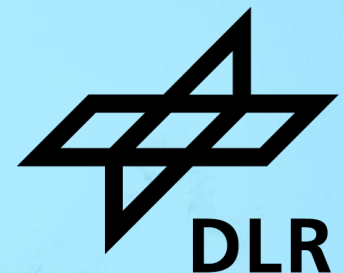# EXPLORING TRANSITION PATHWAYS IN LOGISTICS: A MULTI-LEVEL PERSPECTIVE ON ARTIFICIAL INTELLIGENCE, DEGLOBALIZATION, AND SUSTAINABILITY

Daniel Weiss, Tilman Matteis, Gernot Liedtke

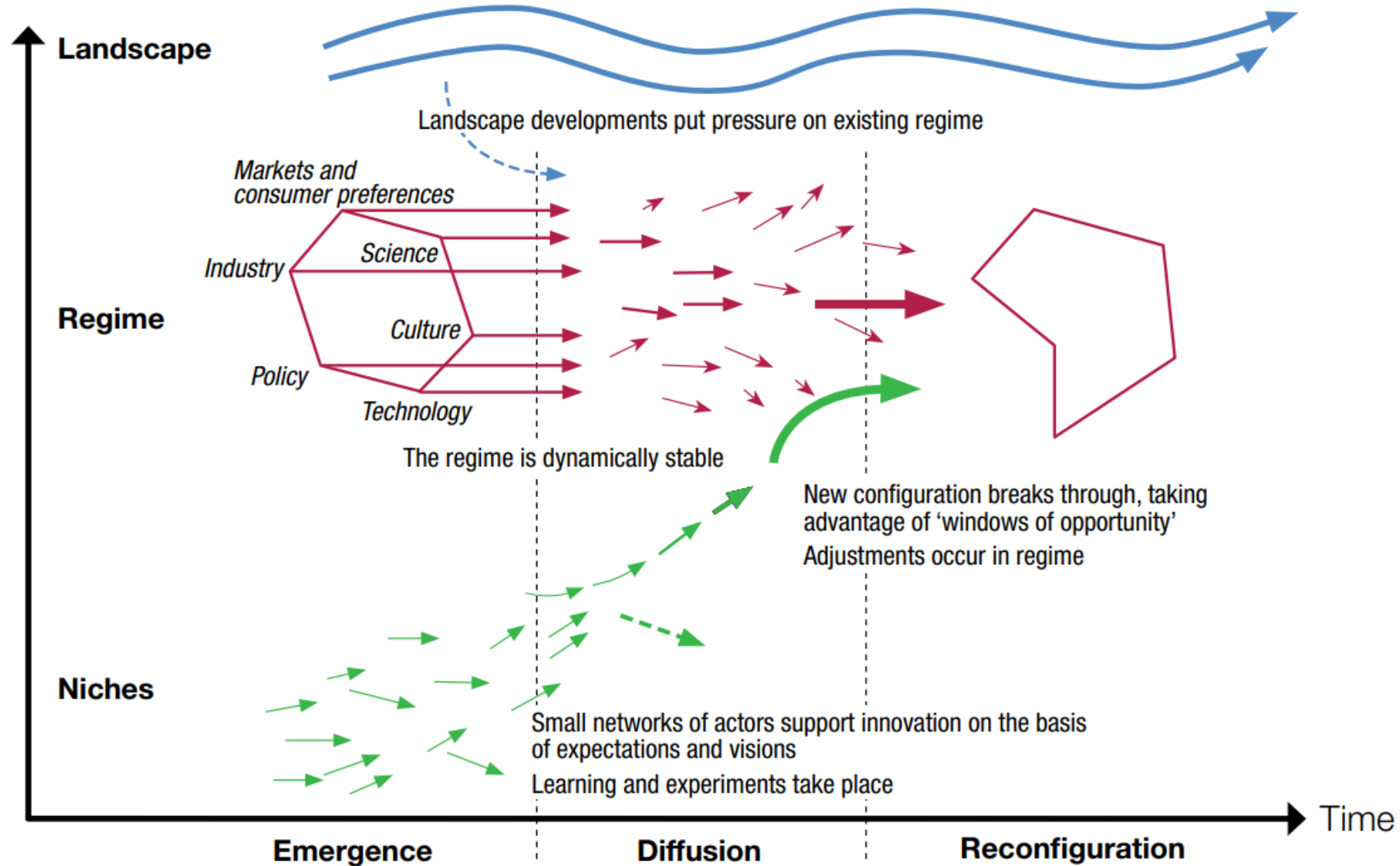*Institute of Transport Research, German Aerospace Center (DLR), Germany*

DLR

Content

➢Deglobalisation as a new paradigm for transportation?

➢Multi-Level-Perspective (MLP)

➢The current context of Artificial Intelligence, Deglobalization, and Sustainability

➢Possible transition pathways of the transportation system

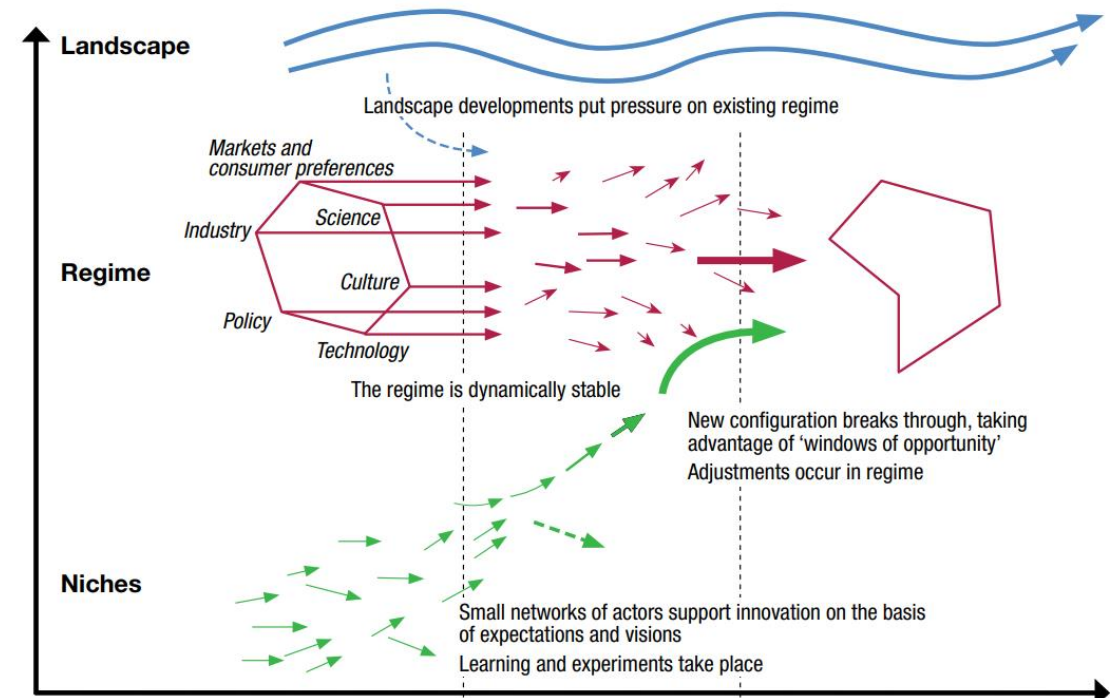➢How to prepare for uncertainty in future pathways

Deglobalisation

Multi-Level-Perspective (MLP)

Landscape

Landscape developments put pressure on existing regime

Markets and consumer preferences

Industry

Science

Regime

Culture

Policy

Technology

The regime is dynamically stable

New configuration breaks through, taking advantage of 'windows of opportunity' Adjustments occur in regime

Niches

Small networks of actors support innovation on the basis of expectations and visions

Learning and experiments take place

Emergence　　Diffusion　　Reconfiguration

Time

Geels 2002, 2010

Exploring Transition Pathways in Logistics

Multi-Level-Perspective (MLP)

- Explains the breakthrough of innovations on the market

  - **Landscape:** Outside developments that influence the market
  - **Regime:** The way the market works today
 - **Niches:** Settings in which innovations can develop and mature in a somehow protected environment

Landscape

Landscape developments put pressure on existing regime

Markets and consumer preferences

Industry — Science

Regime — Culture

Policy — Technology

The regime is dynamically stable

New configuration breaks through, taking advantage of 'windows of opportunity' Adjustments occur in regime

Niches

Small networks of actors support innovation on the basis of expectations and visions

Learning and experiments take place

Multi-Layer-Perspective (MLP)

In the case of freight transport

- **Landscape:** Deglobalization, Digitalization, Climate Change

- **Regime:** Freight transport as it is today

- **Niches:**
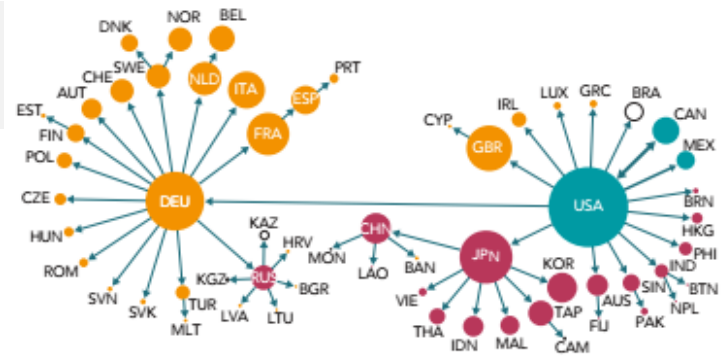 - Disruptive technologies like 3D-printing
  - Localized value-chains
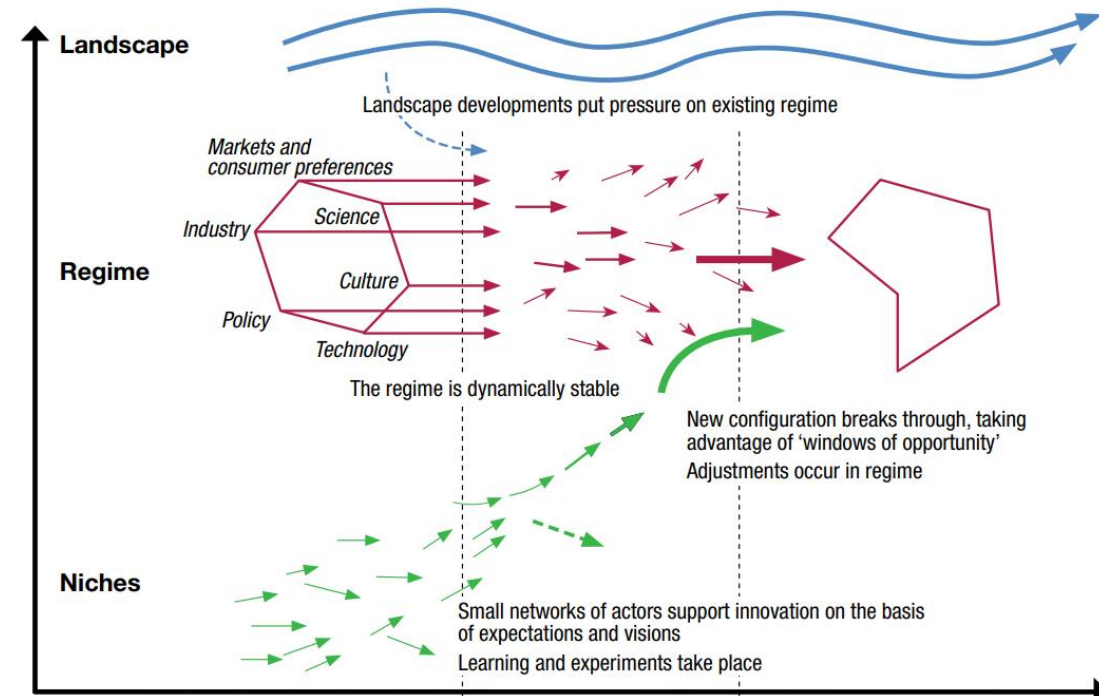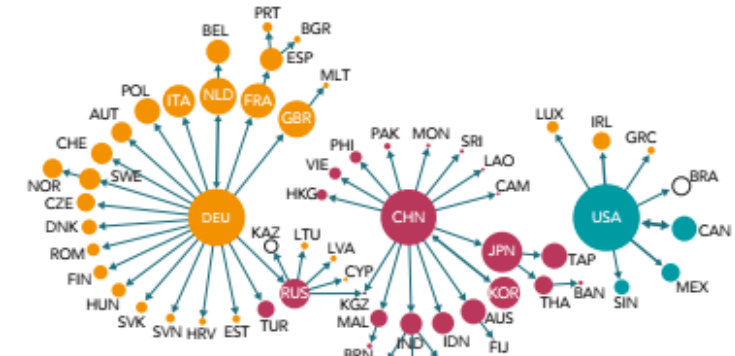
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Landscape Pressures

- Regional shifts in trade have been going on slowly for some years now

Supply hubs in complex
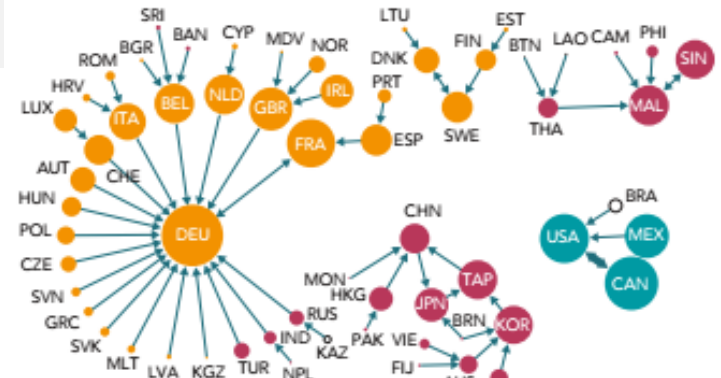value chain networks

2000

2017

Demand hubs in
complex value chain networks

2000

2017

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Landscape Pressures

- First examples of re- and nearshoring can be observed

Photo taken by Tilman Matteis in the Vienna Technical Museum (2023)

https://www.c-and-a.com/de/de/shop/jeans-made-in-europe

- Digitalization and automatization can accelerate this development

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Landscape Pressures
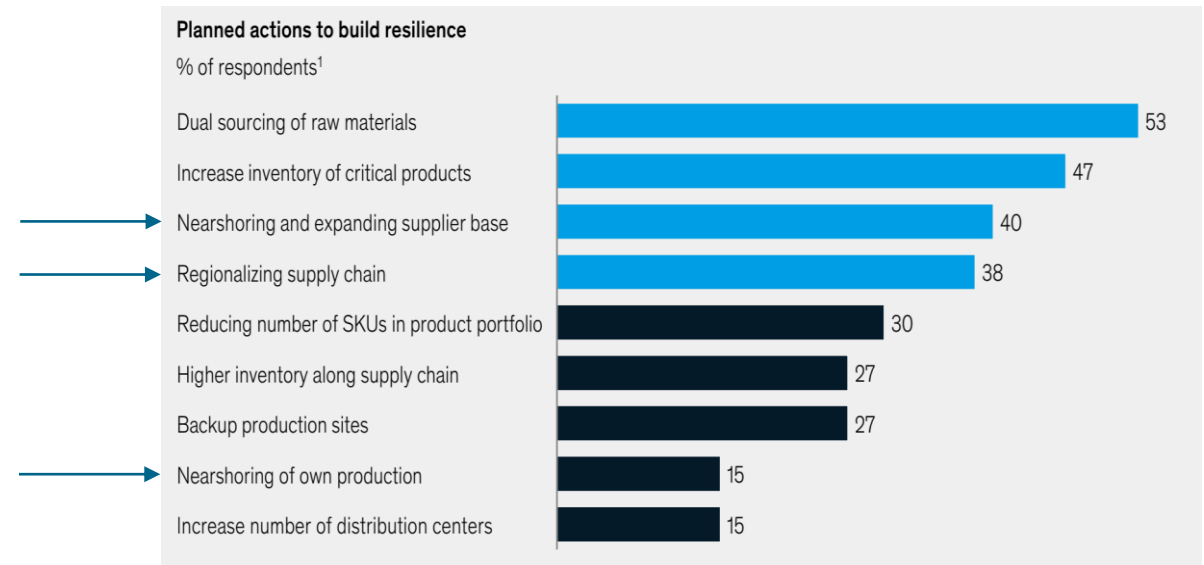
- Cost advantages from trade decrease

- Increased risks (Corona, Geo-politics)

- Increased risk perception
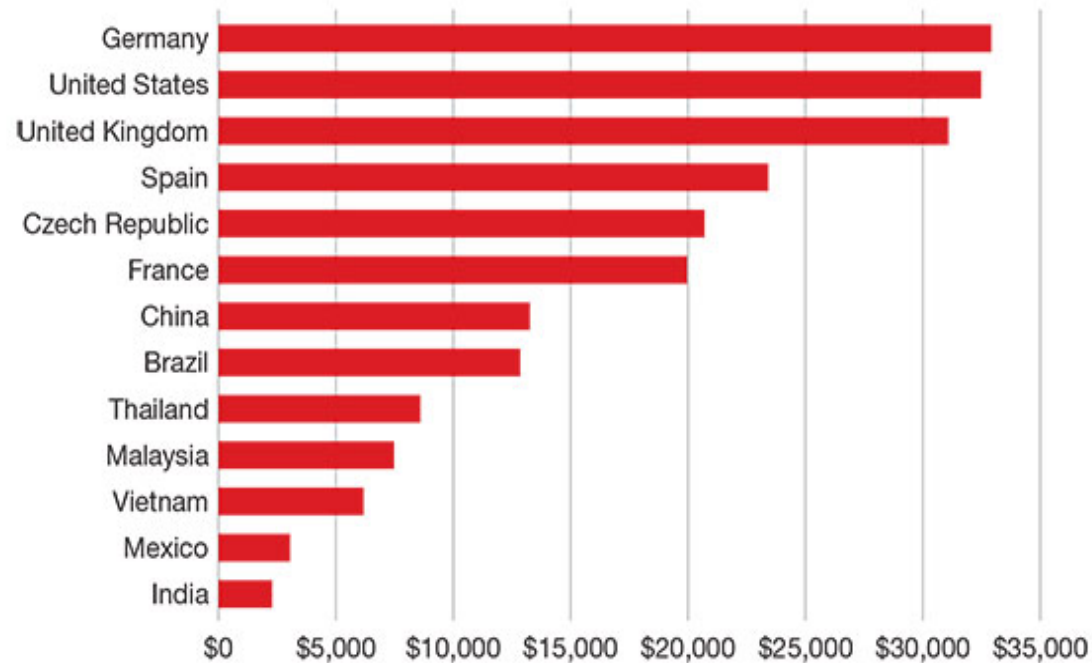
https://www.logisticsmgmt.com/article/global_labor_rates_china_is_no_longer_a_low_cost_country
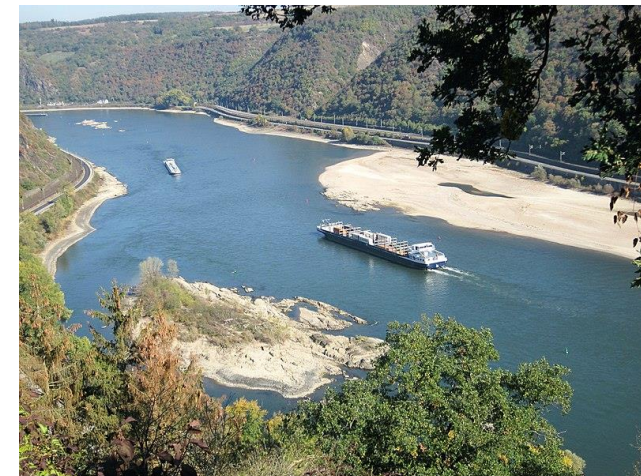
McKinsey (2020)

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Transport regime

- Fossil fuel dependent

- Labour-intensive

- But also so far: Very adaptable

- Digitalization + green technologies

https://upload.wikimedia.org/wikipedia/commons/e/e6/Maersk_Huacho_container_ship_at_Pasir_Panjang_Container_Terminal.jpg
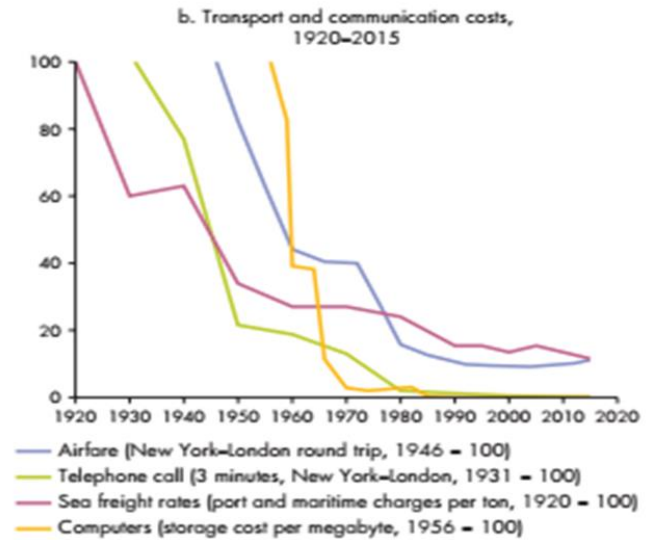Wzhkevin, CC BY-SA 4.0, via Wikimedia Commons

https://upload.wikimedia.org/wikipedia/commons/5/55/Oberwesel_Jungferngrund_Tauber_Werth_Niedrigwasser_2018.jpg
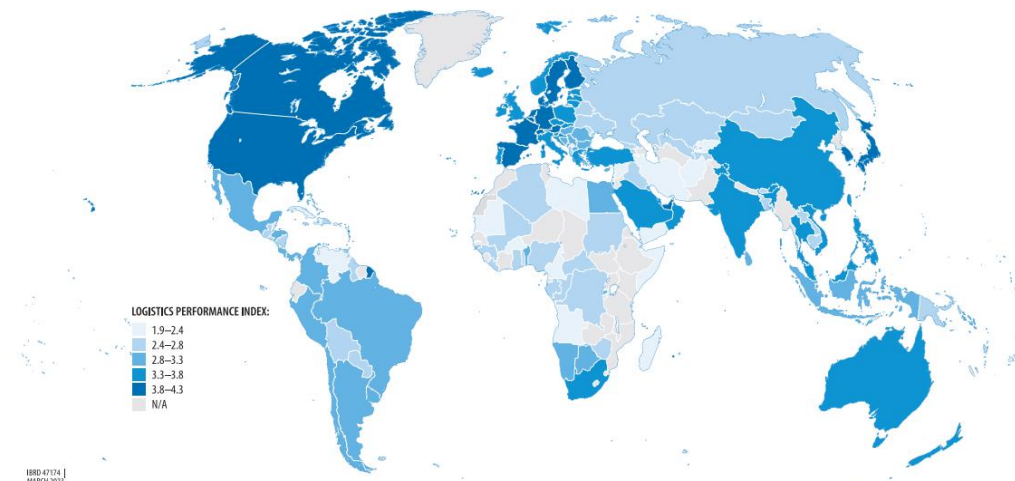Marion Halft, CC BY-SA 4.0, via Wikimedia Commons

Exploring Transition Pathways in Logistics

Transport regime

- Characterized by decades of declining costs

- Enabled the emergence of global value chains

- But: It needs the right conditions
  - Needs cost advantage
  - It must be flexible and available
  - ➢ Cooperation necessary

b. Transport and communication costs, 1920–2015

- Airfare (New York–London round trip, 1946 = 100)
- Telephone call (3 minutes, New York–London, 1931 = 100)
- Sea freight rates (port and maritime charges per ton, 1920 = 100)
- Computers (storage cost per megabyte, 1956 = 100)

WTO (2020)

LOGISTICS PERFORMANCE INDEX:
- 1.9–2.4
- 2.4–2.8
- 2.8–3.3
- 3.3–3.8
- 3.8–4.3
- N/A

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World Bank (2023)

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Transition Pathways

- Transitions depend on
  - The intensity of pressure from the landscape
  - The maturity of available niche solutions

- Typology of Geels and Schot (2007):
  - Transformation (regime is able to adapt, niches are adopted)
  - Transition (new regime emerges, technology and/or processes are replaced by niches)

- Where do we stand in the freight transportation and logistics sector?

# Exploring Transition Pathways in Logistics

Transformation

- Regime is able to adapt to pressure from landscape changes
  - Current value chains continue to exist
  - The way how the goods are transported changes slightly
    - Sustainable drives for ships and trucks
    - Digitization of single operations to improve efficiency
- Niche solutions are mature enough and become part of the regime

https://upload.wikimedia.org/wikipedia/commons/2/26/Electric_lorry_battery_icon.png
Tommaso.sansone91, CC0, via Wikimedia Commons
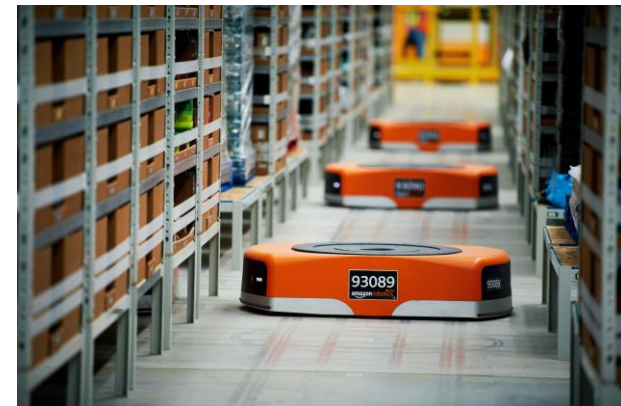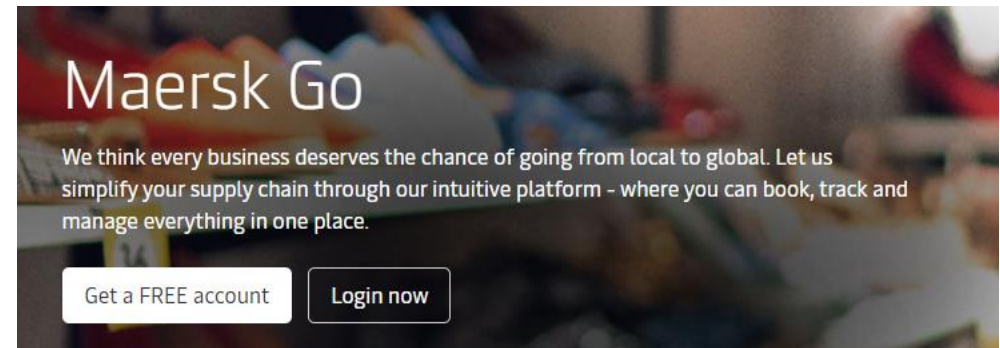
Exploring Transition Pathways in Logistics
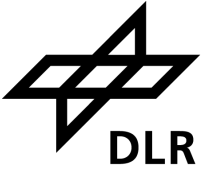
Transition: Reconfiguration

- Global value chains break-up → new regime emerges

➢ But incumbent actors of the former regime stay dominant

➢ Symbiotic niche innovations are adapted by regime actors

- Example: Platformization of shorter (intracontinental) transport chains

https://www.maersk.com/transportation-services/go

Exploring Transition Pathways in Logistics

Transition: Technological substitution

- Landscape pressures tilt cost advantage of global value chains

- Niches are competitive to regime

- Example for a possible scenario: 3D-Printing

- Transport demand for regime actors changes

➢ Incumbents are replaced by newcomers

https://www.dbcargo.com/rail-de-en/logistics-news/spare-parts-from-3D-printer-sustainable-and-efficient-10788052

https://www.dhl.com/content/dam/dhl/global/core/documents/pdf/dhl-trendreport-3dprinting.pdf

Take home message

What does this mean for university education?

- Methods to identify promising niches have to be emphasized
  - Obtain information about early developments (Weiss and Nemeczek 2021, 2022)
    - In technological niches
    - In consumer preferences

- Strengthen methods of data and computer science in the curriculum

- (Big) data and AI for resilience

Contact

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