

AIR CARGO CONFERENCE

Resilience of logistic networks – challenges and tools

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TOPICS

- Need for global supply chains
- The idea of resilience
- Business Continuity
- Key factors & indicators for resilient supply chains
- Services and products of Fraunhofer for improving resilience

RISKS AND THREATS TO SUPPLY CHAINS

Natural Risks

- e.g., earthquakes, floods, cyclones or volcano eruption.
- Examples: Japan earthquake 2011; Eruption of the Iceland volcano 2010.



Infrastructure Risks

- e.g., quality of road and rail infrastructure, airports and seaports.
- Examples: low quality of infrastructure across Africa.

Political Risks

- e.g., political stability, corruption, regulations and trade promotion.
- Examples: conflict in Eastern Ukraine, Syria, Arabian Spring



Macro-economic Risks

- e.g., interest and exchange rates fluctuations, unemployment and growth rates.
- Examples: 2009 financial crisis.

Social Risks

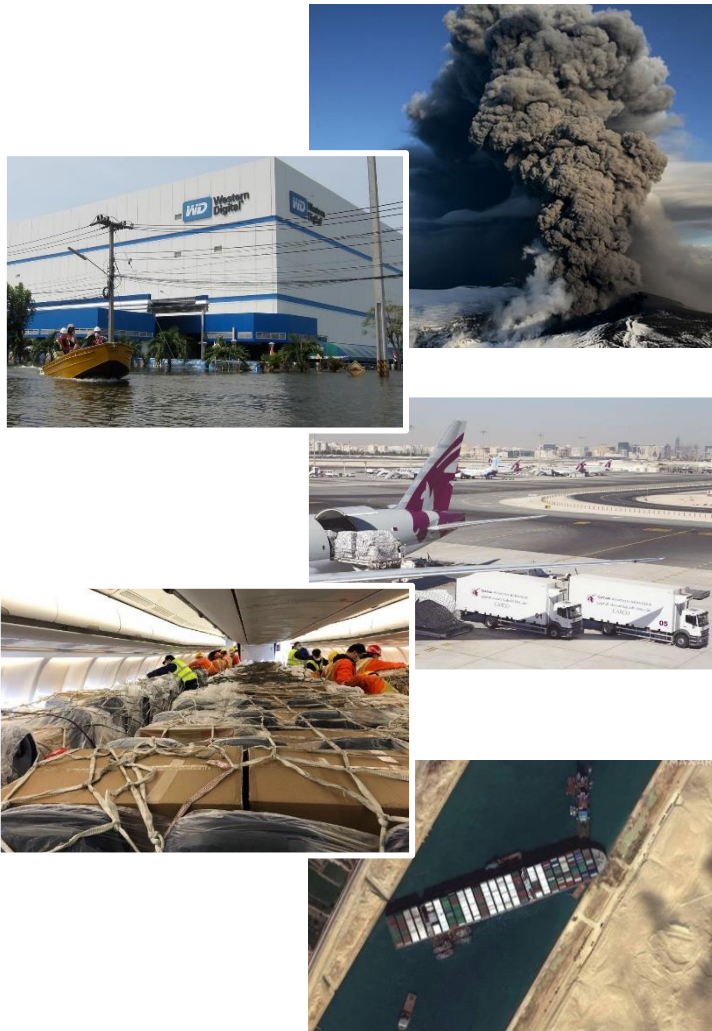
- e.g., terrorism, education levels, standard of living and business engagement.
- Examples: terrorist attacks in France in 2016.



Operational Risks

- e.g., quality, safety and compliance management, machine breakdowns, accidents.
- Example: Pakistan garment factory fire 2012.

EXAMPLES OF EVENTS AND CONSEQUENCES

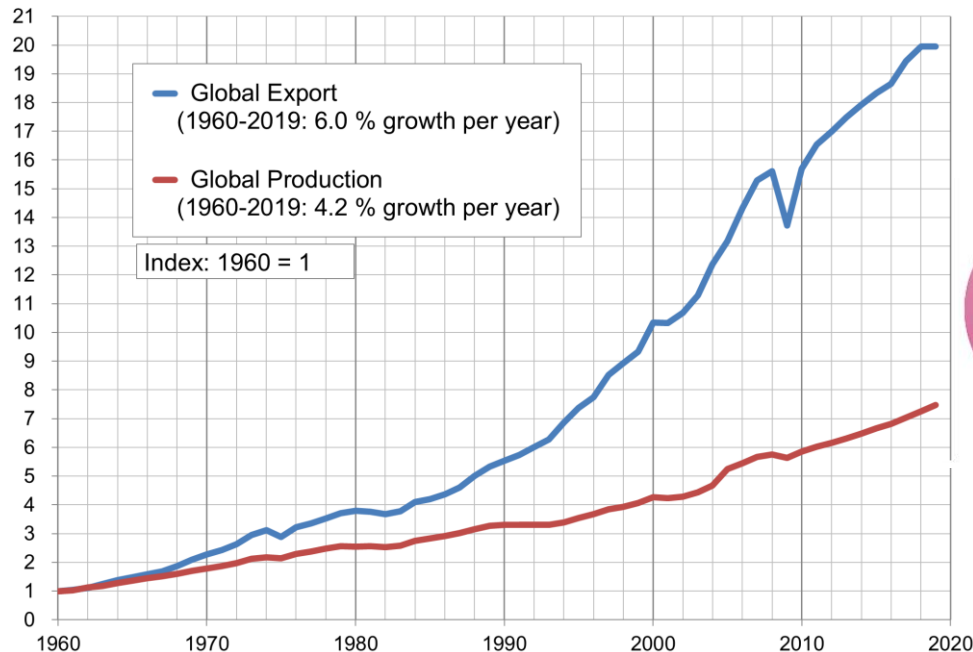


Event	Category	Implication
Volcanic eruption Iceland 2010	Nature event	European sky closed for one week for air traffic
Flood of the century Bangkok 2011	Nature event	Flooding of factories in Thailand leads to global supply bottlenecks for hard disks
Middle East Embargo Qatar 2016	Political Crisis	Air corridors closed for about 4 years, land and water routes also affected
COVID 19	Global pandemic	Reduction in global passenger air traffic by more than 80% for 1 ½ years to date
Blocked Suez Canal	Infrastructure accident	Blocking the waterway for six days, around 400 vessels were delayed

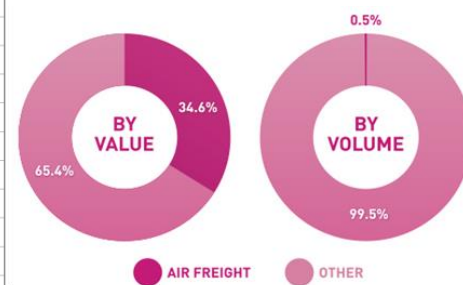
GLOBAL MANUFACTURING NEEDS GLOBAL SUPPLY CHAINS

Global transportation is rising faster than global production due to increasing global work sharing

Global transportation is predominantly carried by maritime shipping – air cargo with < 1% of volume (tons) but ~ 35 % of value of goods (US\$)

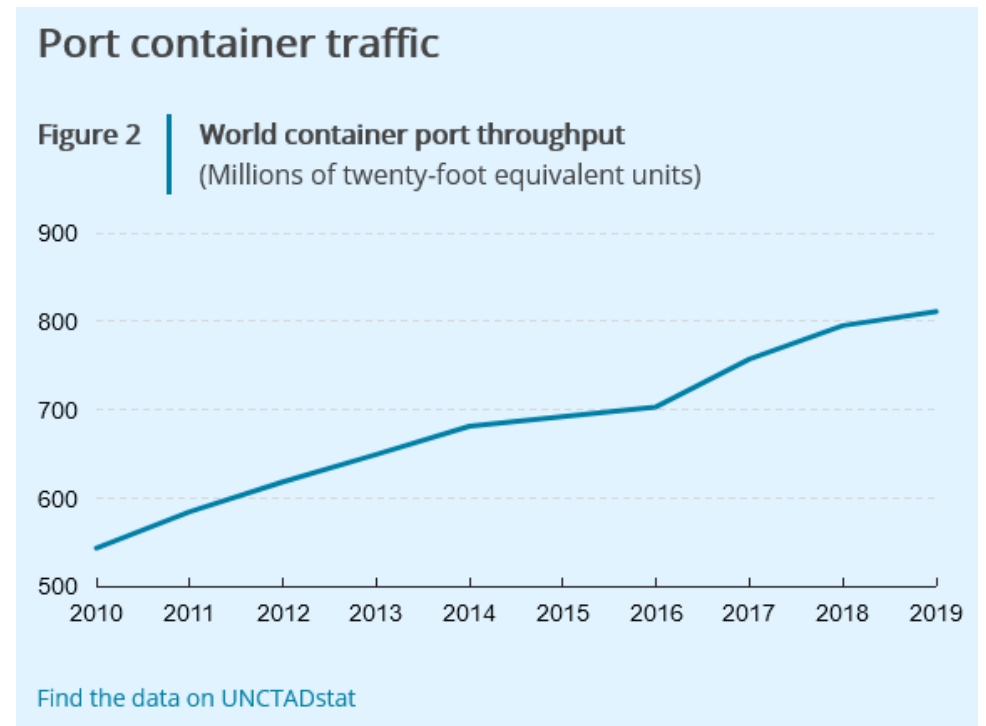


Source: WTO 2020



Value of goods in air transport:
 $6.4 \cdot 10^{12}$ US \$

Source: ATAG 2017



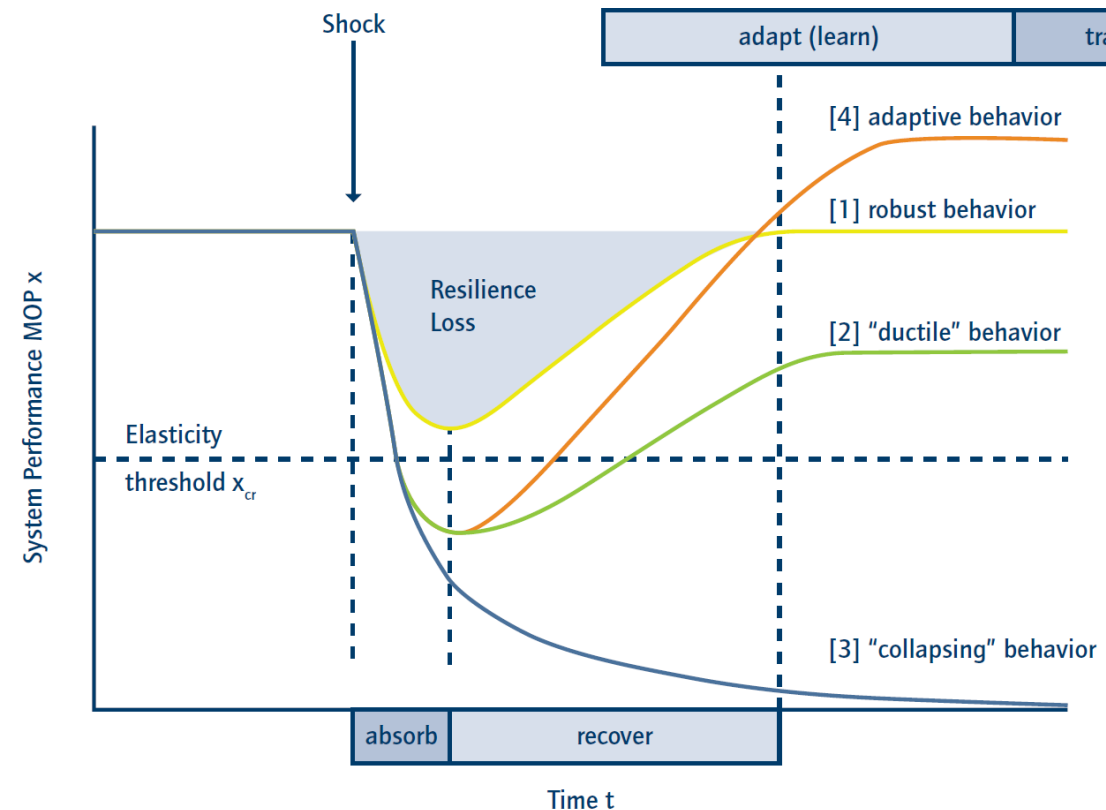
GLOBAL SUPPLY CHAINS CREATE PROSPERITY

- Worldwide division of labor has increased global prosperity.
- The UN Millennium Development Goal on poverty reduction for 2015 was already achieved in 2011 (to reduce by at least half the proportion of the world's population living on less than \$1.25 a day from 1990 levels).
- The EU is one of the largest players in international trade, along with the US and China.
- EU exports account for more than 15 percent of global exports. More than 80 percent of European exporters are small and medium-sized enterprises (SMEs).
- Container handling has been robust in recent years despite critical debates on globalization and protectionist measures taken in many cases

THE IDEA OF RESILIENCE

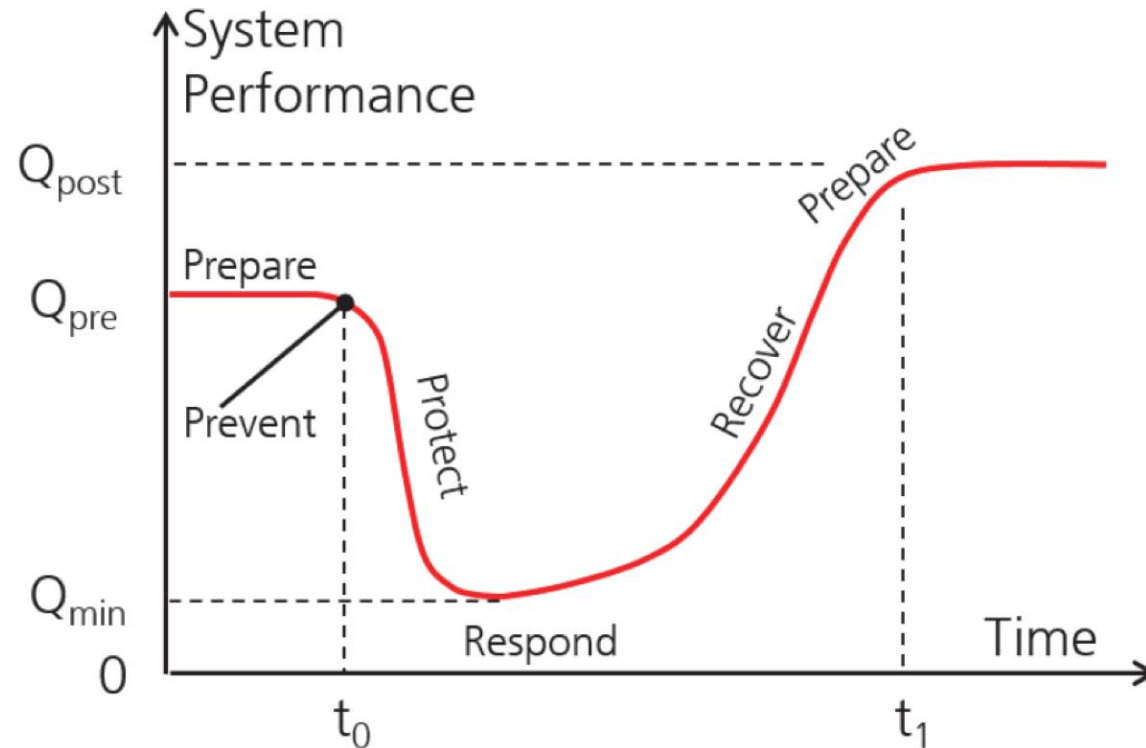
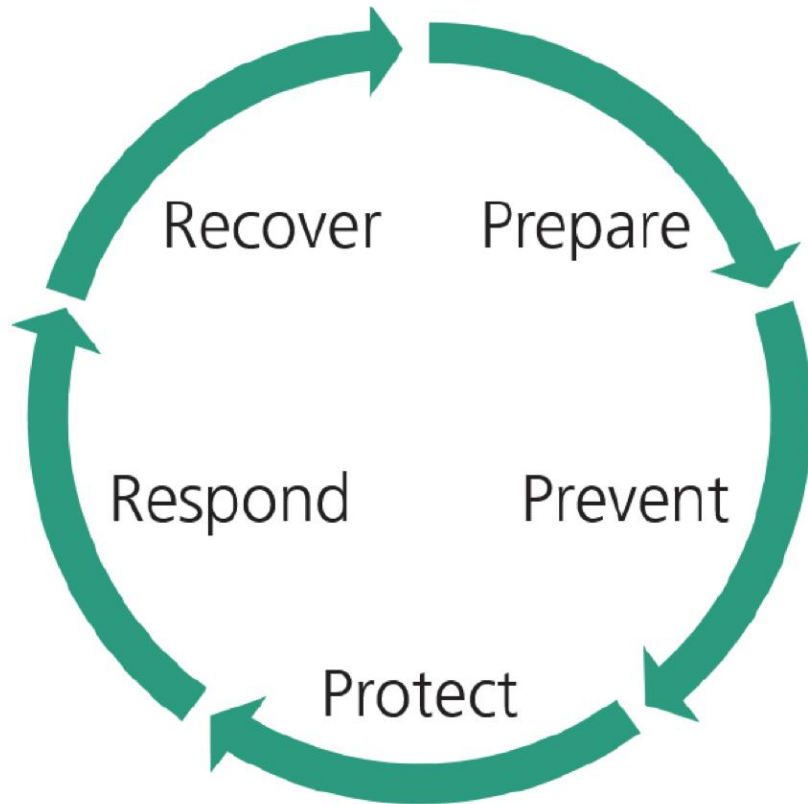
In 1973 the Canadian ecologist Crawford S. Holling marked a quantum leap in the field of resilience research when he published an article entitled “Resilience and Stability of Ecological Systems” in the Annual Review of Ecology and Systematics. Today this idea is successfully transferred and applied to a wide field of business and life in general.

How resilient and non-resilient systems respond to a shock

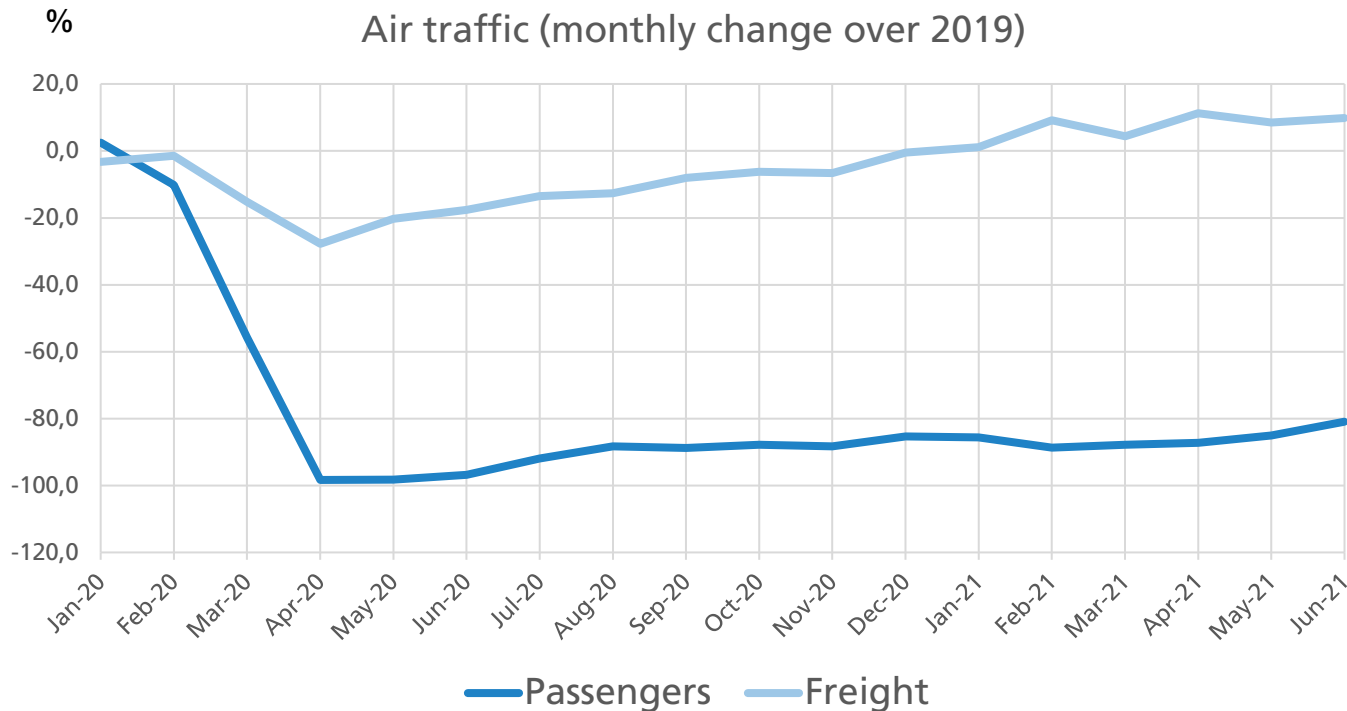


Four essential patterns, (1) absorbing a shock without collapsing, (2) recovering from a shock to gain structure, functions and essential feedback loops again, (3) adapting through self-organization and learning, and (4) eventually transforming into a different system by altering structures, functions and feedback loops.

DEFINITIONS, CYCLE AND PHASES OF RESILIENCE



GLOBAL AIR TRAFFIC – PASSENGERS VV FREIGHT



Growth in air freight with significant decrease in passage means

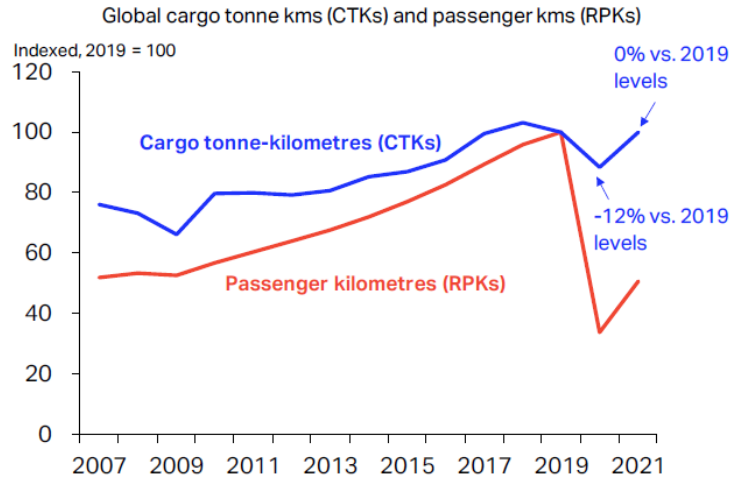
- Shortage of cargo space
- Rising prices for air freight
- Adjustment of logistics
 - Need to plan & book early
 - Additional demand for charter flights / integrator
 - Shift to land and sea shipping

Source: ICAO Air Traffic Monitor / IATA Air Cargo Market Analysis
 International Passengers – RPK
 World Freight Traffic - Freight Tonne-Kilometres – FTK

REBUILDING THE TRANSPORT CAPACITY FOR AIR FREIGHT

1. Loss of 80% of belly hold capacity for air cargo on passenger flights

4. Securing of remaining capacity in the amount of 88% (EU) and 96% (Germany) respectively

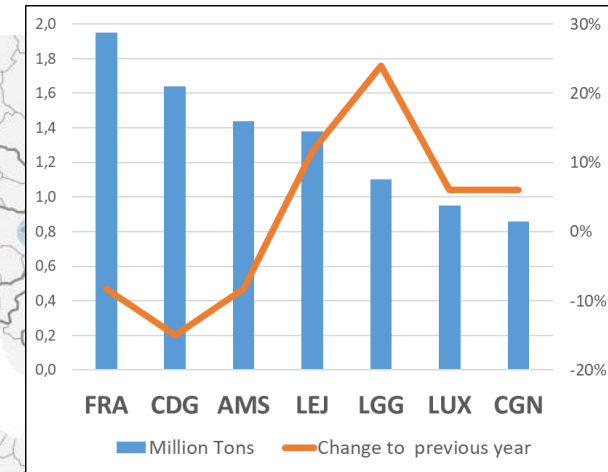
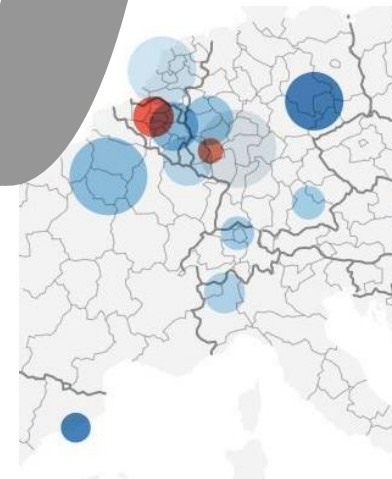
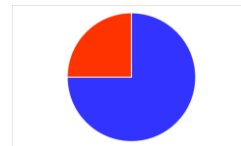
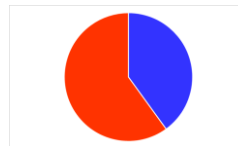


3. Shift in air cargo volume market shares between European airports 2019 - 2020

2. Shift in air cargo tonnage shares from passenger co-loads to full freighters

previously 60 : 40

actual 25 : 75



Sources: ACI Europe, IATA Economics, ADV, DVZ, Lux-Airport.lu, Centreforaviation.com

BUSINESS CONTINUITY

“Business continuity is about having a plan to deal with difficult situations, so your organization can continue to function with as little disruption as possible.” (source: BCI)

Planners must have information about

- equipment, supplies and suppliers, locations, including other offices and backup sites
- documents and documentation, procedures, staff and qualifications.

The analysis should include threat and impact analysis, impact scenarios and alternatives.



BUSINESS CONTINUITY

- early references in the 1970s
- mostly focus on IT infrastructure

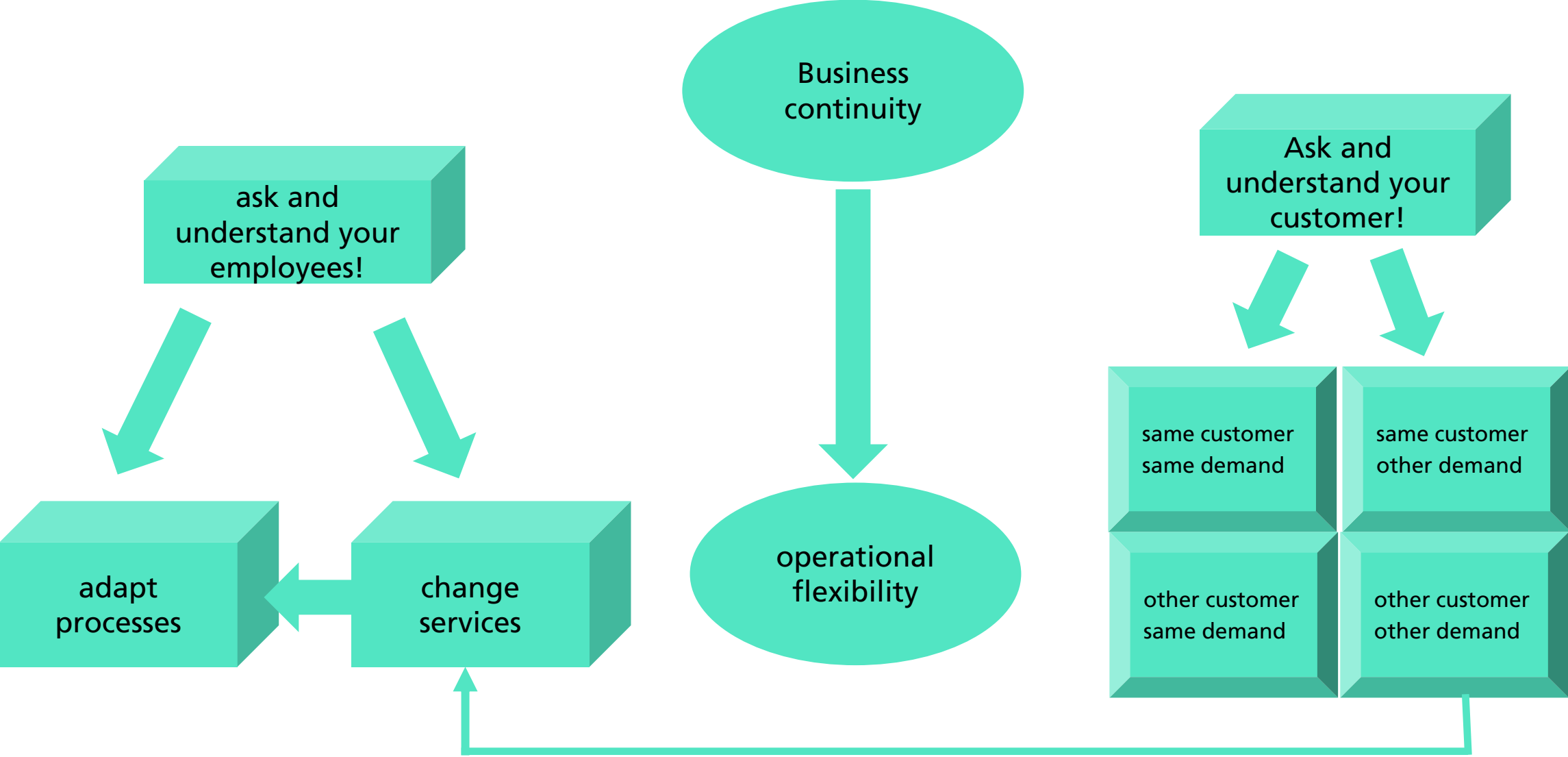


The **Business Continuity Institute (BCI)** was established in 1994 by Andrew Hiles and others, evolving from the Survive Group (a network of experts) and has around 8,000 members in > 100 countries

The ISO 22301 standard for *Business continuity management systems* was developed by ISO technical committee ISO TC 223 on societal security and published for the first time in 2012.



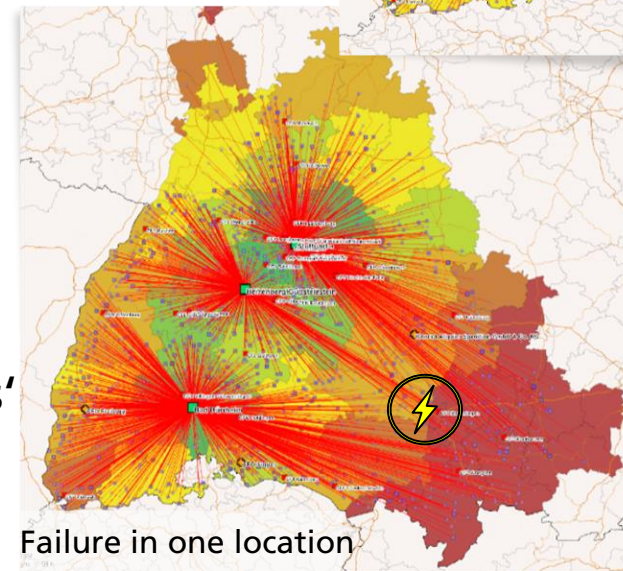
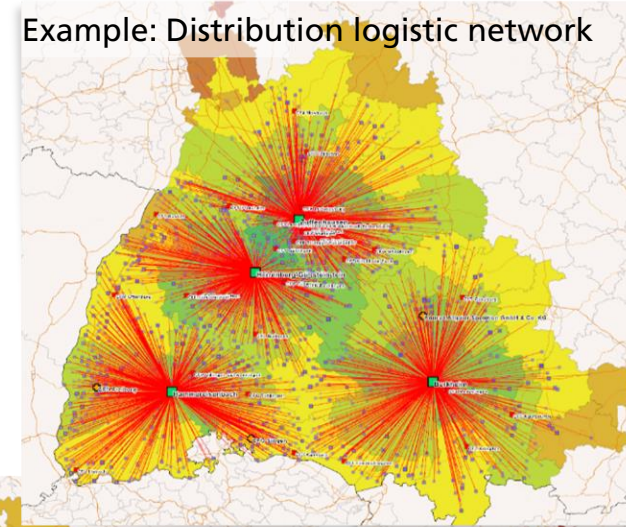
BUSINESS CONTINUITY



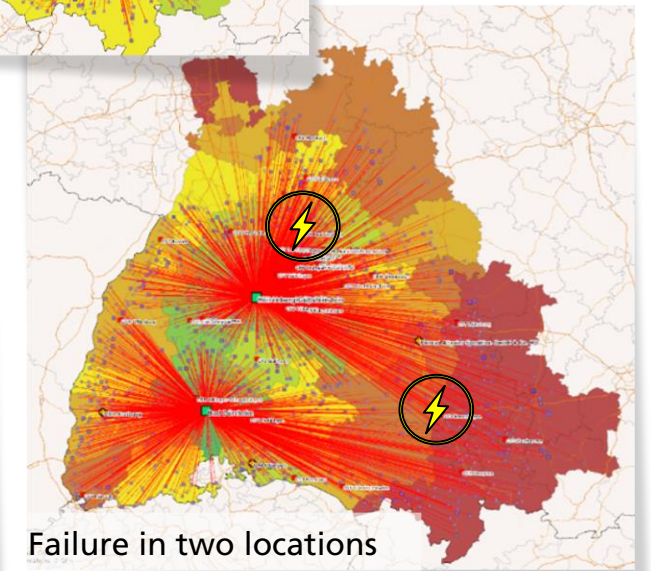
PLANNING FOR RESILIENT STRUCTURES

- Strategic planning of e.g. distribution networks aims at least cost / best service solutions
- Using optimization tools like DISMOD it makes sense to analyze consequences of failure in parts of the network
- Define your strategy between
 - ‚You don’t build the church for Easter’ and
 - ‚Expect failure in any part of your network!’
- Calculate the most reasonable ‚extra resources’ to enable good logistic services for reasonable investment – **quantity & visualize !**

Example: Distribution logistic network



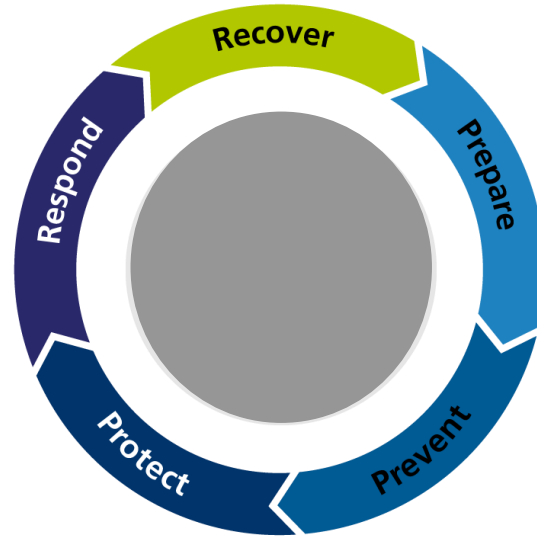
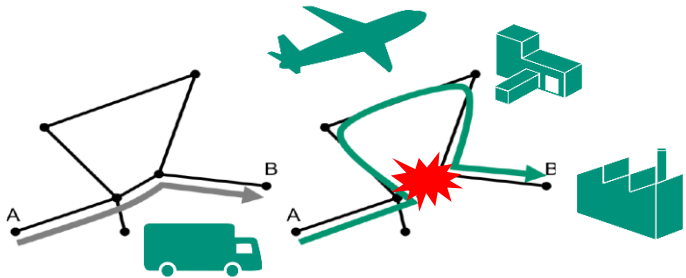
Failure in one location



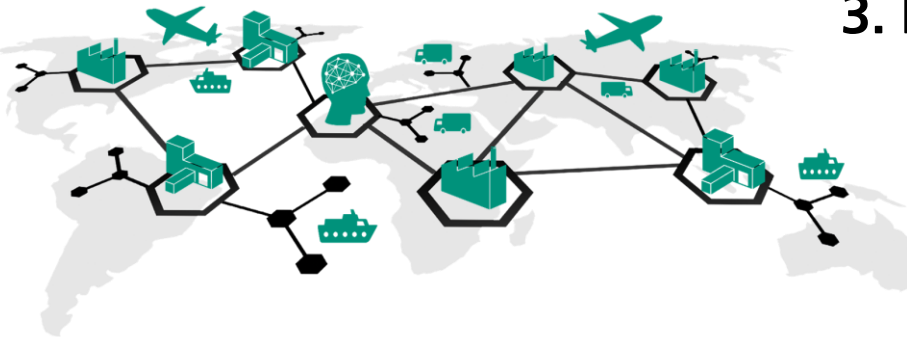
Failure in two locations

Resilience Concept According to the Five Phases

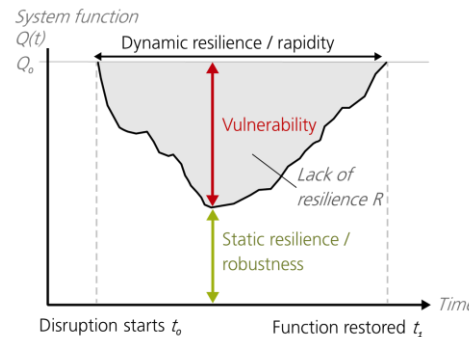
5. Decide and action



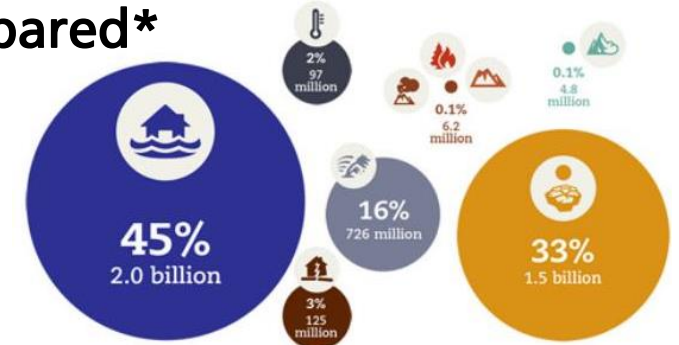
4. Resilient network design



3. Detect, measure, evaluate



1. Be prepared*



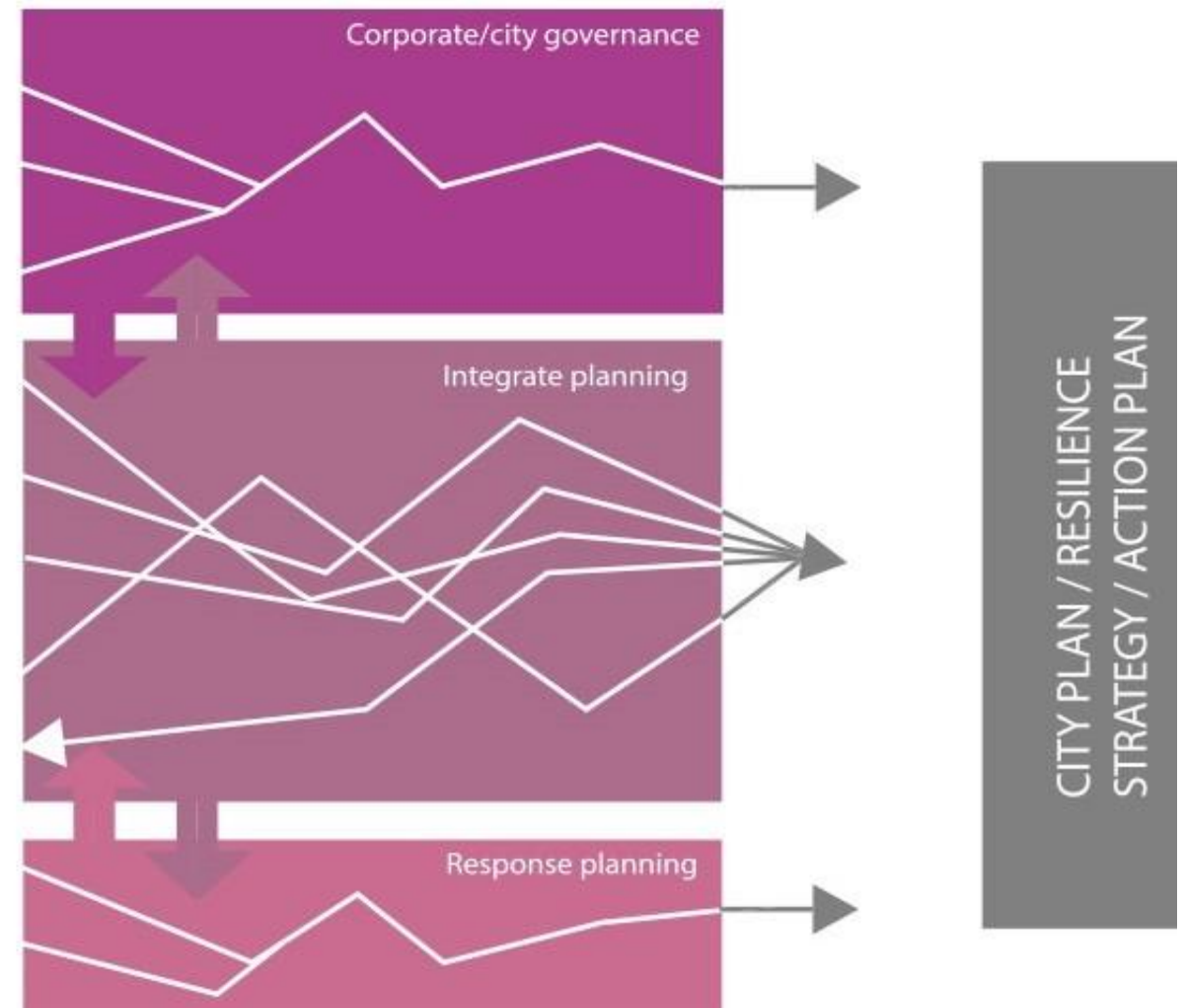
*) Number of people affected by disaster type 1998-2007; source : UNISDR 2018

2. Data capture



THE TEN ESSENTIALS FOR MAKING CITIES RESILIENT

- 1  Organise for disaster resilience
- 2  Identify, understand and use current and future risk scenarios
- 3  Strengthen financial capacity for resilience
- 4  Pursue resilient urban development and design
- 5  Safeguard natural buffer to enhance the protective functions offered by natural ecosystems
- 6  Strengthen institutional capacity for resilience
- 7  Understand and strengthen societal capacity for resilience
- 8  Increase infrastructure resilience
- 9  Ensure effective disaster response
- 10  Expedite recovery and build better



INNOVATIONS FOR RESILIENT PROCESSES

e.g. AI-based recognition of dangerous goods notices for air freight

- Strict rules in air freight (number of units is limited) for the transport of "Hazard Goods".
- New symbols appear regularly (especially in Asia)
- Recognition of hazard goods symbols on packages
- Machine learning of a neural network for classification of symbols (27 at project end)

Advantages

- Automated recognition of dangerous goods labels leads to more efficient handling processes
- Reduced error rate



„FRAUNHOFER-PRODUCTS“ FOR RESILIENT NETWORKS, SUPPLY CHAINS AND COMPANIES

IML, IFF: Resilience indicators for supply and production networks & reorganization and redesign for increasing resilience

IPA, IPK: Adapting business models and organizations for resilience

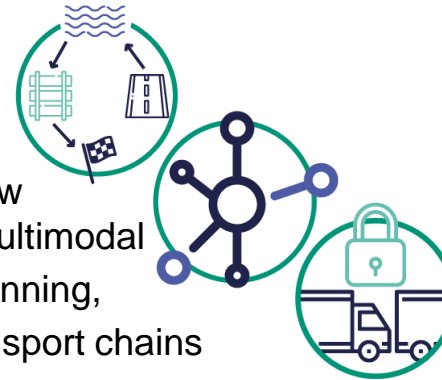
IPT, IEM: Secure IT for Resilient Supply Chains

ISI: Technology forecasts, strategy development and roadmaps of future technological evolutions

OTD  **NET**
IML: Order-To-Delivery-NETwork Simulator

 **DISMOD**
integrated planning

IML:
Network flow analysis, Multimodal network planning, Secure transport chains



FRe  **E**
EMI: Fraunhofer Resilience Evaluator



 **VITRUV**

IFF: Risk-based choice of maintenance strategies and virtual startup

IFF: Risk analysis in production and supply networks

Risk management analyses compliant with ISO 31000 / 2009

IVI: iSand Internet Social Analyser in Natural Disasters

IML, IPA: Blockchain technology (use cases, process and resilience improvements)

LBF: Inline-Monitoring of Damage Indicators for Transport Infrastructures

IAIS: 360° Check Cyber Resilience

Winners of the COVID-19 Pandemic

- Sanitary products, Protective masks, Test laboratories
- Video conferencing systems, IT / mobile offices
- Digital content, game consoles
- Online retailer
- Food, beverages
- DIY stores, gardening supplier
- Bicycle industry and trade
- Sports boat industry and trade
- Mobile homes, camping



- Air freight / sea freight
- Parcel service provider / Integrators

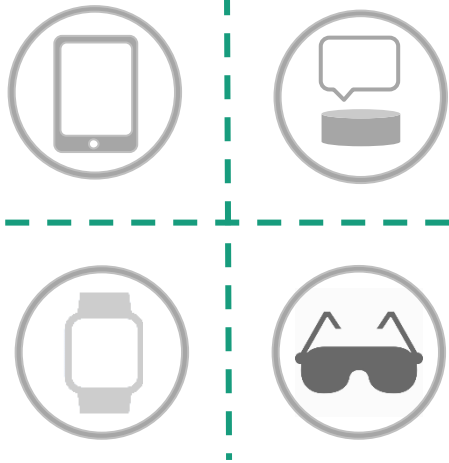


and Losers

- Tourism, event and trade fair business
- Mobility, esp. air traffic
- Hotels and restaurants
- Brick and mortar retail, esp. fashion
- Aircraft manufacturers, Aviation
- Automotive and suppliers
- Culture, sports & event business
- Industrial contract logistics
- Merchant logistics (partial)
- Full truck load transport
- Rail freight transport



Learnings



- There is no alternative to global supply chains
- We need all modes of transport
- Re-inventing Air-Cargo with reduced belly capacity
- Resilient structures & processes
- Priority by customers - capabilities by people
- More IT & AI ahead!



THANK YOU FOR ATTENTION!



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