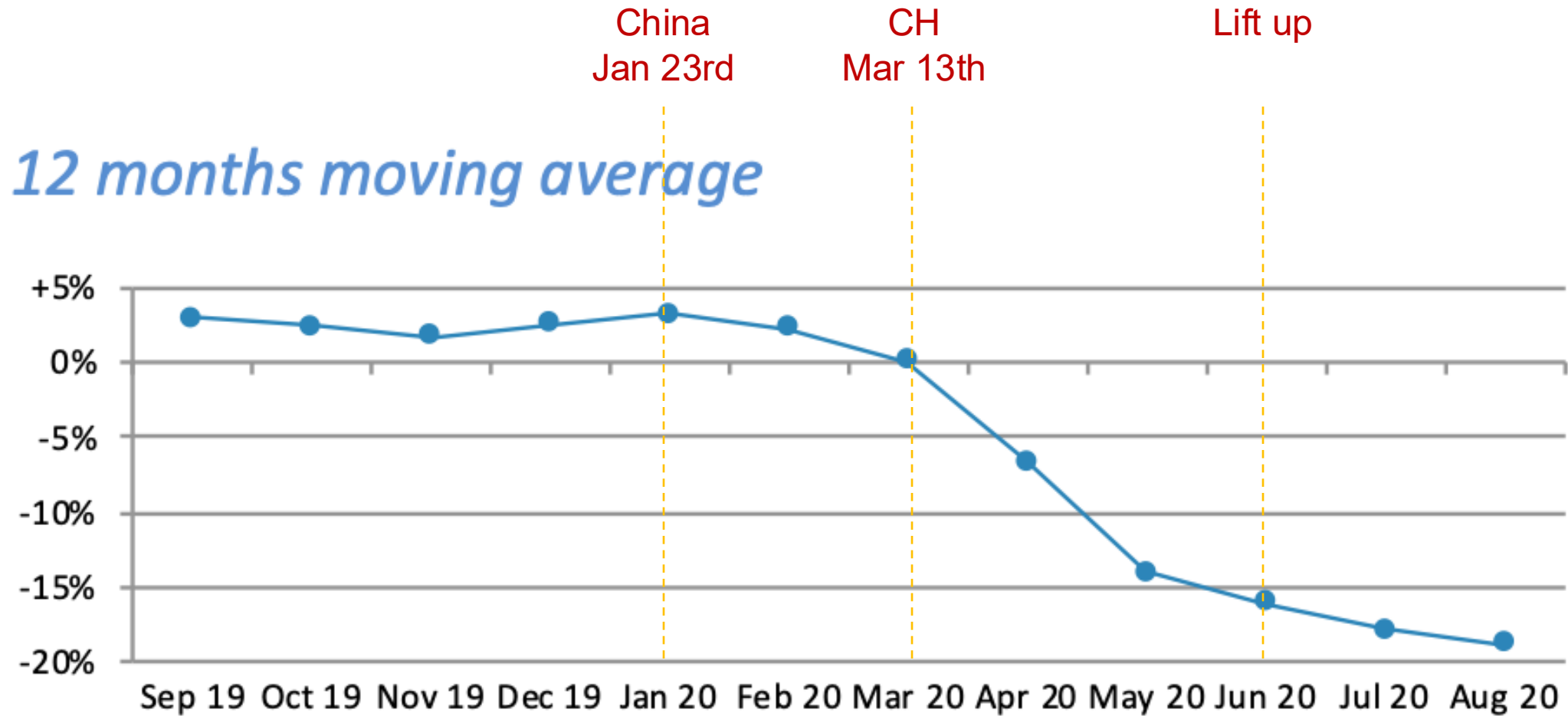


Source: Hites Ahir, Nicholas Bloom, and Davide Furceri, "World Uncertainty Index," Stanford mimeo, 2018



Source: Harvard Business Review, 2022 (<https://hbr.org/2022/09/visualizing-the-rise-of-global-economic-uncertainty>)

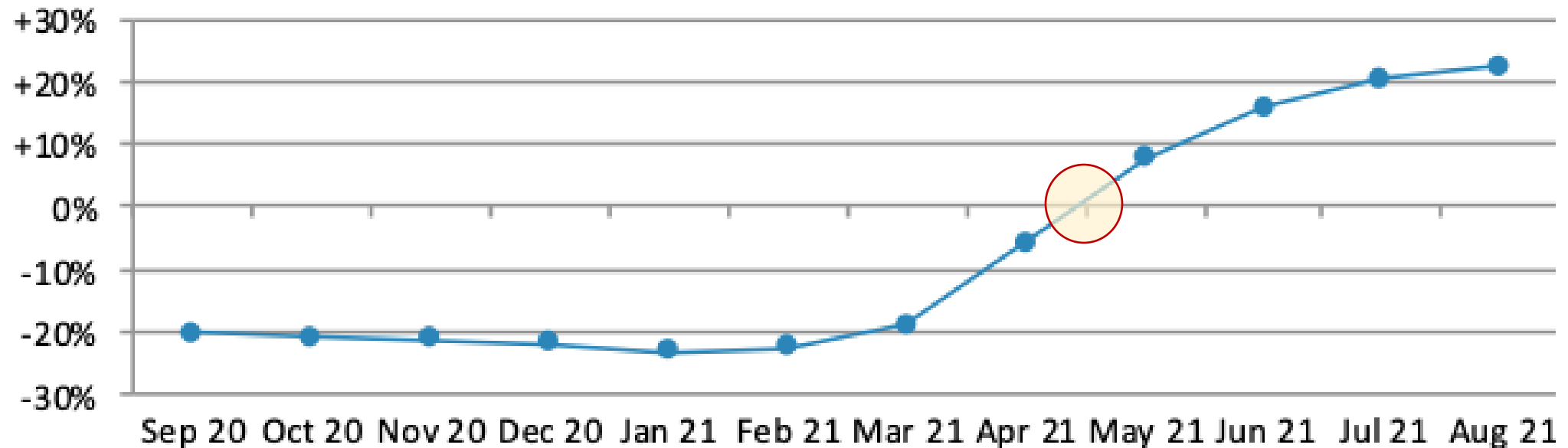
The Swiss Watch Industry – Export During COVID-19 (Sep19-Aug20)



Source: Federation of the Swiss Watch industry FH: https://www.fhs.swiss/scripts/getstat.php?file=comm_200808_a.pdf

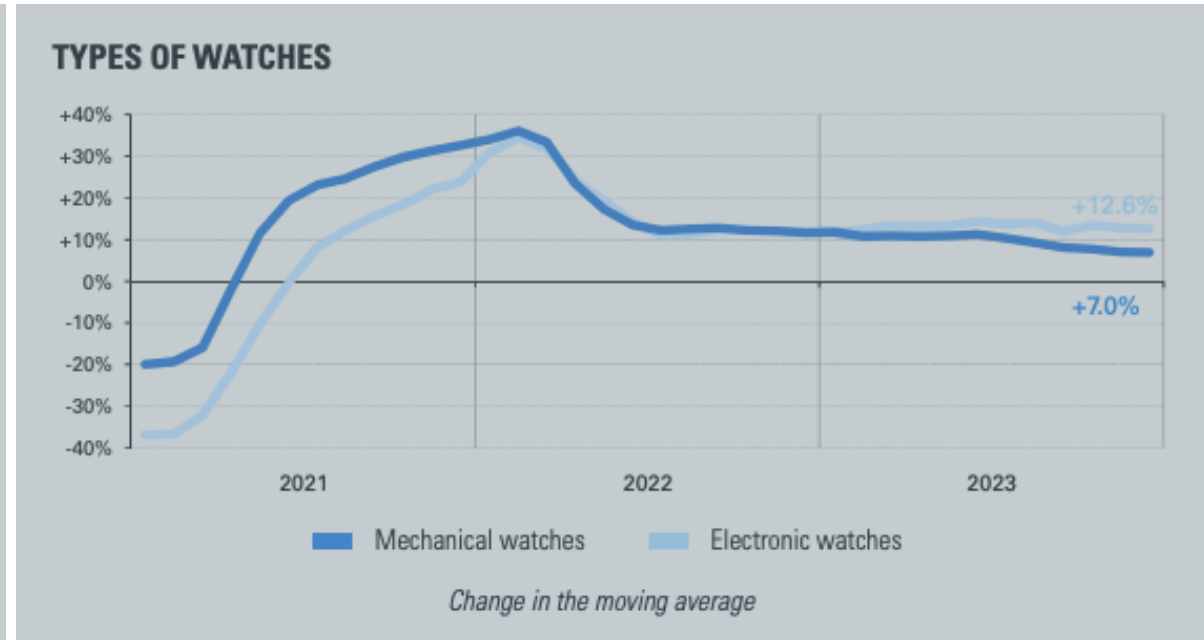
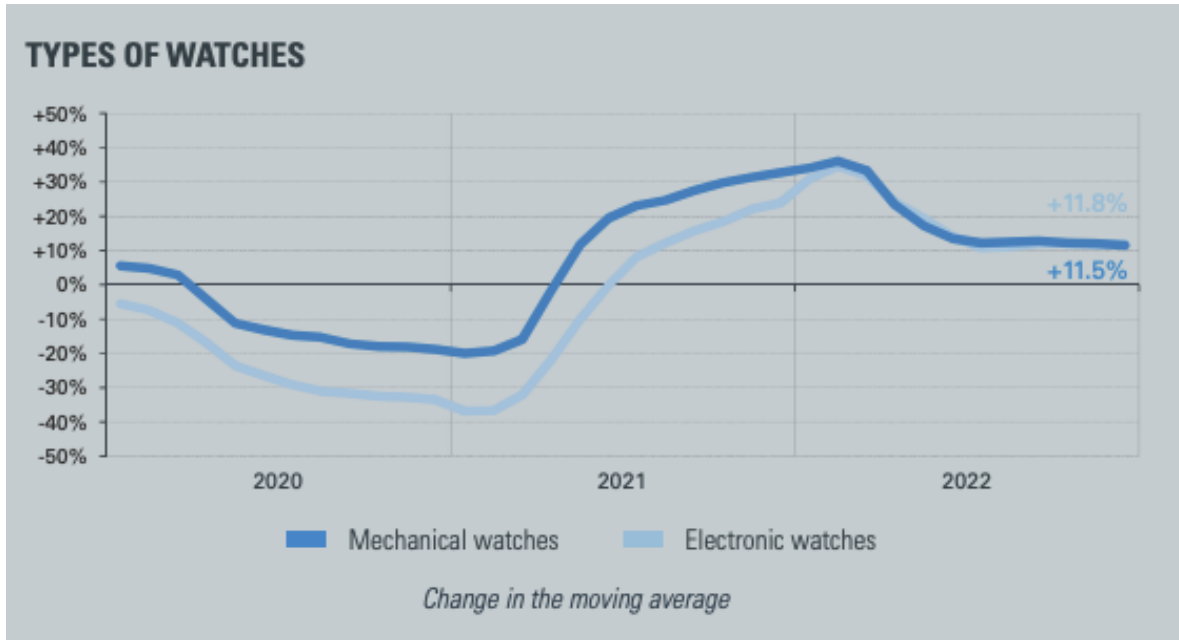
The Swiss Watch Industry – Export During COVID-19 (Sep20-Aug21)

12 months moving average



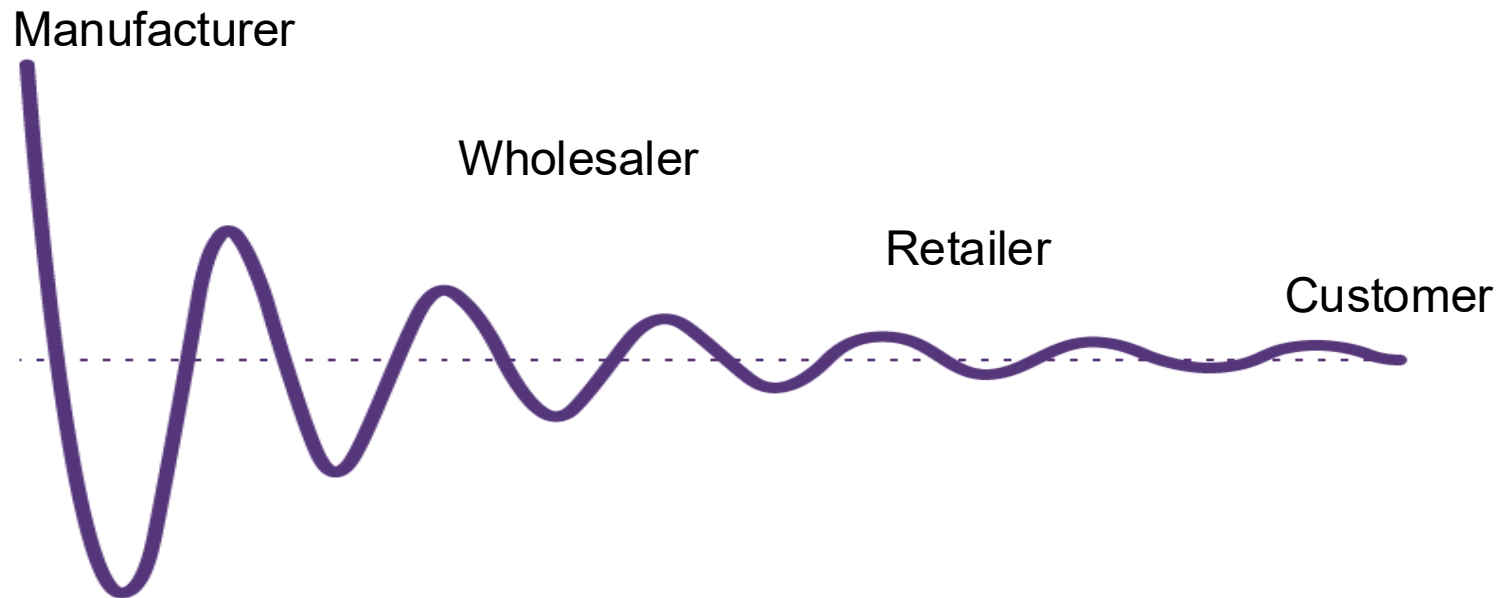
Source: Federation of the Swiss Watch industry FH: https://www.fhs.swiss/scripts/getstat.php?file=comm_200808_a.pdf

The Swiss Watch Industry – (2020-2023)



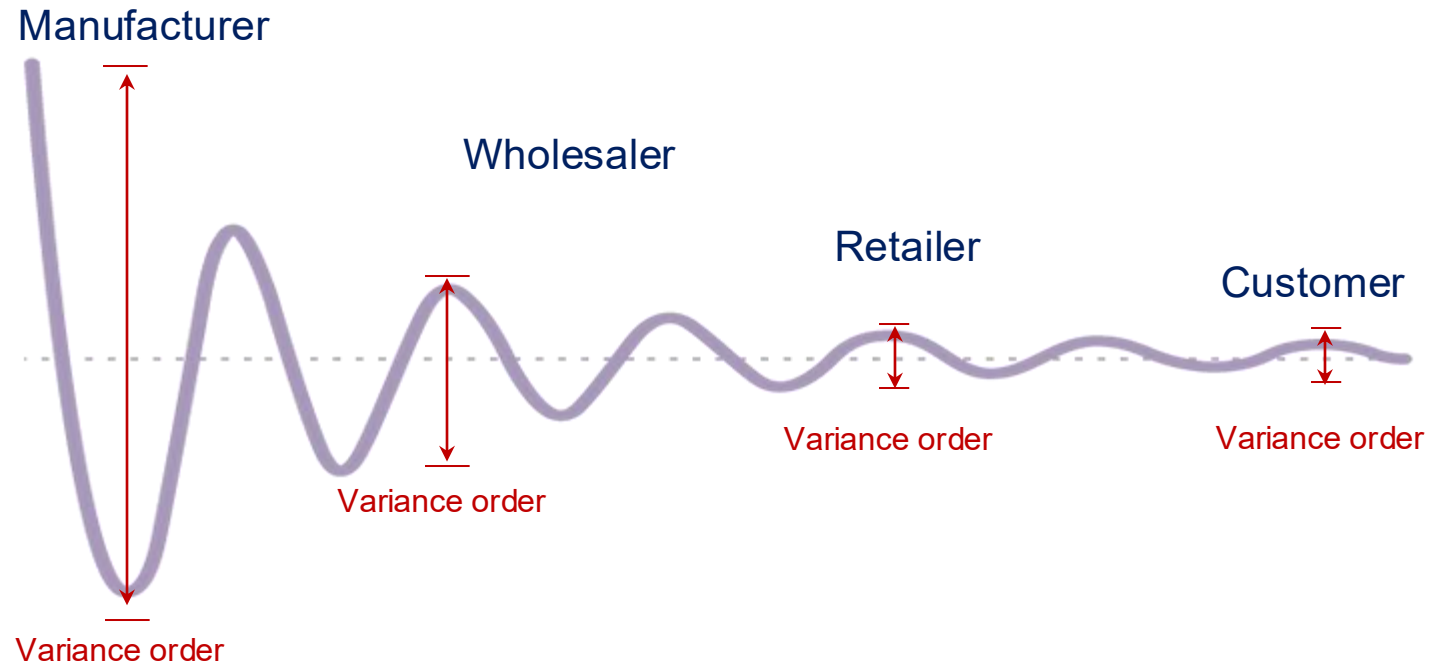
Source: Federation of the Swiss Watch industry FH: <https://www.fhs.swiss/eng/statistics.html>

Bullwhip Effect



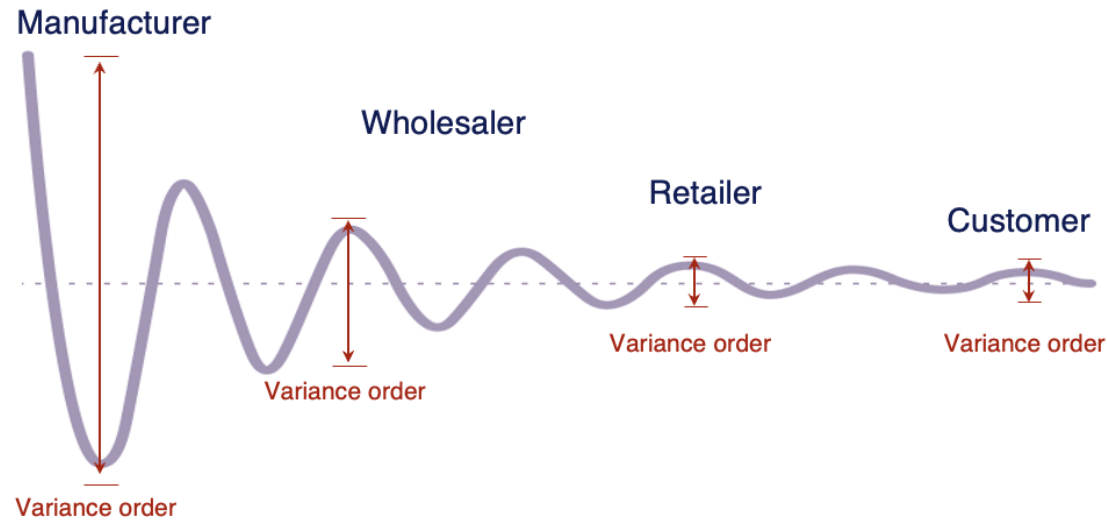
Bullwhip effect: The demand variabilities (amplification and oscillation) along the supply chain.

Measuring Bullwhip Effect



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

Measuring Bullwhip Effect



1. Bullwhip Effect Formula for Each Echelon

For each stage in the supply chain, the **bullwhip effect (BWE)** is calculated as:

$$BWE_i = \frac{\text{Variance of Orders Received at Echelon } i}{\text{Variance of Orders Sent to Next Echelon } (i + 1)}$$

Where:

- i represents an echelon (e.g., Manufacturer, Wholesaler, Retailer).
- A higher BWE value means greater demand amplification at that echelon.

2. Bullwhip Effect Formula for the Whole Supply Chain

To measure the **overall bullwhip effect** across the entire supply chain (from the customer to the manufacturer), we compare the **order variance at the manufacturer** with the **demand variance at the customer**:

$$BWE_{\text{Total}} = \frac{\text{Variance of Orders Received by Manufacturer}}{\text{Variance of Customer Demand}}$$

Where:

- **Numerator:** Captures the variance at the manufacturer (which is the most volatile in the chain).
- **Denominator:** Represents the demand variance at the customer (which is the source of the orders).

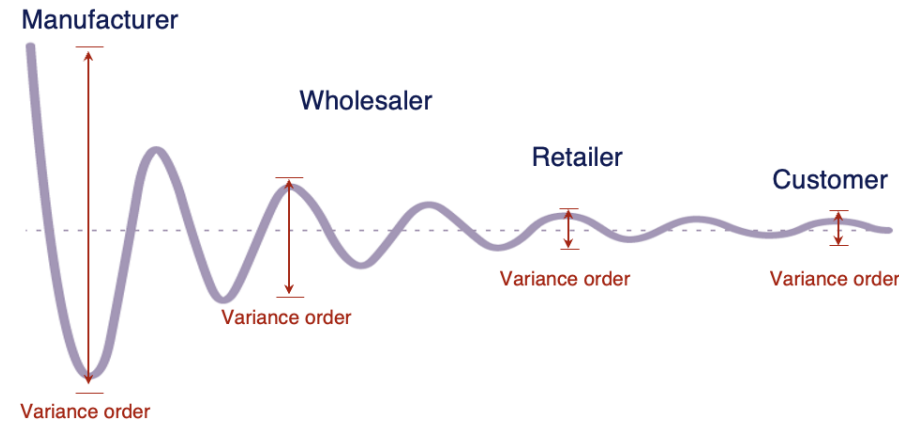
3. Alternative Approach: Multiplicative Form Across Echelons

Since the bullwhip effect accumulates across multiple echelons, we can also express it as:

$$BWE_{\text{Total}} = BWE_{\text{Wholesaler}} \times BWE_{\text{Retailer}} \times BWE_{\text{Manufacturer}}$$

This approach assumes each echelon amplifies the variance, and the total effect is the product of individual echelons' bullwhip ratios.

Demand Disruption – Causes of Bullwhip Effect



Operational Reasons

- Demand processing (forecast errors)
- Leadtime variability
- Lot-sizing
- Promotions and forward buying

Behavioral Reasons

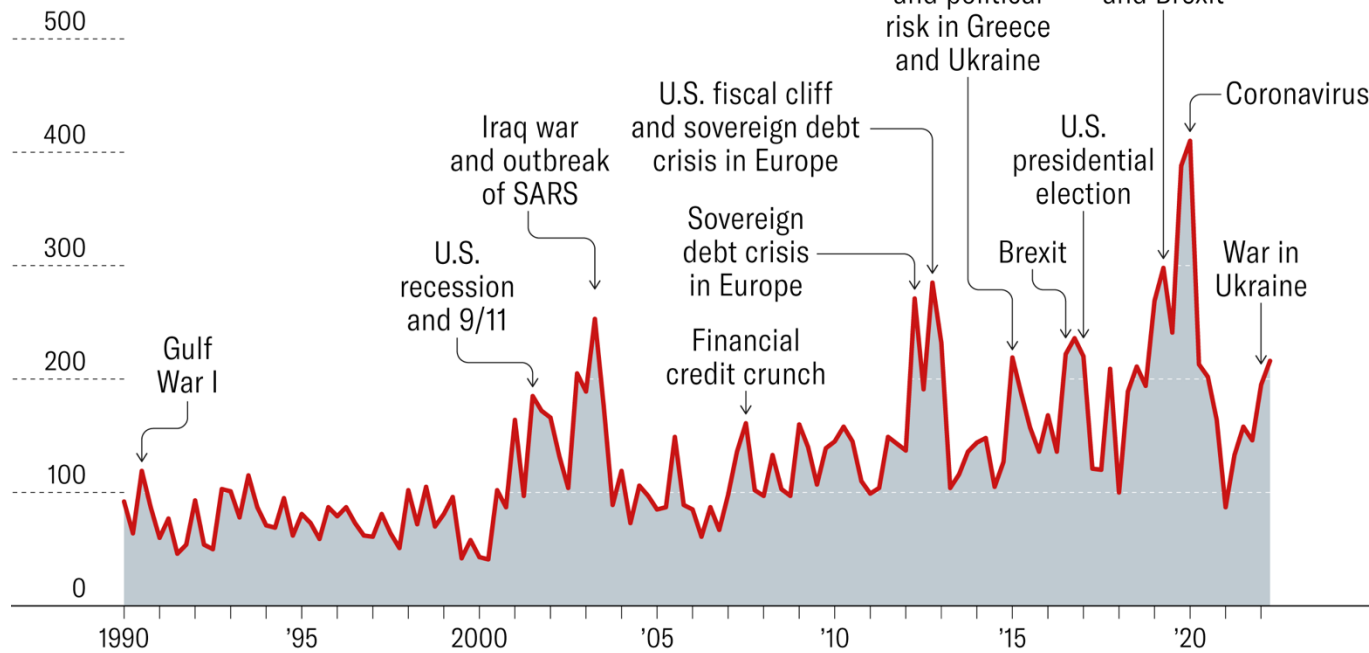
- Trust
- Mis-perceptions of feedback and time lags
- Panic ordering after unmet demand
- Perceived risk of bounded rationality of others

Case 2: Geopolitics (War in Ukraine)

The Rise of Economic Uncertainty – The World Uncertainty Index

World Uncertainty Index

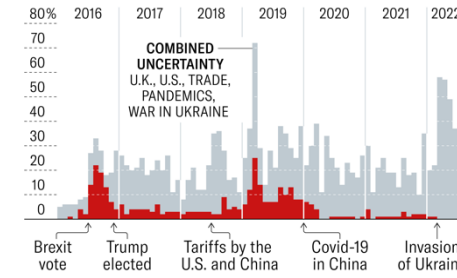
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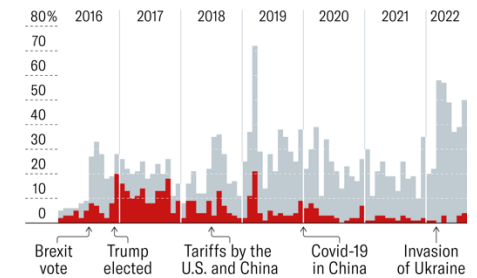
Source: Hites Ahir, Nicholas Bloom, and Davide Furceri, "World Uncertainty Index," Stanford mimeo, 2018



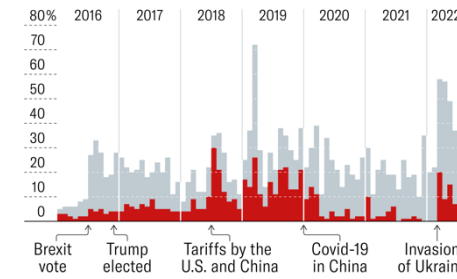
1. The U.K.



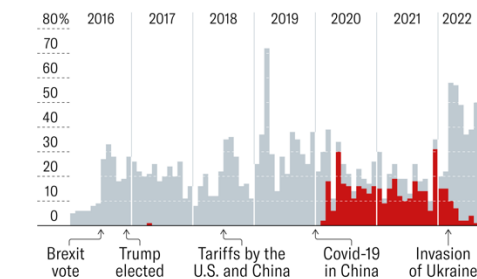
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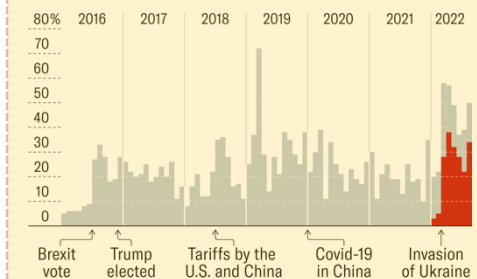
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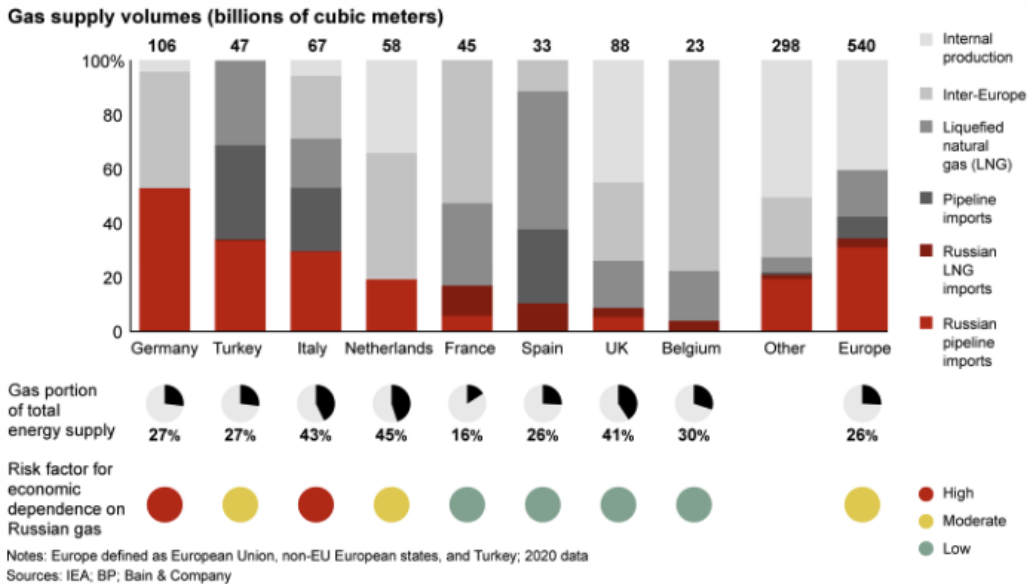
Source: Hites Ahir, Nicholas Bloom, and Davide Furceri, "World Uncertainty Index," Stanford mimeo, 2018



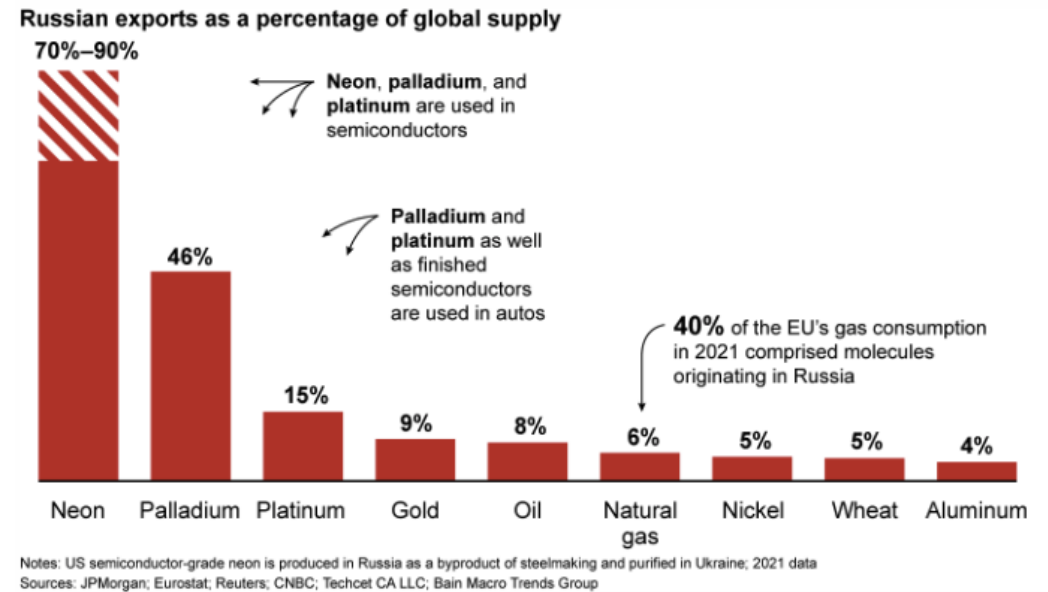
Source: Harvard Business Review, 2022 (<https://hbr.org/2022/09/visualizing-the-rise-of-global-economic-uncertainty>)

How Should Your Supply Chain Respond to the Crisis in Ukraine?

Europe counts on Russia for a third of its natural gas supply, with Germany most dependent

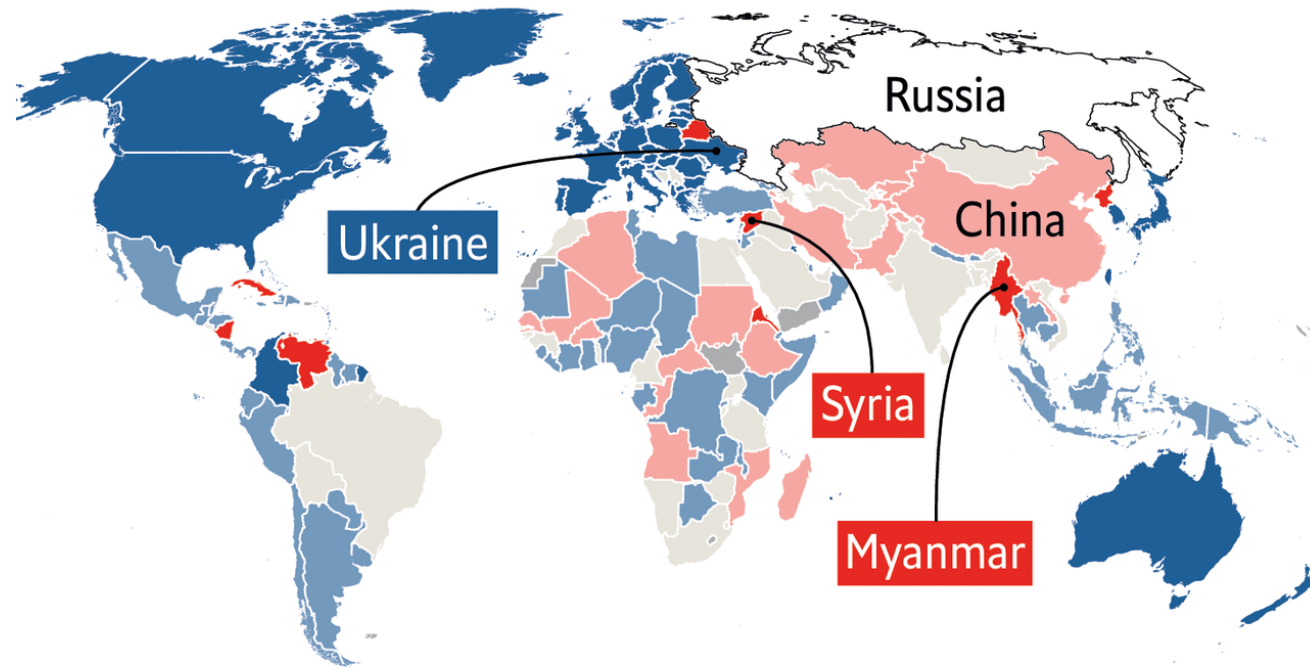


Makers of semiconductors and automobiles have relied on Russia for some commodities



Source: <https://www.bain.com/insights/how-should-your-supply-chain-respond-to-the-crisis-in-ukraine/>

A Divided World – Government Responses to Ukraine War, 2022



Source: EIU

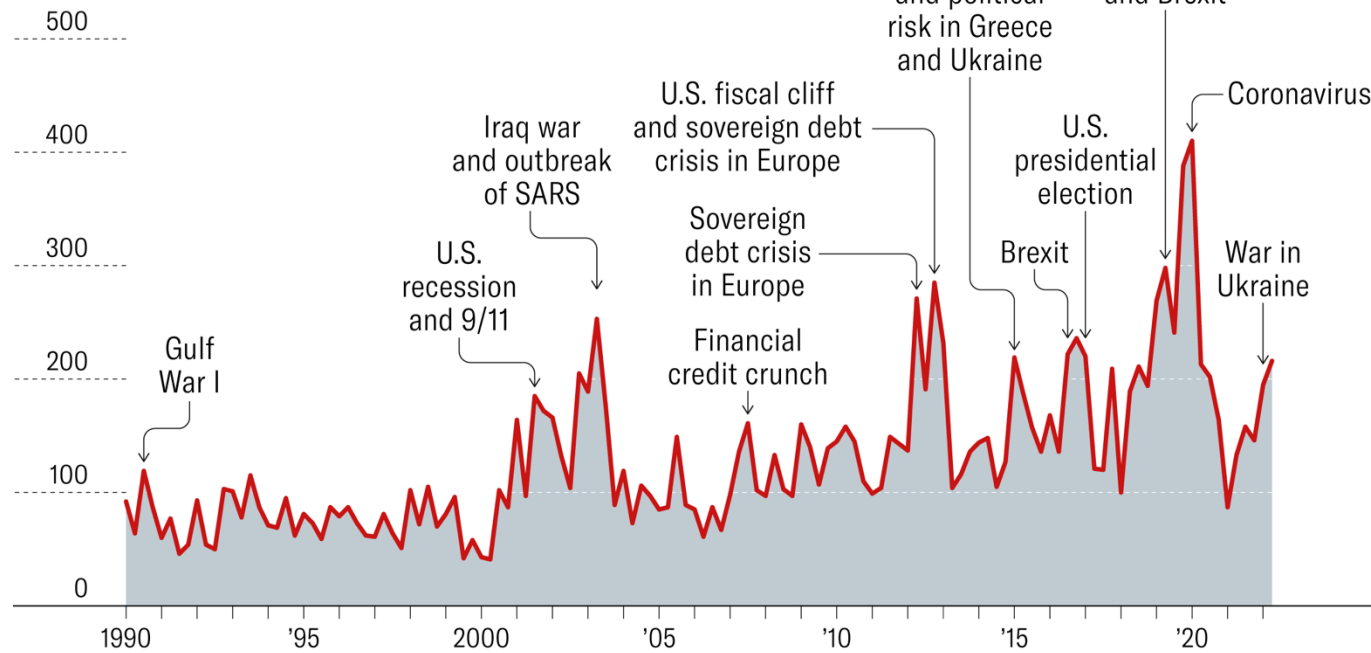
Source: EIU (<https://www.eiu.com/n/>)

Case 3: Geography Concentration Risks

The Rise of Economic Uncertainty – The World Uncertainty Index

World Uncertainty Index

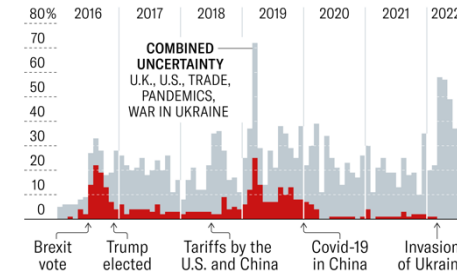
Normalized, 1990-2010 is 100 on average



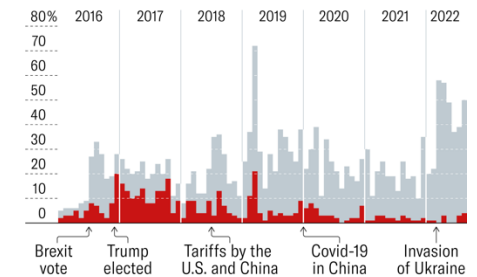
Source: Hites Ahir, Nicholas Bloom, and Davide Furceri, "World Uncertainty Index," Stanford mimeo, 2018



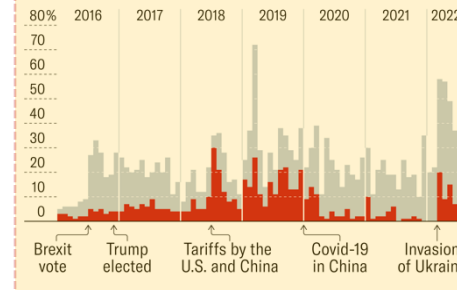
1. The U.K.



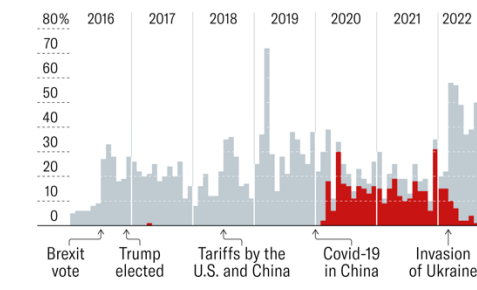
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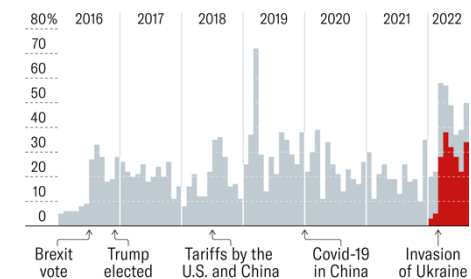
3. Trade



4. Pandemics



5. The war in Ukraine



Source: Hites Ahir, Nicholas Bloom, and Davide Furceri, "World Uncertainty Index," Stanford mimeo, 2018



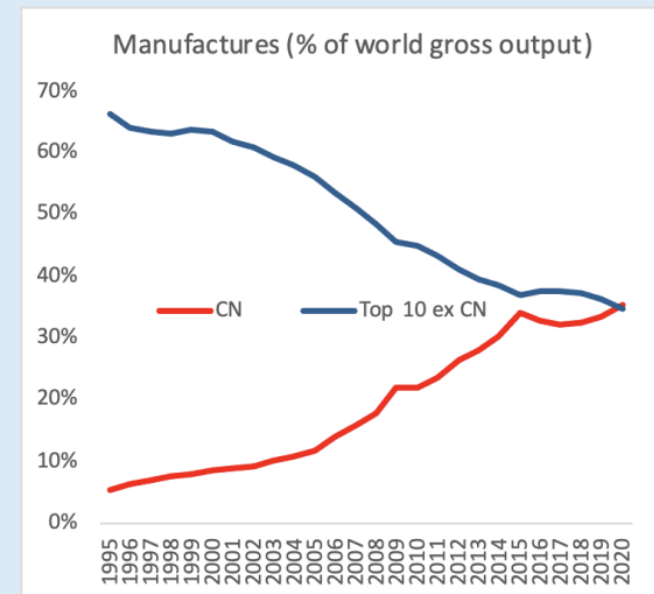
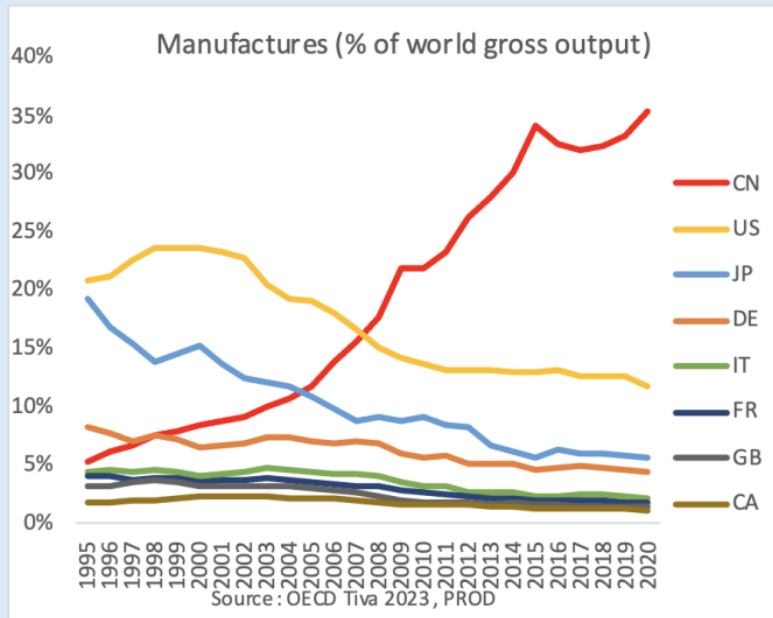
Source: Harvard Business Review, 2022 (<https://hbr.org/2022/09/visualizing-the-rise-of-global-economic-uncertainty>)

The Rise of the Factory of the World – China

World shares of gross production

G7 shares declined sharply (gross production)

China's share rose sharply (gross production)



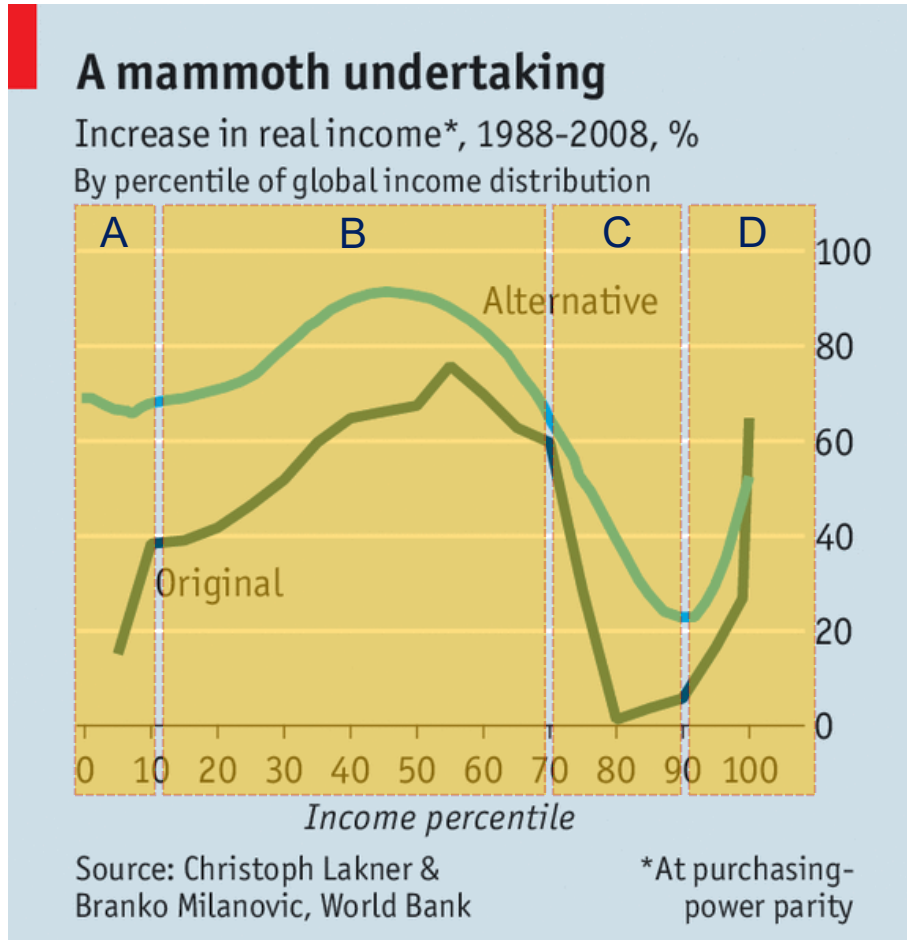
2

Source: Author's elaboration of OECD TIVA database 2023, charts based on PROD for all manufacturing sectors.

IMD

Source: <https://cepr.org/voxeu/columns/china-worlds-sole-manufacturing-superpower-line-sketch-rise>

Global Income Growth – From 1988 to 2008



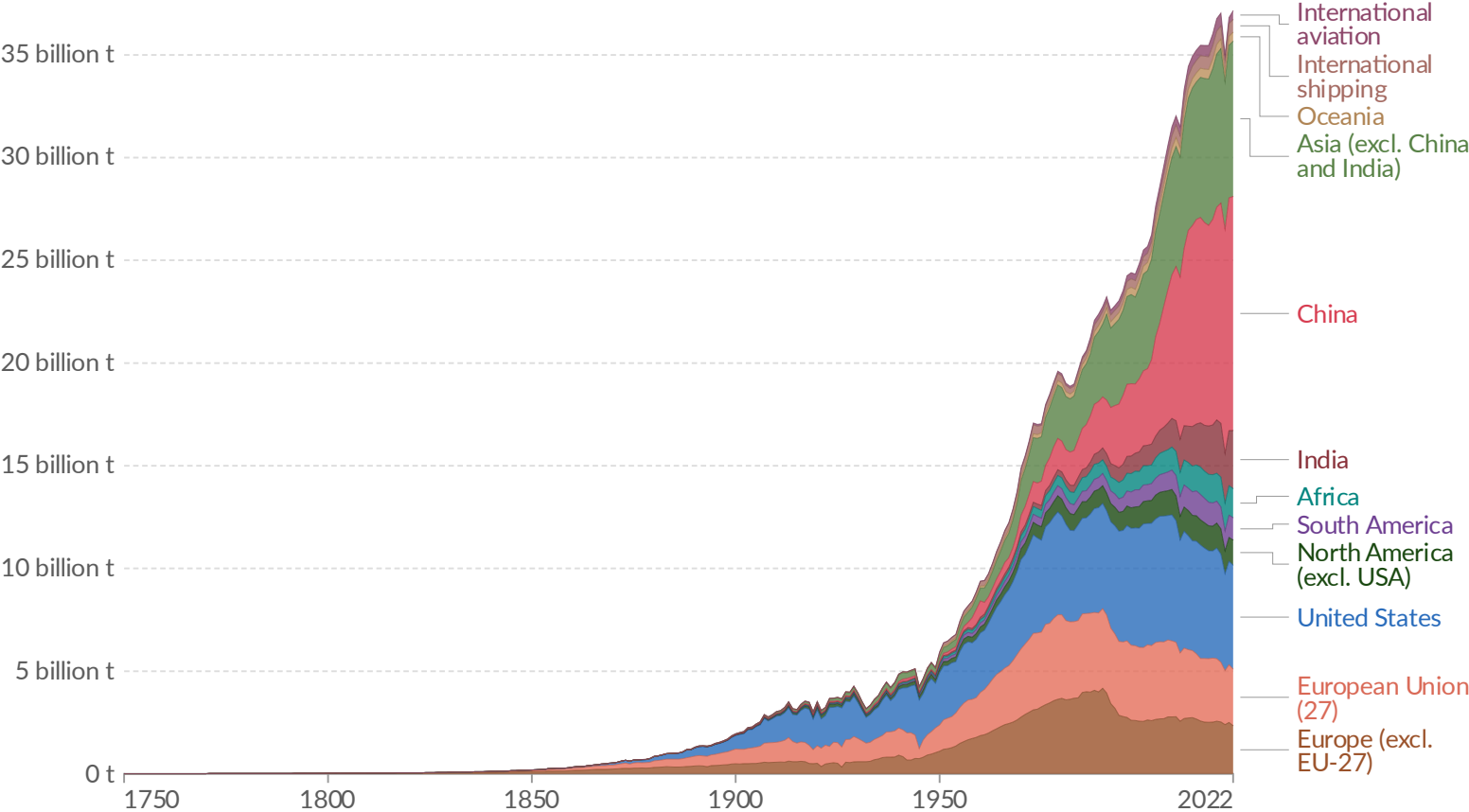
- **A:** Poorest locked out of growth
- **B:** Rising incomes in emerging economies – mainly China
- **C:** Decline of developed-world middle class
- **D:** Booming global elite

Economist.com

Source: *The Economist*, 2016 (<https://www.economist.com/finance-and-economics/2016/09/17/shooting-an-elephant>)

Annual CO₂ emissions by world region

Emissions from fossil fuels and industry¹ are included, but not land-use change emissions. International aviation and shipping are included as separate entities, as they are not included in any country's emissions.



Data source: Global Carbon Budget (2023)

OurWorldinData.org/co2-and-greenhouse-gas-emissions | CC BY

1. Fossil emissions: Fossil emissions measure the quantity of carbon dioxide (CO₂) emitted from the burning of fossil fuels, and directly from industrial processes such as cement and steel production. Fossil CO₂ includes emissions from coal, oil, gas, flaring, cement, steel, and other industrial processes. Fossil emissions do not include land use change, deforestation, soils, or vegetation.

RELATIVE STANDING OF GREAT EMPIRES

- Major Wars
- United States
- China
- United Kingdom
- Netherlands
- Spain
- Germany
- France
- India
- Japan
- Russia
- Ottoman Empire

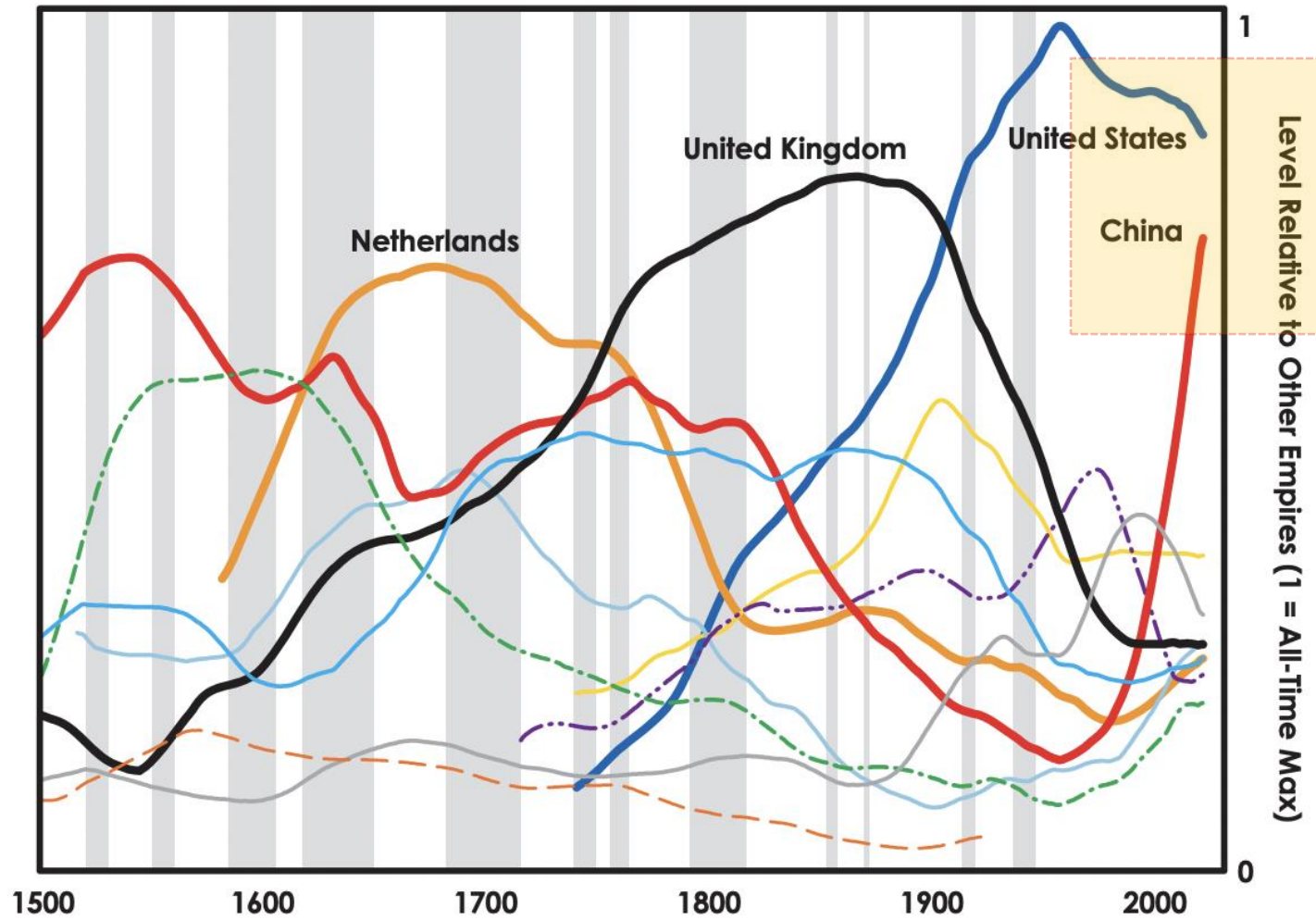
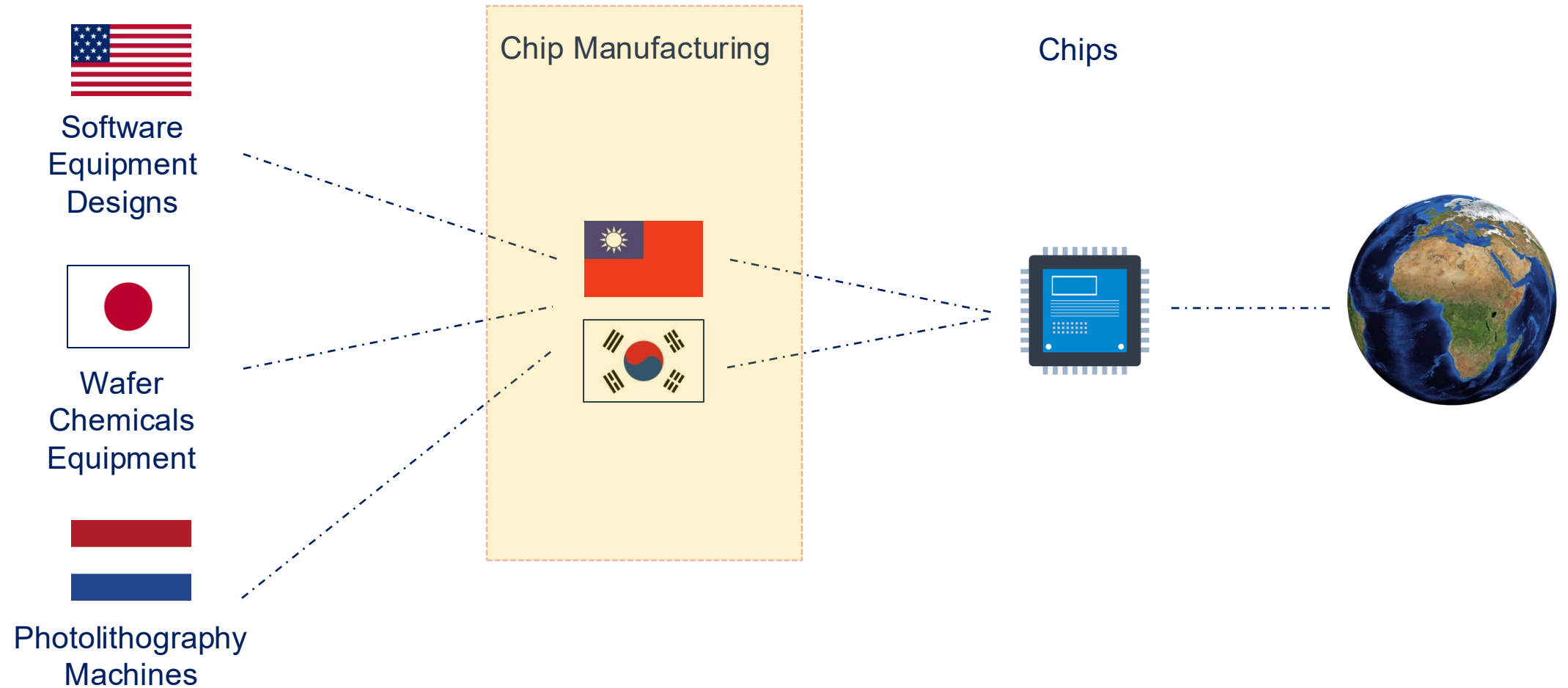
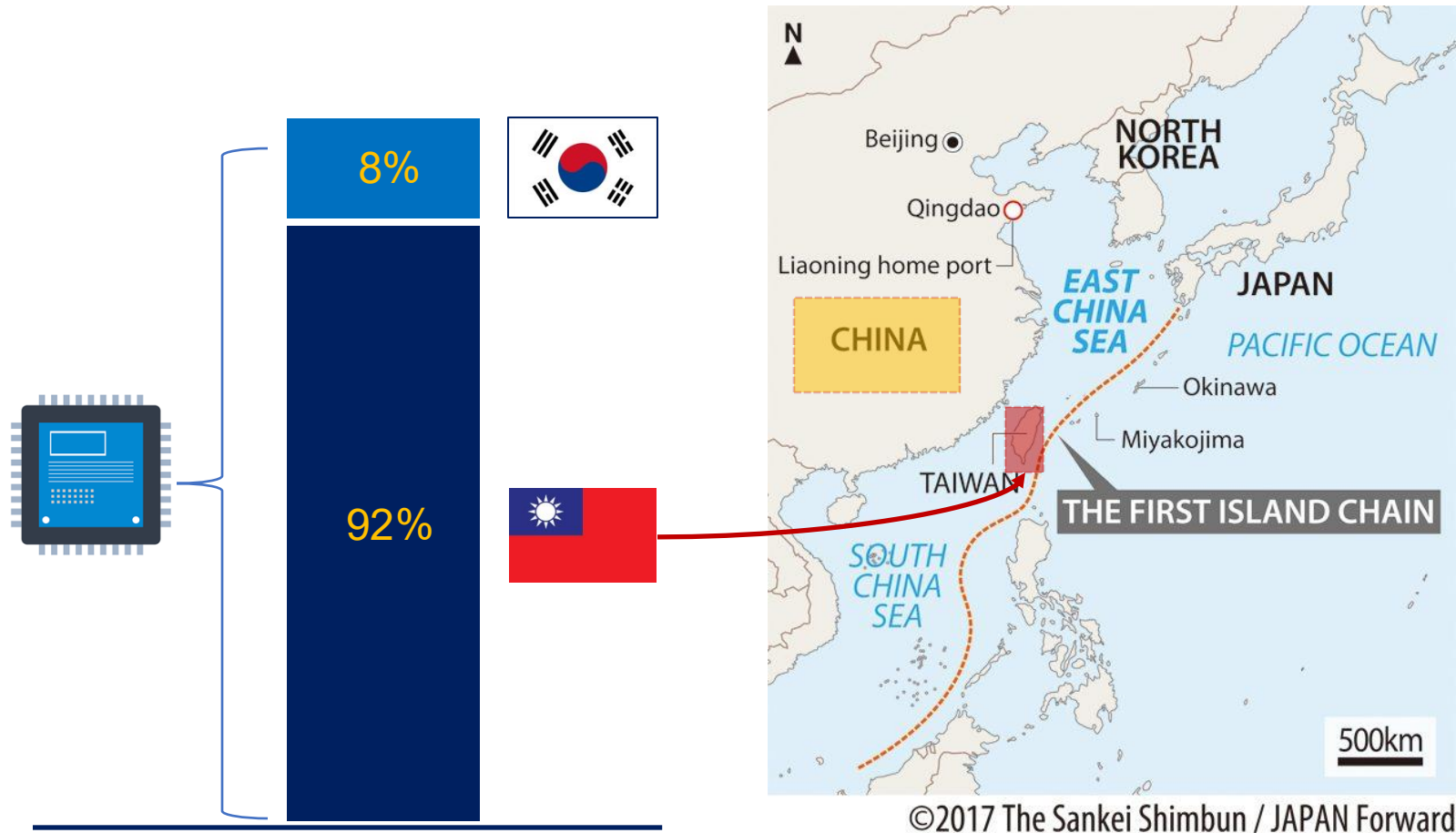


Chart Source: *Changing the world order*, Ray Dalio, 2021

Simplified Chip Supply Chain



Making of Advanced Chips – Less than 10 nm



We are getting into new era of tension, distrust, and multi-sourcing!

Simplified Supply Chain – Disruptions

Demand disruption

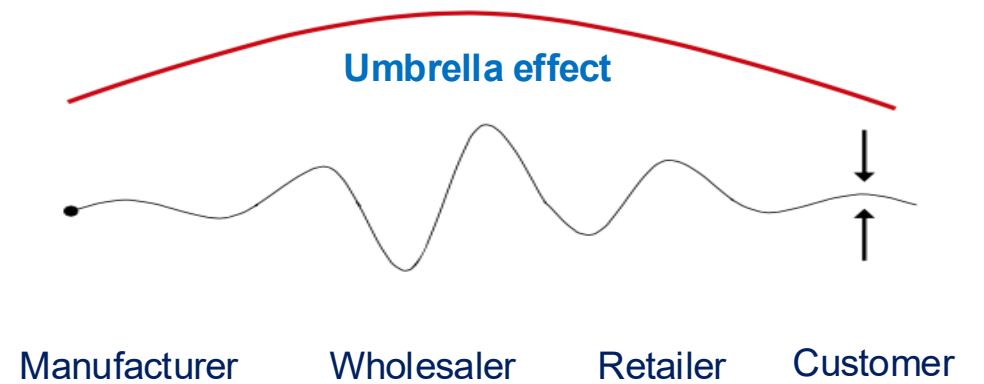
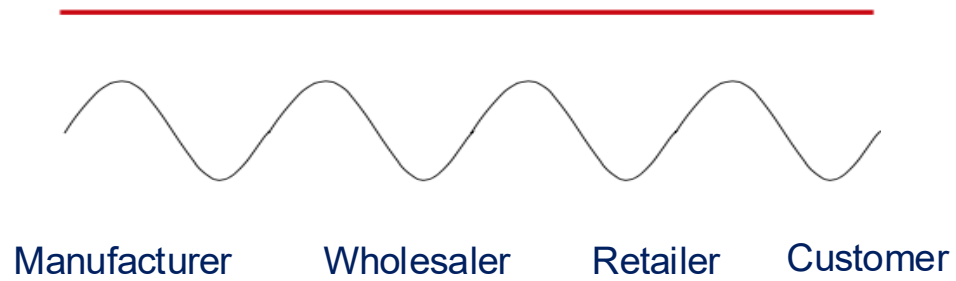
1. Demand processing (forecast error)
2. Leadtime variability
3. Order batching (lot-sizing)
4. Promotions and forward buying (Price variation)
5. Behavioral reasons



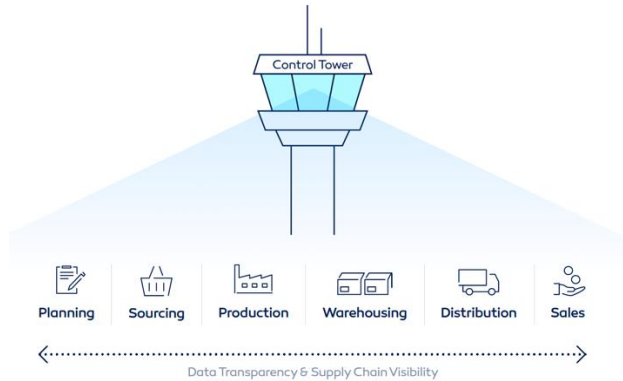
Supply disruption

1. Pandemic
2. Natural disaster
3. Capacity limitation
4. Delivery prioritization
5. Behavioral reasons

Bullwhip Effect – Types



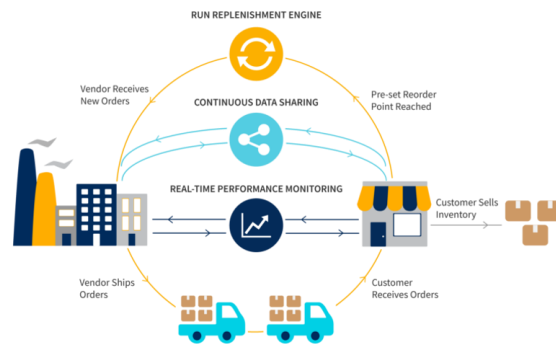
Bullwhip Effect – How to Tame it



Information sharing



Just in Time (JIT)



Vendor Managed Inventory (VMI)



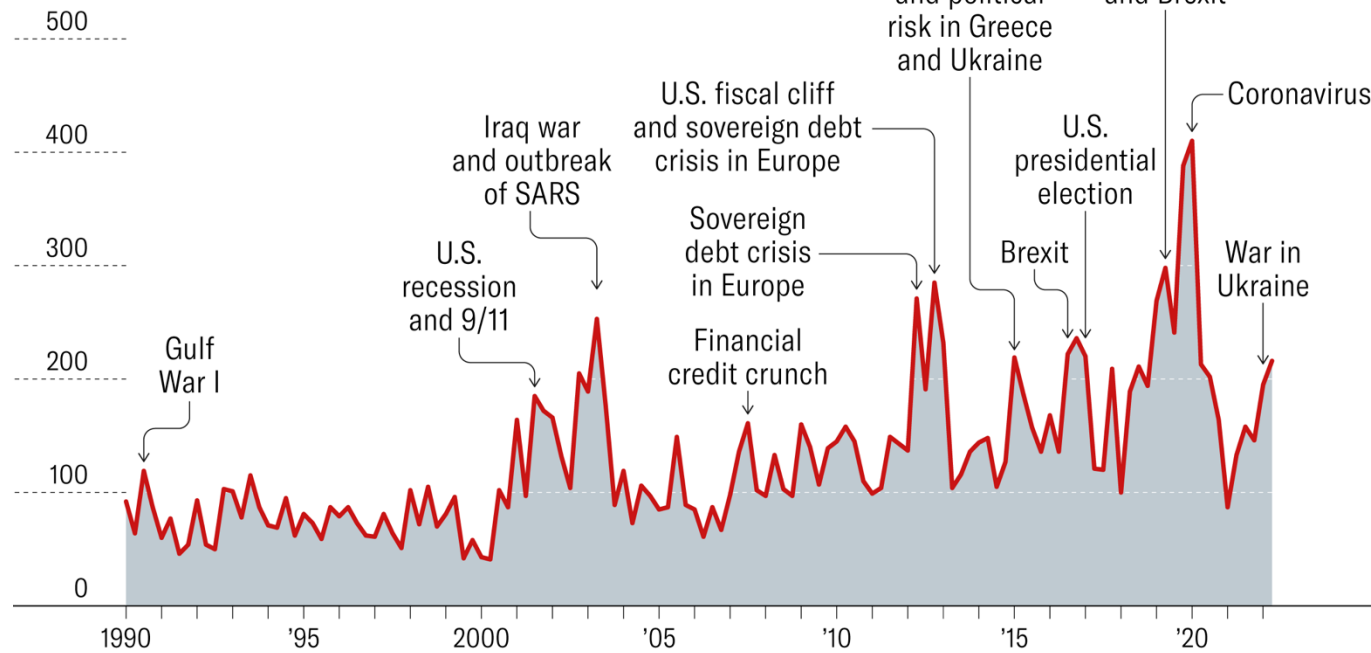
Avoiding price games

Case 4: Tariffs

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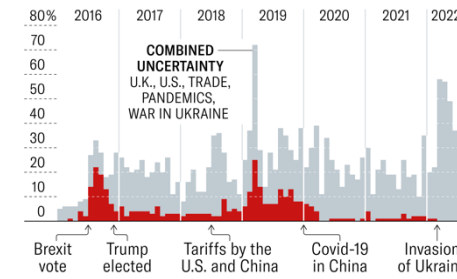
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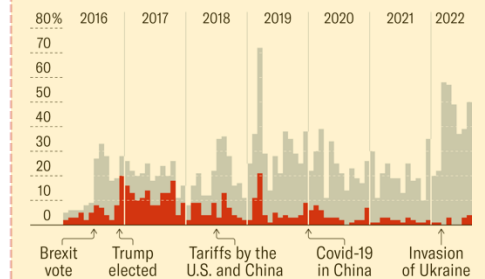
Source: Hites Ahir, Nicholas Bloom, and Davide Furceri, "World Uncertainty Index," Stanford mimeo, 2018



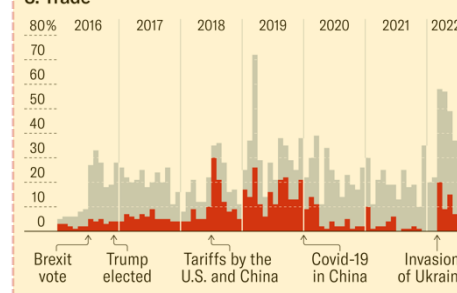
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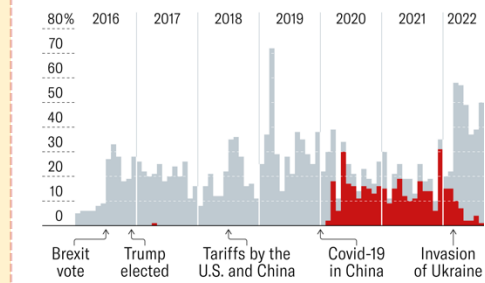
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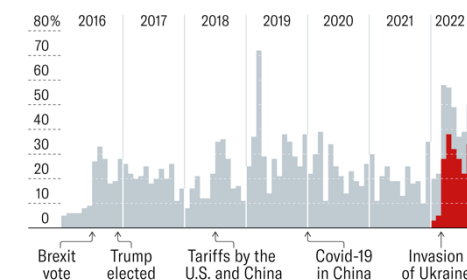
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Source: Hites Ahir, Nicholas Bloom, and Davide Furceri, "World Uncertainty Index," Stanford mimeo, 2018



Source: Harvard Business Review, 2022 (<https://hbr.org/2022/09/visualizing-the-rise-of-global-economic-uncertainty>)



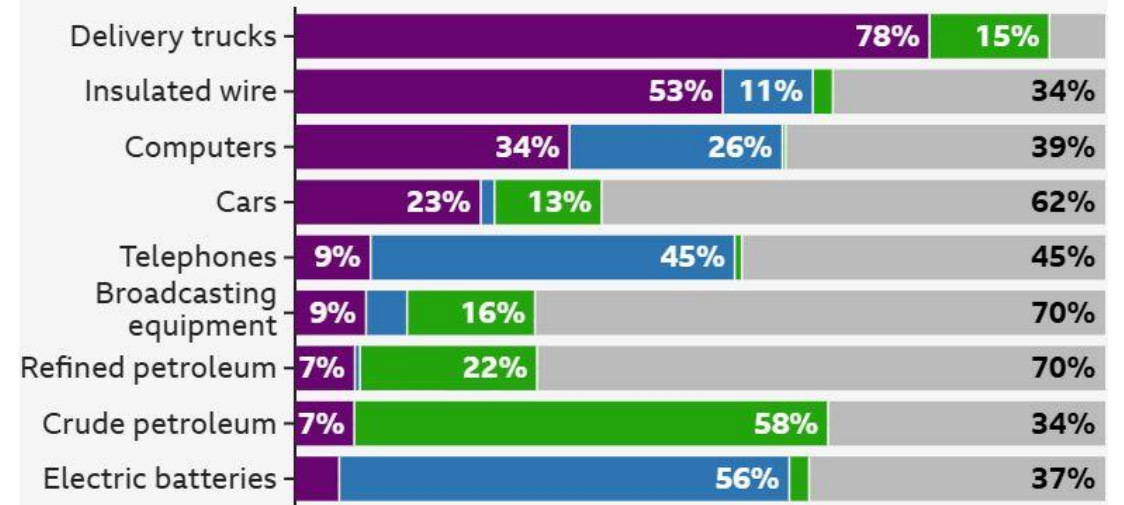
US politics & policy

Trump warns tariffs will cause 'a little disturbance' in defiant speech

Trump's tariffs: Which products will be affected?

Key items imported to the US from Mexico, China and Canada in 2024

■ Mexico ■ China ■ Canada ■ Others



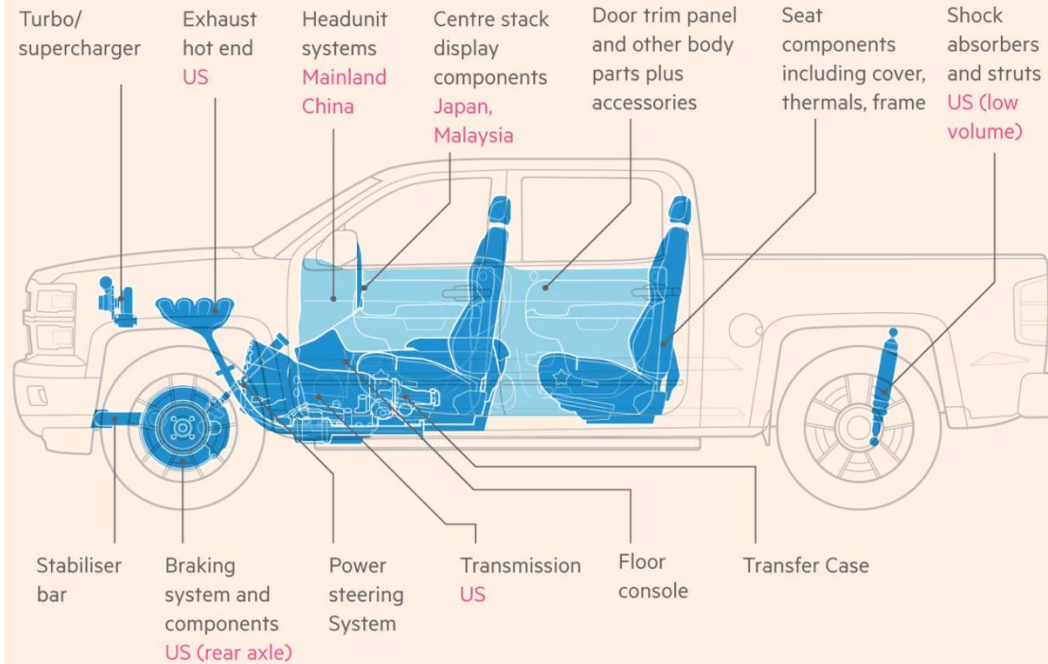
Source: US Census Bureau • BBC calculations based on item's customs value in US\$
2024 data through November



How Donald Trump's Tariffs Threaten an Iconic US Pick-up Truck

Silverado components manufactured in Mexico

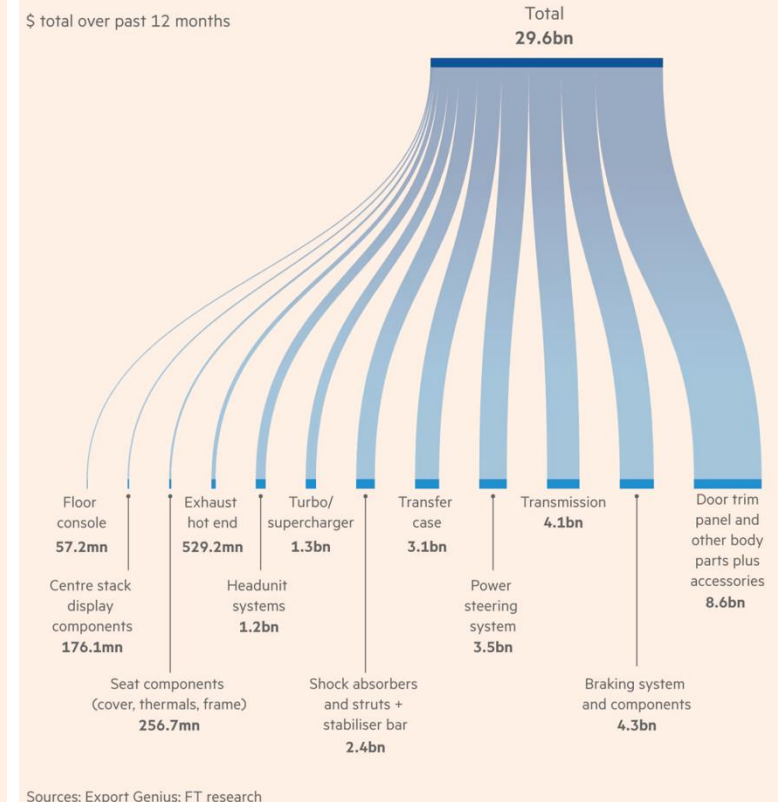
Other countries where those components are manufactured shown in red



Source: S&P Global Mobility Components Sourcing Analysis; FT research © FT

Mexico-to-US exports of car parts used in Silverado production

\$ total over past 12 months



Sources: Export Genius; FT research

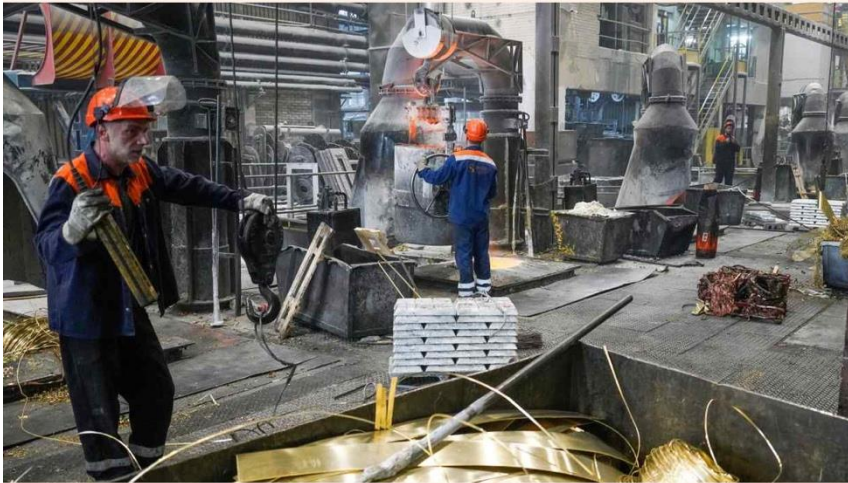


The Chevrolet Silverado remains one of America's most popular pick-up trucks © <https://www.chevrolet.com/trucks/silverado/1500>

Source: <https://www.ft.com/content/fb55f297-7e29-4215-a67f-4217e1a026d6>

Copper smelting industry reels from threat of tariffs and China rivals

Fees charged to transform ore have fallen to all-time lows as Glencore halts operations at Philippines plant



Global copper smelters are struggling to compete with rivals in China, which have rapidly built facilities and control about half of smelting capacity worldwide © Oliver Bunic/Bloomberg

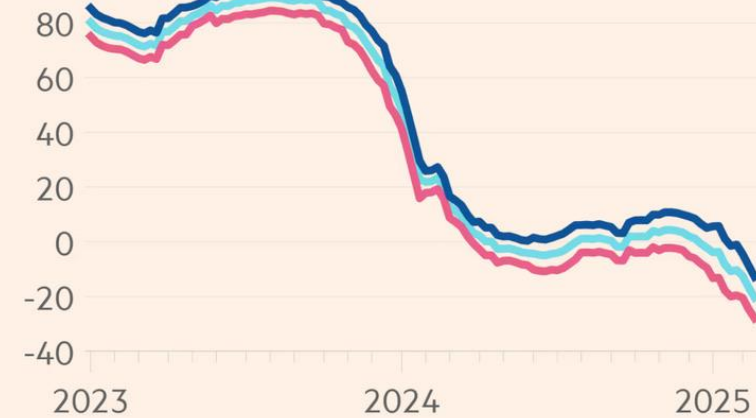
Camilla Hodgson in London 3 HOURS AGO



Copper processing fees have fallen to all-time lows

Spot market price (\$/tonne)

— Smelter price — Trader price
— Combined index price



Copper concentrates treatment charge index. Smelter and trader buying prices and midpoint index

Source: Fastmarkets

Source: <https://www.ft.com/content/a4631d66-0d73-42fc-9e76-dfc6172c97d9>

Production Management (ME-419)

Coaching Rooms

Amin Kaboli

Week 2 – Session 4 – September 20th, 2024

Meet Your Coaches & Group Members

Coaches



Seung
CM1100



Maria
CM1106



Lucie
CM1104

The Art of Giving and Receiving Effective Feedback



Feedback is a gift



Feedback/comments are
always welcome

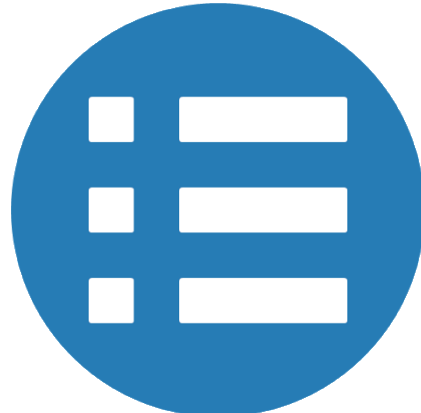
Giving Effective Feedback



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, ...