

# SCM tools for future - proofing

Capstone: Future-proofing supply chains



Aalto University  
School of Business

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# Do you want to “crowdsource brainstorming” on your case?

<https://www.menti.com/almdwuknobm4>

**OR go to menti.com and input  
code:**

**53 92 86 4**



If there is a topic, idea or question related to your case that you want to “crowdsource” for brainstorming, you can put it to the link on the left.



We will return to these questions during today’s and Thursday’s lecture



Note: given the NDAs, only put questions that do not reveal confidential data to crowdsourcing

# **Future-proofing is not all a new bag of tricks!**

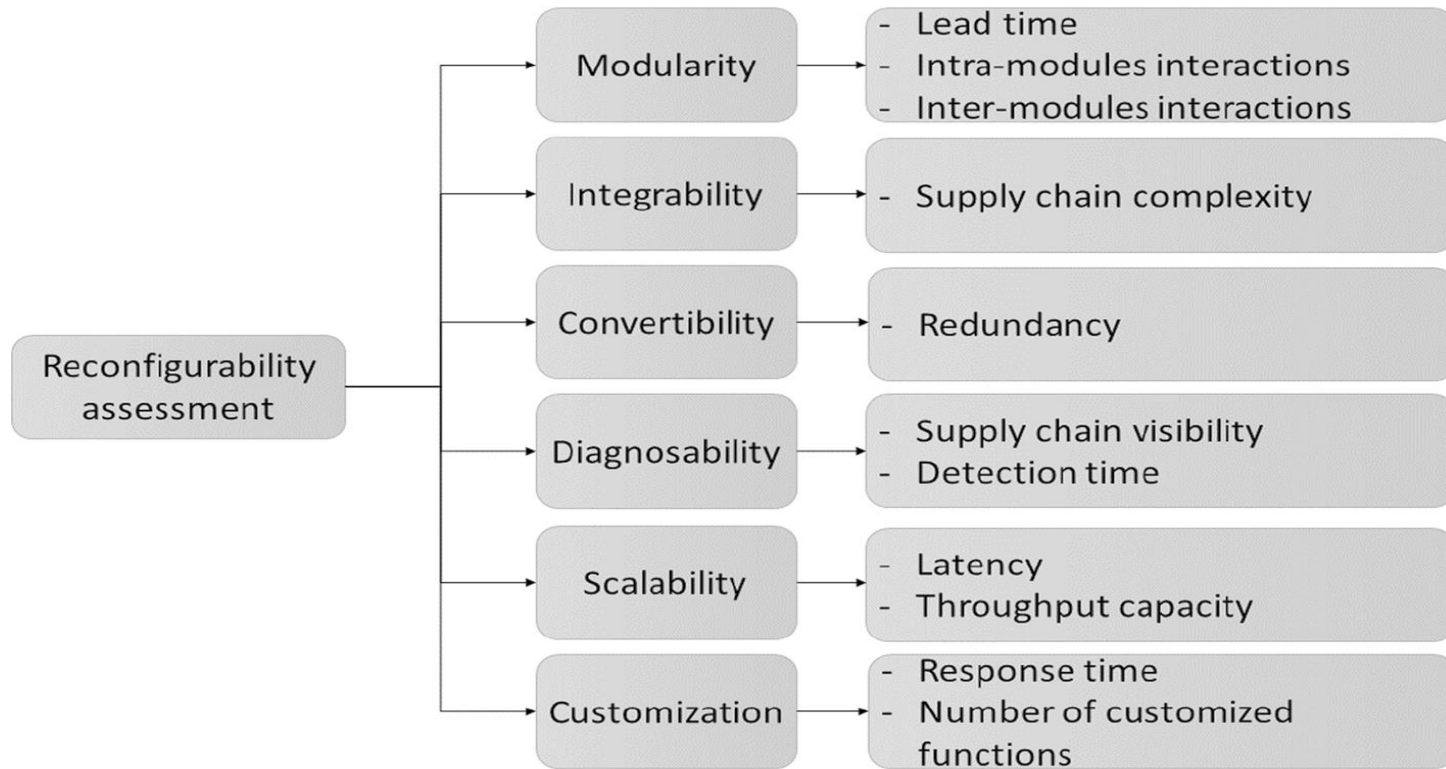
**Supply chains are facing unprecedented uncertainty and a lot of external factors / megatrends will reshape them in the next years**

**Some of the issues will require “outside the box” thinking and novel solutions, BUT**

- Some will just require a more extensive and thorough application of existing tools
- Some will require going back to basics
- Some will not require (or lead to) any changes

**A new problem does not always require (a new) solution!**

# Changes are happening now – and changes will be needed again



**A?**

# Reconfiguration often needed at multiple levels

**Build a supply chain that  
has high reconfigurability  
so it can be changed based  
on changes in supply,  
demand or strategic  
objectives!**



**The chain or network  
level**



**The factory level**



**The workstation level**

# Future-proofing

For climate change



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# Mitigating climate change

**Sustainable supply chain management is the priority action for mitigating climate change!**

**Actions to prioritize include e.g.:**

- Emission reductions – including scope 3
- Energy and material usage reduction
- Reduce, reuse, repair etc.

**Increasing efforts in SSCM are also needed to protect biodiversity**

**While focus should be on mitigating climate change, simultaneously actions will be needed to mitigate for its already present impacts**

# Climate change brings a multitude of risks to supply chains

Realized risks identified based on Financial Times articles

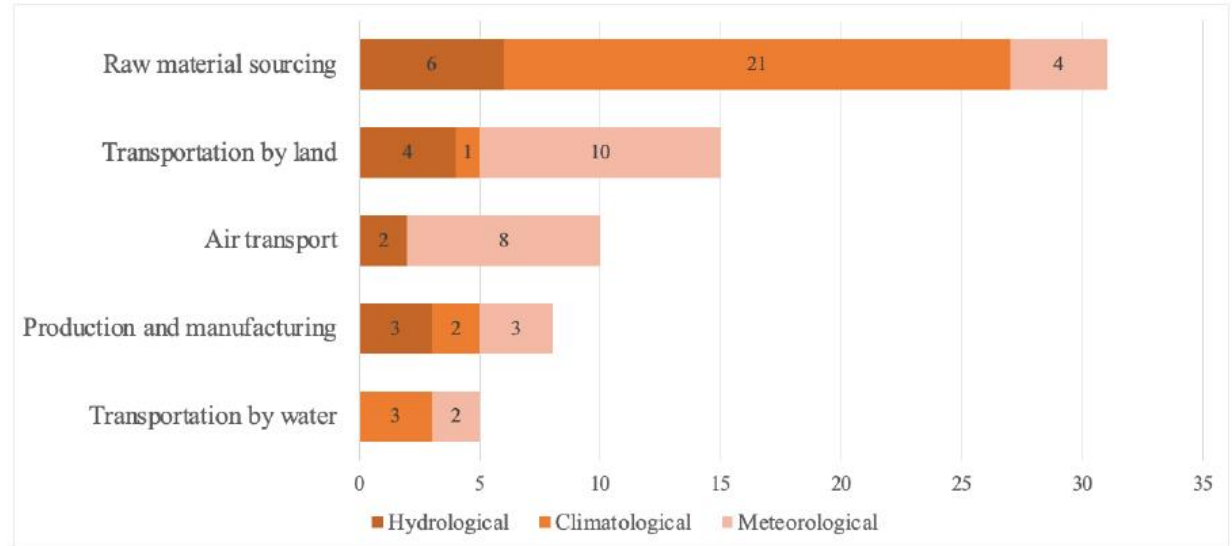


Figure 4. Risk categories in supply chain operations



	<i>Climatological risks</i>			<i>Meteorological risks</i>				<i>Hydrological risks</i>		
	Extreme cold Early/late Frost	Extreme heat	Drought, Water level decrease	Storm	Extreme wind, Hurricane, Typhoon, Cyclone	Rainfall	Snow, Icing, Hail	Sea-level rise, Water level increase	Flood	Permafrost degradation Sea ice melt
<b>Raw Material Sourcing</b>	Quality decrease Pests and Diseases, Livestock deaths Damage to vegetation Change in land use and ecosystems Growth pattern changes Lower yields, Crops destroyed Disruptions Natural Resource Scarcity (Forest) Fires, damages			Quality decrease Deforestation Diseases Disruptions in production Productivity decrease Increased lead times Damage to plants and infrastructure Livestock destroyed				Quality decrease Soil erosion, oxygen deficiency in soil Salt contamination Decreased output Root decomposition Growth pattern changes		
<b>Manufacturing</b>	Halt in productions Decreased machine utilization			Disruptions in processes Damage to factories				Halt in production Output decrease Factory Closures		
<b>Transportation Land</b>	Road and rail network damage Disruptions Increased repair costs Mud- & landslides			Disruptions, Delays Altered fuel consumption Damage to infrastructure and vehicles				Disruptions Infrastructure damage, Corrosion (railways, stations, bridges) Mudslides Road closures, Delays		
<b>Transportation Air</b>				Difficulty in steering Damage to vehicles Cancellations				Relocation of premises through sea-level rise Disruptions		
<b>Transportation Water</b>	Disruptions in operations Reduced fleets Delays Cancellations			Disruptions Damage to vessels				Floods, sea-level rise disrupting ports Disruptions caused by ice & icy floods Halt in traffic		

# Climate-proof your supply chain

Energy efficiency & CO2 emissions a highly connected issue



## Climate change risks

### Physical

- Extreme weather events: storms, floods, hurricanes, cyclones, heatwaves
- Chronic changes in climate: temperature, precipitation and wind speed change, seasonal weather unpredictability

### Transition

- Regulations: material restrictions, carbon tax, fuel and energy tax or restrictions, reporting requirements
- Demand and stakeholders: stakeholder pressure, management attention, consumers' environmental awareness

## Implications to supply chain operations

- Decreased quality and availability of natural resources and raw materials
- Destructed assets, products, and production sites
- Limited use or increased price of certain materials, fuels, and energy sources
- Damaged infrastructure and power stoppages
- Employee efficiency, health, and safety, labor supply
- Disruptions in water availability affecting raw material sourcing and production
- Unreliability, costs, and delays in transportation systems
- Challenges in inventory planning due to uncertain demand and supply, specifically with outerwear due to unseasonal weather
- Costs of investments in reporting, data management, technologies, risk management
- Changes in the quality, price, and demand for finished goods
- Failure to deliver products on time

## Supply chain risk management measures

MSc thesis Pispa, 2022

### Risk identification and categorization

- **Identification**
- General risk maps (e.g., by the World Bank)
- Scenarios
- Cause and effect analysis
- **Categorization**
- Transition (regulation, reputation) and physical (acute, chronic) risks
- Own, upstream, and downstream operations
- Logistics risks as one group, other risks by product line

### Risk assessment

- Likelihood and impact: low, medium, high
- Country-level assessment
- Short-term risks assessed in detail and quantified
- Long-term assessments based on alternative climate scenarios
- TCFD as support for physical, UNFCC for transition risks
- Forecasting models for well-known risks
- Scenario and sensitivity analyses for uncertain risks

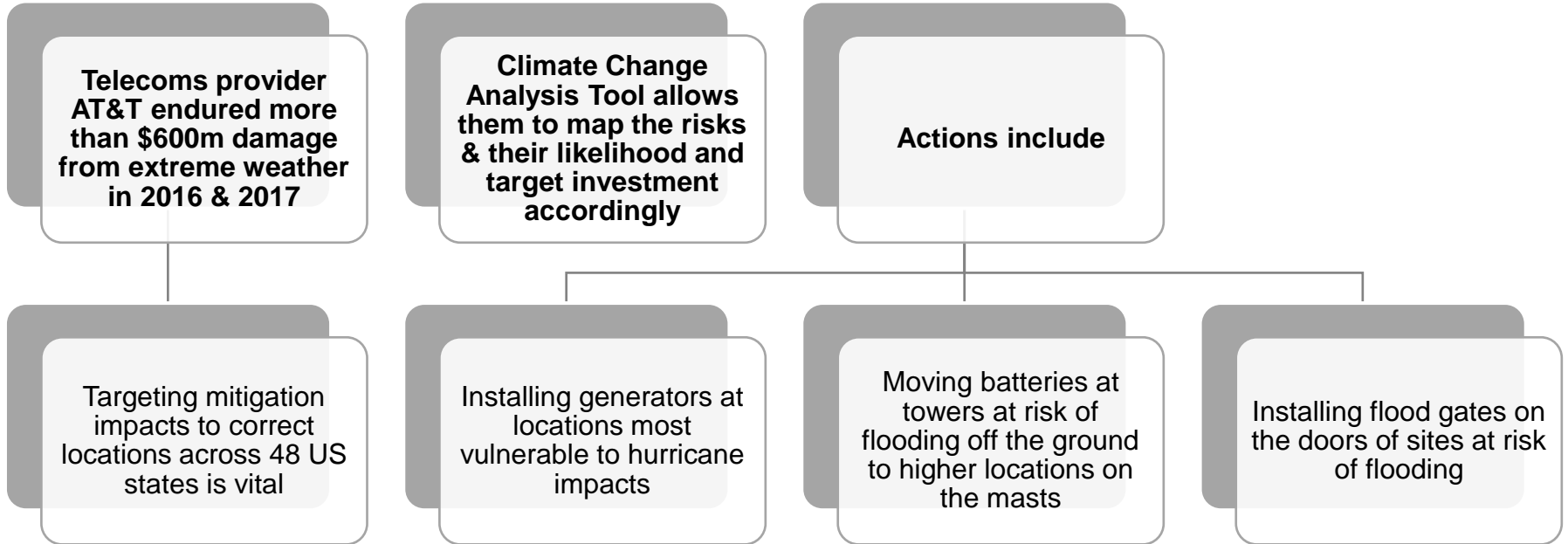
### Risk adaptation

- **General risk adaptation**
- Flexibility (e.g., substitutive products and components, network structure of supply chain)
- Investments in infrastructure, technologies and data management software
- Long-term key supplier relationships
- Continuous supplier evaluation
- Risk awareness, flow of information
- Transparency of operations
- Buffer time for orders and production schedules
- Alternative transportation modes or routes

### Climate change risk-specific

- Backup suppliers, decentralization of supply, supply close to home operations
- Relocation of supply from a high-risk area
- Backup inventory
- Drainage systems and plans for floodwater handling
- Energy efficiency improvements
- Alternative raw materials and energy sources

# CASE STUDY: AT&T and climate data



# Future-proofing

For inflation and  
economic downturns



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# Tackling inflation in a supply chain

- **Share asset use in pre-competitive or noncompetitive situations**
- **Place fewer but larger orders to help a key supplier operate more cost-efficiently.**
- **Join buying consortiums**
- **Acceptance: Aim for low impact, not no impact**
- **Awareness: Be prudent with expenditure by knowing expenditure**
- **Action: Don't negotiate price, negotiate partnerships**

Hong 2022

GEP 2022

# Leading through inflation

- **Data Visibility**
  - Realtime view of requirements, stock, supply options and risks, collaborating with suppliers to balance needs with capacity and price
- **Reuse and Reduce**
  - Those circular solutions again!
- **Prequalify multiple components**
- **Supply chain finance**
  - Helping tier N stay afloat if limited alternatives

# Supply chain finance - examples

Trade credit

Purchase order financing

Buyer investment

Inventory financing



**FIGURE 2**

## **Action areas for supply chain management during periods of economic crisis**

### **Action Area**

### **Key Actions**

- |          |   |  |
|----------|---|--|
| <b>1</b> | <b>Understanding true demand</b>                  | <ul style="list-style-type: none"><li>• Identify reliable information</li><li>• Communicate with customers</li><li>• Develop demand scenarios</li></ul>                              |
| <b>2</b> | <b>Monitoring and safeguarding supply</b>         | <ul style="list-style-type: none"><li>• Identify supplier criticality</li><li>• Monitor supplier health and lead times</li><li>• Ensure the survival of critical suppliers</li></ul> |
| <b>3</b> | <b>Creating flexible, breathing supply chains</b> | <ul style="list-style-type: none"><li>• Understand the effects of demand fluctuations</li><li>• Convert fixed costs into variable costs</li><li>• Define smart contracts</li></ul>   |
| <b>4</b> | <b>Aligning inventories to free up cash</b>       | <ul style="list-style-type: none"><li>• Avoid surplus-inventory intake</li><li>• Align inventory policies</li><li>• Streamline service offerings</li></ul>                           |
| <b>5</b> | <b>Preparing for upswing</b>                      | <ul style="list-style-type: none"><li>• Retain and develop talent</li><li>• Prepare long-term projects</li><li>• Provide upside capacity</li></ul>                                   |

**Hoberg and Alicke, 2020**  
**“5 lessons for supply chains from the financial crisis”**

# Tendering

Supplier market intelligence  
RFI/RFP process  
Reverse auctions  
Expressive bidding

**Back to basics?  
Cost-savings  
with the Kraljic  
matrix,  
Leverage-  
category  
approach**

# Globalization

Global sourcing  
Make or buy  
LCC sourcing  
Bestshoring

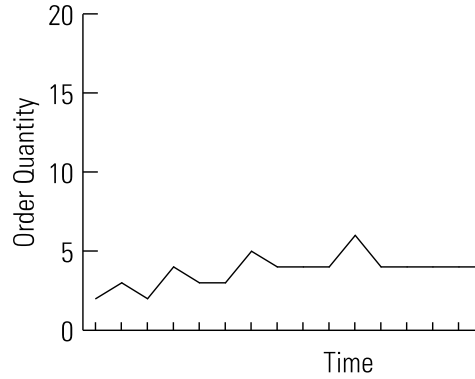
# Supplier pricing review

Price benchmark  
Total cost of ownership  
Unbundled prices  
Leverage market imbalances

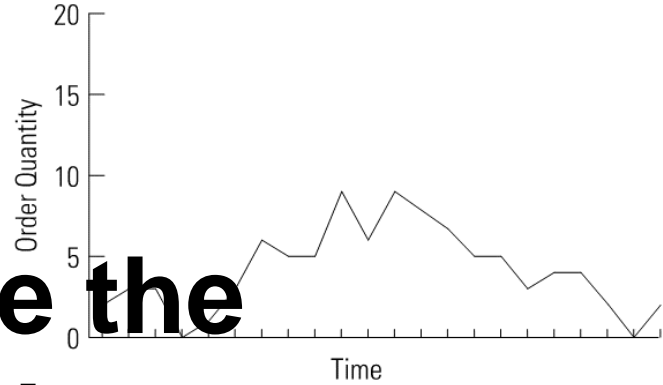
# Target pricing

Cost regression analysis  
Factor cost analysis  
Cost based price modelling  
Linear performance pricing

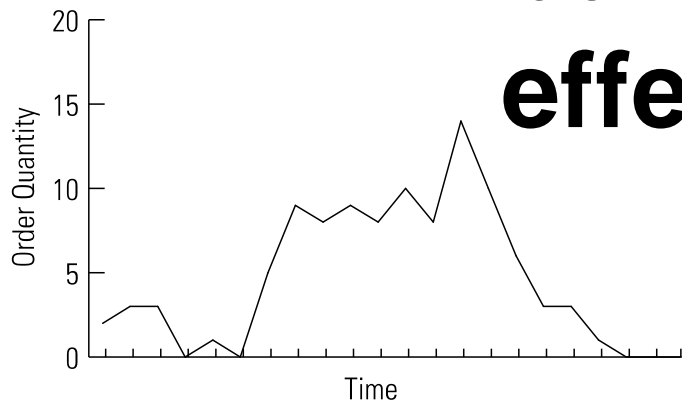
Consumer Sales



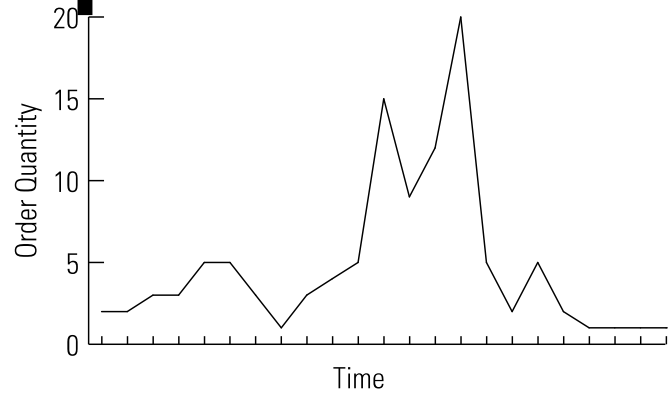
Retailer's Orders to Manufacturer



Wholesaler's Orders to Manufacturer



Manufacturer's Orders to Supplier

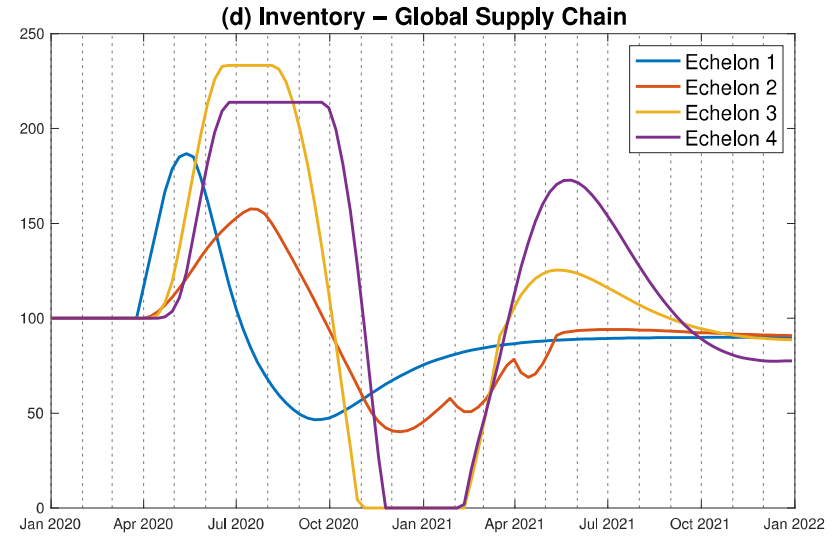
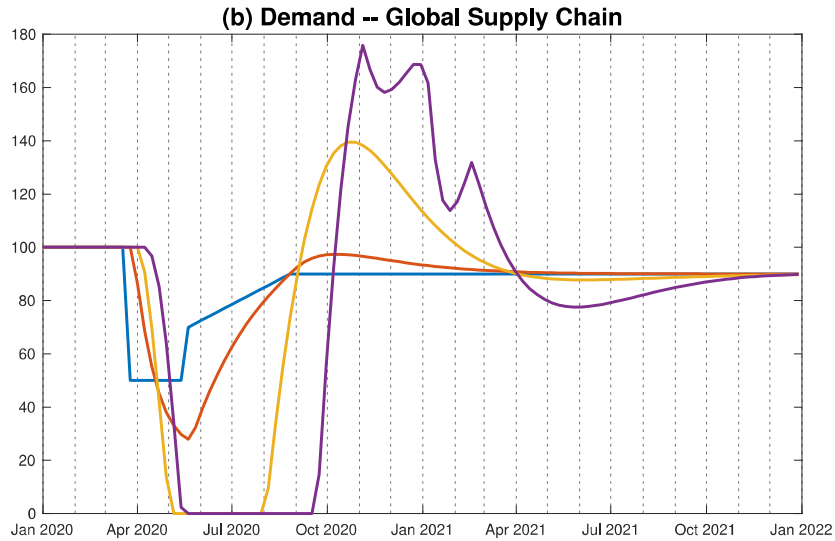


**Beware the  
bullwhip  
effect**

# Bullwhip effect in 2008 as a result of the financial crisis: case chemical industry

**Lehman Wave shakes the Chemical industry**  
**ROBERT PEELS\***,  
**MAXIMILIANO UDENIO**,  
**JAN C. FRANSOO**,  
**SJAAK GRIFFIOEN**

Level in supply chain		Percentage of sales decline
Upstream	Resin production	30%
	Paint production	20%
	Parts production	15%
	OEM	8%
Downstream	Retailer	Fairly stable



**Forecasted model of covid impacts on demand and inventory across a global supply chain**

# Future-proofing

Raw material  
availability and price  
volatility



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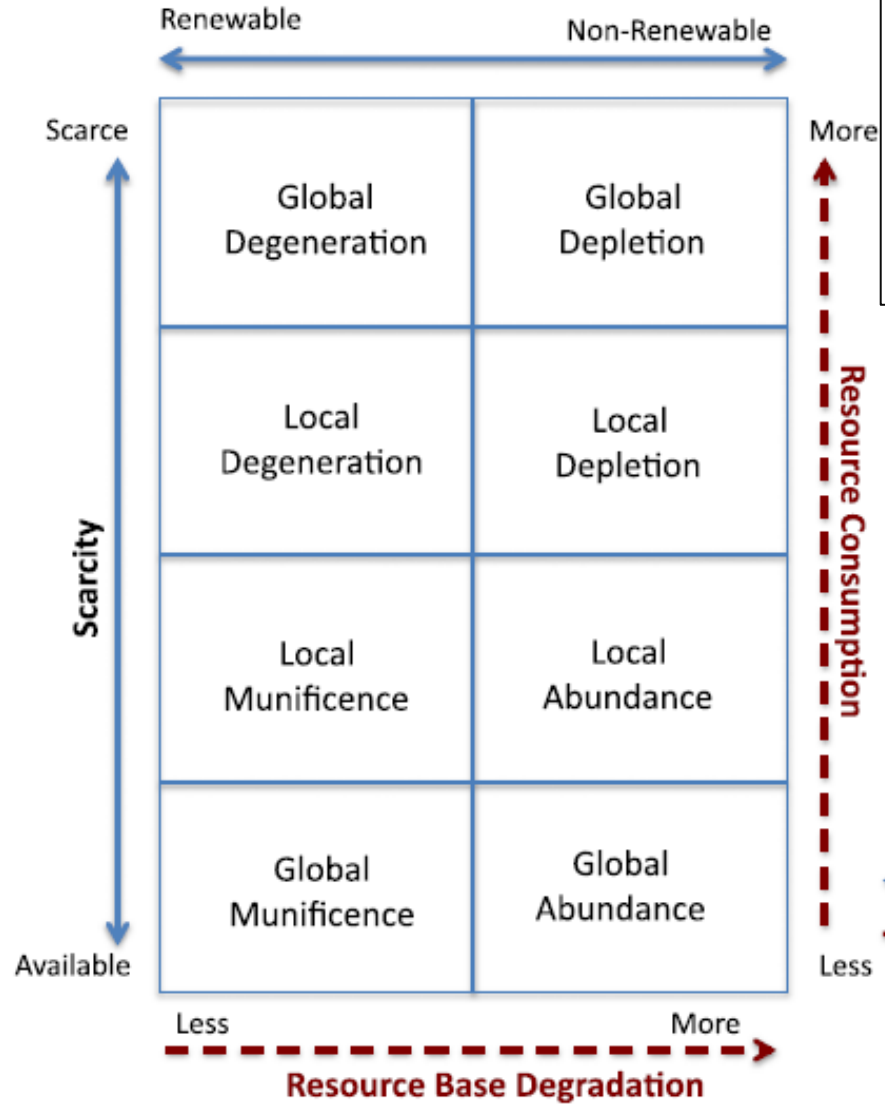


# Managing price volatility risk

1. Do nothing
2. Do not accept price increases from suppliers
3. Control commodity costs through hedging
4. Pass through commodity price increases (and decreases) to customers
5. Combine hedging and pass-through prices when customers want to lock in costs
6. Offset the adverse impact of commodity prices through cost reductions
7. Charge customers "insurance" (a higher price with bigger margins) to account for their cost risk
8. Substitute for alternative materials

Critical issues report, Managing Commodity Pricing and Availability Volatility, Caps 2012

### Renewability



While the EU works to detangle itself from economic dependence on Russia, exponential increase in demand for raw materials is creating supply risks due to high dependency on China, industry and experts have warned.

The demand for critical raw materials is about to skyrocket until 2050 – by around 500%, according to [projections](#) from the World Bank. This development is, for the most part, driven by the Green transition: electrical cars, for instance, require over six times as many minerals as conventional vehicles, the international energy agency said in a [report](#).

As around 19 of the 30 raw materials that the European Commission has labelled ‘critical’ are primarily produced in China, there is a high risk that these dependencies could lead to supply

RETAILERS // MARCH 21, 2022 • 7 MIN READ

### The shortage of paper, glass and raw materials has upended manufacturing

You can’t make certain chips, motors, batteries, or a host of other key technologies without certain materials. Deloitte predicts that multiple regions will run short of gallium and possibly germanium as soon as 2024, impacting chipmakers. By 2025, we may start seeing shortages of rare earth elements (REEs) for magnets in electric car motors and more, as well as lithium and cobalt for batteries.<sup>1</sup> Actions can be taken, however, that can help avoid shortages in the near, medium, and long term.



# Resource employment and conservation approaches

- **Resource employment approaches:**
  - Avoidance
  - Logistics techniques
  - Allocation approaches
  - Sustainment approaches
- **Conservation approaches:**
  - Resource recovery (=circular economy)
  - Resource base protection initiatives (=sustainable supply chain management)

# Overall mitigation approaches

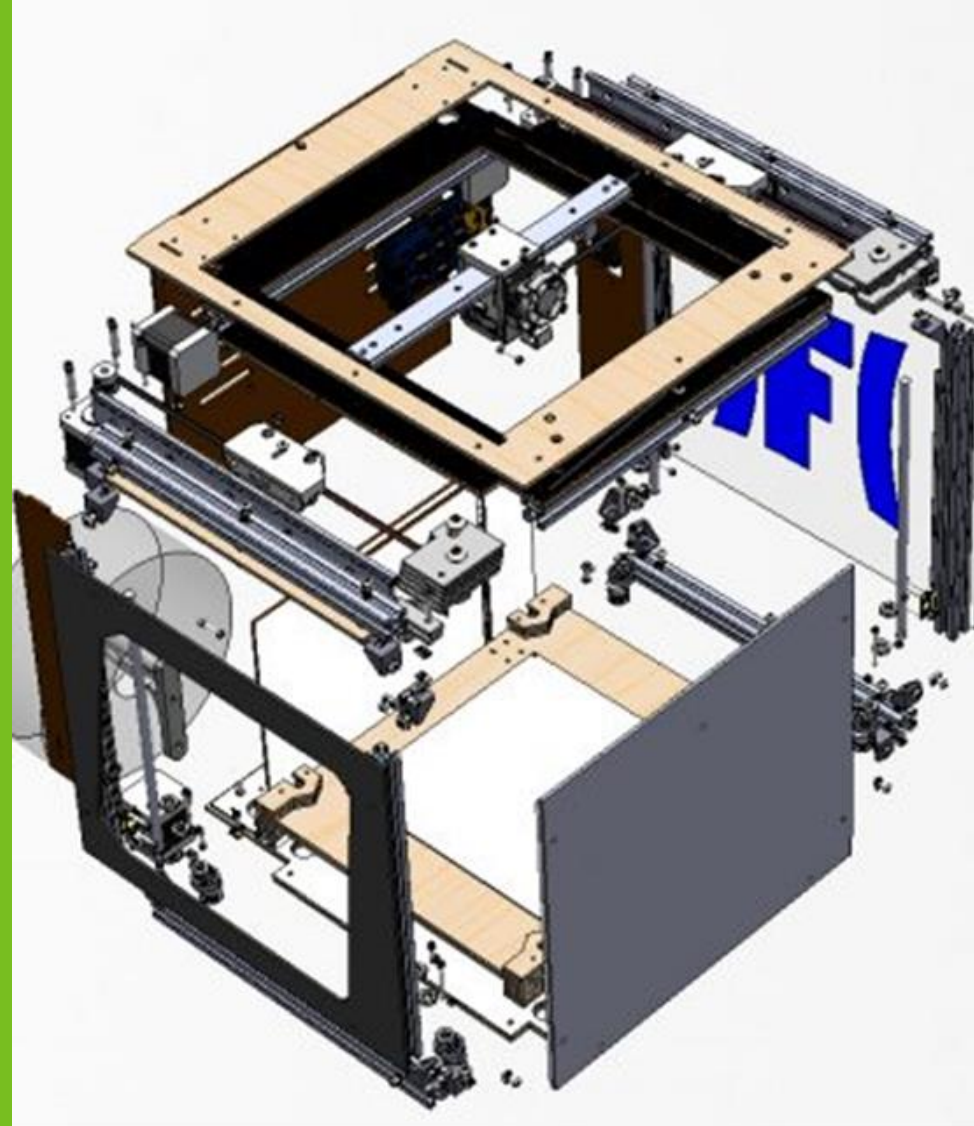
- **Fortification strategy:** short-term avoidance, long-term supporting of renewal
- **Mobilization strategy:** combine logistics approach with resource base protection
- **Discretion strategy:** combine avoidance and recovery
- **Compilation strategy:** combine logistics approach with recovery
- **Cultivation strategy:** combine resource base protection and allocation approaches
- **Perpetuation strategy:** combine sustainment and protection approaches

# Future-proofing

Through  
postponement or  
speculation



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# Postponement decisions

## Time postponement

- Delaying forward shipment of goods
- Delaying manufacturing/differentiating tasks

## Form postponement

- Upstream
- Downstream

## Place postponement

- Delaying forward shipment of goods with a focus on keeping inventory in central location until customer order

# The P/S Matrix and Generic Supply Chain P/S Strategies

**Logistics**

**Manufacturing**

		<b>Speculation</b> Decentralized inventories	<b>Postponement</b> Centralized inventories and direct distribution
<b>Speculation</b> Make to inventory	<b>The full speculation strategy</b>	<b>The logistics postponement strategy</b>	
<b>Postponement</b> Make to order	<b>The manufacturing postponement strategy</b>	<b>The full postponement strategy</b>	

# Postponement Strategies Results and Conclusions

**Postponement can be considered as efficient strategy for managing product variety**

- Improves service & reduces variability of service delivery
- Reduces costs

**Value of postponement increases when**

- ...forecast uncertainty increases
- ...product proliferation increases

**Postponement is most efficient when demand between product derivatives is roughly equal**

- Multi-channel environment

# **Old strategy – new name? Micro supply chains**

**Micro supply chains move production and distribution from global manufacturing hubs to closer to the end customer**

**Combining mass production with modular technology to enable late form postponement**

**Working within borders means less vulnerability to exchange rates and tariffs**

**Ability to manufacture in smaller batches will reduce inventory costs and waste**

# **Micro-fulfillment – not postponement but speculation**

**Micro-fulfillment: placing small-scale warehouse facilities in accessible urban locations close to consumer**

**AI and analytics (so not really speculation!) with automation are used to deliver goods rapidly**

**Requires detailed thinking through of:**

- Locations for the micro-warehouses
- Delivery times offered
- Product selection
- In-house vs outsource?



# **Design for adaptability is the new “design for x”?**

**Both too little and too much modularity are problematic**

**Components exhibiting fast rates of technological change should not reside in the same module with components that evolve slowly**

**Products containing components with heterogeneous rates of technological change should have greater modularity than products composed of components with homogenous rates of technological change**

# Future-proofing... Service operations



# How do the big risks and trends impact service operations?

Robotics and automation?

Labor shortages?

Artificial intelligence and chatbots?

Drones and autonomous vehicles?

Sustainable operations and supporting circularity?

Climate change?

Geopolitics?

## Postal incumbents face 4 universal truths today

**E-commerce consumer:** shoppers are demanding, especially regarding price

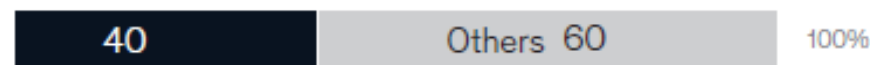
**70%**

of consumers prefer the cheapest delivery form, which is usually free  
TNS, Pitney Bowes shopper studies

**Competition:** the growing products face fierce competition

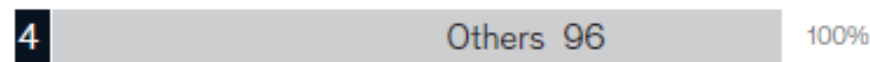
Incumbents' parcel market share<sup>1</sup>

McKinsey estimate based on EU countries' regulatory publications



Incumbents' share of ad spending

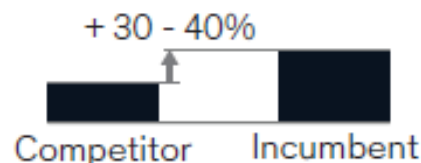
McKinsey estimate based on IPC Global Postal Industry Report 2018



**Costs:** legacy costs are a high burden for incumbents

Unit costs for parcels – urban areas

McKinsey estimate based on operators' investors presentations and press articles



**Capabilities:** incumbents are not digital natives

Forbes top 100 digital companies 2018

Forbes

- 1 Amazon
- 42 Alibaba
- 46 JD.com
- 74 Zalando

**No postal incumbents listed**

# Xiao & Kumar 2021

**Table 1.** Applications of Robotics in Marketing Practice.

Marketing Mix	Marketing Functions	Categories	Examples
Product and service	Product	Product	Kuri
		Product	Google Home
		Product	Amazon's Echo
		Product	iRobot Roomba
		Product	Aibo robotic dog
	Supporting services	Service and product <sup>a</sup>	ElliQ elder care assistant robot
		Service and product	Moley Robotics' Robo Chef
		Service	National Public Radio's sportswriter robot
		Service	Aethon's autonomous medical robot TUG
		Service	Walmart's autonomous shopping cart Dash
		Service	Aloft's robotic butler Botlr
		Service	Windstream's Wendy chatbot
	Public service	Service	Volvo's Robot-based Autonomous Refuse collector (ROAR)
	Service	Knightscope's security robot K5	
Price	Risk assessment	Service	Lending Robot
	Bidding	Service	Ebay's auction sniper
Place	Logistics and transportation	Service	Amazon's warehouse robots
		Service and product	Tesla's driverless semitruck
Promotion	Sales force	Service	Nescafé's sales assistant Pepper
	Advertising	Service	Nike's Chalkbot
	Sales promotion	Service	Deal finder shopbot Honey

<sup>a</sup>This robot is usually used for commercial service, but can also be used as personal product.

# Operations in the sharing economy

- **Peer-to-peer resource sharing**
  - There are many buyers and sellers
  - The supply side is not distinct from the demand side
  - Supply stimulates demand, and vice versa
  - A resource unit can sustain the consumption needs from more than one consumer
- **On-demand service platforms**
  - Capacity affects demand, and vice versa
  - Capacity can be controlled only indirectly via wages and prices
  - Capacity and demand vary temporally and spatially

# Operations in the sharing economy

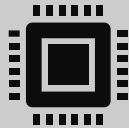
**Benjafaar & Hu  
2024**



**Inventory theory: from  
controlled to  
uncontrolled supply**



**Revenue Management:  
From Exogenous to  
Endogenous Capacity**



**Queuing Systems:  
From Fixed to Random  
Number of Servers**