

A Work Project, presented as part of the requirements for the Award of a Master's degree in
Management from the Nova School of Business and Economics.

**CHALLENGES OF THE OPERATIONAL ADOPTION OF WIND-POWERED
CARGO VESSELS IN THE LOGISTICS INDUSTRY**

The future of the logistics industry in the European Union by 2032

Strategic Planning Field Lab: Individual Part

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Abstract

This research study has its origin in the environmental concerns regarding carbon dioxide emissions in maritime logistics. Through the exploration of sustainability innovation, the focus is put on wind-powered cargo vessels. This paper aims to explore and explain the industry dynamics that complicate the operational adoption of wind-powered cargo vessels. Through the application of the multi-level perspective, three key factors were identified to challenge wind power in the maritime sector: managerial reluctance, locked-in heavy oil fuel, and gradual industry reorientation. These hinder the sustainable transition process, required for ocean freight to comply with the global sustainability goals.

Keywords: *maritime logistics, carbon dioxide, heavy oil fuel, wind power, wind-powered cargo vessels, multi-level perspective, sustainable transition*

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“We must change course and we must do it now”

– Rebeca Grynspan, UNCTAD Secretary-General

Environmental stewardship has led to a shift in the public and private attitude to prevent further climate change and minimize environmental degradation (Deutsche Post DHL Group 2022c). Thereby, decarbonization has become central to businesses, governments, and customers (Deutsche Post DHL Group 2022a). Governmental organizations are increasingly formulating environmental targets with the European Union (EU) aiming to become climate-neutral by 2050 (European Commission 2022). The EU’s Sustainable Finance Disclosure Regulation (SFDR) is one measure to hold companies accountable for their emissions and will apply to the logistics industry from the first of January 2023 (European Securities and Market Authority 2021). This development creates pressure for logistic companies to transform their processes, since the supply chain produces about 60% of the world’s total carbon emissions (Deutsche Post DHL Group 2022c). If maritime logistics were a country, it would be the sixth largest emitter of carbon dioxide (Degnarain 2020). Greenhouse gas emissions from the world’s maritime fleet increased by 4,7% from 2020 to 2021 (UNCTAD 2022). Ocean container vessels are mainly powered by heavy fuel oil (HFO), which releases high amounts of pollutants throughout its combustion (Deutsche Post DHL Group 2022b). To comply with the goal of zero-emissions by 2050, global shipping needs to reduce carbon dioxide emissions per mile travelled by 40% until 2030 (Youd 2022). Thus, maritime logistics experts started to explore alternative energy solutions, which include drop-in biofuels and non-drop-in fuels like ammonia and methanol, as well as hydrogen and liquified natural gas (LNG) (Degnarain 2020). Additionally, wind propulsion started to be discussed again, as wind-powered and wind-assisted cargo vessels are estimated to reduce emissions by 20 to 90%, depending on the technology. The most discussed ship designs include Flettner rotors, hard sails, and kites (Degnarain 2020). However, shipping companies remain reluctant towards the adoption of wind energy solutions. This aversion led

to the following research question: *How do industry dynamics in the maritime logistics sector challenge the operational adoption of wind-powered cargo vessels?*

This research will answer the presented issue through four consecutive sections. Firstly, the theoretical framework, used to explain the findings of this study, will be presented, followed by the methodological approach and limitations. Thereafter, the findings will be presented and discussed regarding the industry dynamics that challenge the adoption of wind propulsion in ocean freight. Finally, the conclusions drawn from this study will be synthesized.

2. Literature Review

2.1 The Theory of Innovation Radicalness

Wind-powered cargo vessel solutions like the pilot projects Oceanbird and SeaWings (*Appendix A*) comprise technological and operational innovation. The level of change needed to implement those propulsion solutions can be assessed through the theory of innovation radicalness. Within this theory, the term of innovation is separated in radical and incremental innovations. The former describes the fundamental transformation of activities and a clear change from existing practices, whereas the latter concerns the refinement and modification of existing products or services (Dewar and Dutton 1986). Through the realization of incremental innovation, future adoption of radical innovations can be facilitated. Further, favorable managerial attitudes towards change are central to the enablement of radical innovation, as well as a high involvement of technical specialists who provide in depth knowledge and expertise (Dewar and Dutton 1986). Studies have shown that organizations with centralized and informal structures have a tendency towards radical innovation, whereas complex, decentralized structures foster incremental innovations (Ettlie, Bridges, and O’keefe 1984).

2.2 The Theory of Path Dependency

The persistent use of heavy fuel oil in ocean transport and the adoption difficulties of wind-powered cargo vessel can be explained through the theory of path dependency. Its underlying

argument assumes that past actions and decision will condition future actions and decisions (Arthur 1989). This logic can be transferred to economics, where an outcome is path dependent, if a previous sequence of economic decisions has influenced and narrowed down the potential scope of results (David 1985). Schreyögg and Sydow (2010) formulated three consecutive phases to structure the process of path dependency. Firstly, within the ‘Performance Phase’, decisions and actions are not predictable, as no prior events restrict potential choices. Following is the ‘Formation Phase’ where possible options are limited due to former decisions and the initial choice becomes increasingly difficult to reverse. The ‘Lock-in Phase’ represents the last stage, where restrictions based on former decisions induce a lock-in of a dominant outcome and future flexibility is no longer possible. The inflexibility becomes especially evident when new alternative outcomes are available, but not chosen since a switch is no longer realizable. Thereby, a lock-in of a specific outcome can result in the acceptance of an inferior, inefficient standard, although superior alternatives exist (Liebowitz and Margolis 1995). An organization’s missing capability to adapt to environmental changes can be explained through path dependency and describes the situation where entities are no longer able to solve issues with their traditional means (Kuipers and Boin 2010).

2.3 The Multi-level Perspective

For the analysis of the complex dynamics within the logistics industry that complicate the transition towards wind propulsion as a prevailing energy solution, the multi-level perspective (MLP) will be adopted. The framework is widespread among researchers to evaluate sustainable transitions and has its starting point in persistent environmental problems (Köhler et al. 2019). Integrated within the MLP is the analysis of dynamics of change, based on the above presented theory of innovation radicalness, and the stability of sociotechnical systems, assessed through the theory of path dependence (Klitkou et al. 2015). Within the MLP, Geels (2002) defined sustainable transitions as processes between three MLP levels (*Appendix B*): the

niches, the sociotechnical regimes (ST-regimes), and the sociotechnical landscape (ST-landscape). The niches present a protected space where radical innovations develop before they transition to ST-regimes. The latter entail rules, which enable and constrain activities in communities, as well as dominant practices. The final level is the ST-landscape, an external structure for interactions between niches and regimes. Its context is the most difficult to transform. For sustainability-oriented innovation to be effective, a holistic perspective is needed to evaluate the sociotechnical context of companies and distinguish between societal (ST-landscape) and sectorial (ST-regime and niche) external influences (Hörisch 2015). Transition processes further depend on pioneers, who legitimize novel technological innovations (Jacobsson and Johnson 2000). Opposed to pioneers are incumbents, ST-regime level actors who are reluctant to radical innovation, which is often developed by start-ups within their niches (Geels 2011). Thus, regime actors need to be influenced by niche actors and pioneers to advance sustainability transformations (Hörisch 2015). According to Smith and Raven (2012), this can be done through two modes: fit-and-conform or stretch-and-conform. The former develops innovations to be competitive in the existing regimes, whereas the latter aims to change common practices and established operations.

3. Methodology

This research aims to explore the challenges of the operational adoption of wind-powered cargo vessels in the maritime logistics industry. The subject was kept purposefully broad as an initial starting point since qualitative research is mainly data-driven. After the data collection, a more specific focus was defined through the formulation of the previously stated research question.

This research takes a multi-level perspective as it explores how innovative transition processes depend on the interactions between niches, socio-technical regimes, and the socio-technical landscape. An inductive research approach was used to understand the complexity of the industry context. This approach allows to follow data to understand the context of a situation

(Saunders, Lewis, and Thornhill 2016). This qualitative study uses three semi-structured interviews to obtain non-numerical data and is exploratory, as well as explanatory. The establishment of casual relationships between variables was used to explain how industry dynamics influence the adoption of wind-powered cargo vessels (Saunders, Lewis, and Thornhill 2016). The interviews were non-standardized and included open questions and themes, which were adapted to each interviewee. The interview recordings were then transcribed, and a thematic analysis through color coding was used to identify reoccurring themes (J. A. Smith 2015). Additional knowledge was gathered through secondary data to follow-up on the topics that were discussed in the interviews.

3.1 Limitations

This research represents a snapshot of the maritime industry situation due to the limited time available (Saunders, Lewis, and Thornhill 2016). Further, interviews were only held with three people, which does not allow for a holistic presentation of the dynamics that shape the adoption of sustainable innovation and transition within maritime logistics. Interviewers and interviewees might be subject to bias, as the structure of the interviews and the way the interviews were conducted could have influenced responses. Additionally, only qualitative data was collected, and quantitative research might be needed to verify the general validity of the findings.

4. Findings

The three interviewees, Prof. Dr. Max Johns, Niclas Dahl, and Marcel Blaß, name sustainability and the reduction of CO₂ emissions as main concerns in maritime logistics and the in depth understanding of sustainable propulsion and efficiency solutions as crucial for future industry developments. While aerodynamics and slow steaming are discussed to decrease fuel consumption, biofuels, ammonia, methanol, and LNG are mentioned as greener combustion options. Wind energy is a separate discussion and historically entangled in shipping. According

to Dahl, two types of wind propulsion need to be distinguished: wind-assisted and wind-powered. The former describes supportive propulsion, the latter uses wind as the main energy source. However, wind propulsion still needs to prove its reliability, seriousness, and assurance. Johns considers these aspects realized by Flettner rotors who are increasingly adopted within maritime logistics. Dahl added that wind energy currently benefits from high fuel prices and low infrastructure costs of its implementation. While technology is no longer an obstacle for wind propulsion, Blaß, Dahl, and Johns identify three main concerns regarding wind energy: safety, cost, and operational usage. These are related to limited resale options of wind-powered vessels, instability issues, and the reduction of storage space. Additionally, ship crews need detailed additional training to understand the complex context of wind usage at the ocean. Dahl explains that the shipping sector is one of the most conservative fields. As a result, Johns noted that among incumbents in the shipping industry, emphasis is put on ship efficiency measures to reduce costs, thus optimization processes of existing ships. However, a paradigm shift can be observed, as shipping companies, which are used to move as a cohort, try to understand the multifaceted alternative energies and start to realize that there will not be one solution that fits everyone in the future. Frontrunners like A.P. Møller – Mærsk A/S started to order ships based on methanol, although it is not yet fully developed. The three interviewees consider regulations, like the previously described SFDR, to be a central driver of innovation as regulators increasingly intervene in maritime shipping. Lastly, the interviewees regard business client and end consumer demands for sustainability to be central to further sustainability transitions in maritime logistics.

5. Discussion

Although the presented findings suggest that sustainability and sustainable transformation are central to shipping companies' actions, the operational realization of energy alternatives like wind propulsion remains limited. The level of change needed for wind-powered solutions, the

current supremacy of heavy fuel oil, and incumbents' skepticism were identified as impactful for the limited adoption of wind-powered vessels and will be explored through the application of the presented theoretical framework.

5.1 Managerial Reluctance to Radical Innovation

The industry dynamics of change are highly connected to managerial stances towards innovation, as innovative transition is related to a management style that fosters openness to change (Dewar and Dutton 1986). Current pilot projects for wind-powered cargo vessels entail a fundamental revolution of operations and require expertise for their implementation. Thereby, these projects can be defined as radical innovations that demand a clear change from current practices (Dewar and Dutton 1986). This further entails re-orientation of routing mechanisms, which are usually designed to avoid strong winds. Hard wings like Oceanbird's are dependent on the complex performance of wind and crew members require detailed knowledge to operate them. However, shipping company managers and employees are reluctant to restructure their proven operational systems because of the insecurities related to the complex web of potential future propulsions, as well as security, cost, and operational concerns regarding wind-powered cargo vessels. Dewar and Dutton (1986) consider this attitude a critical disadvantage for radical innovation implementation. Instead, shipping companies realize wind-assist solutions, like Flettner rotors, engage in slow steaming, invest in aerodynamic retrofitting of existing ships, and engine optimization techniques. These innovations characterize the refinement efforts of the shipping industry and represent incremental innovations. Managers appear more comfortable with modifications instead of disruption, which can be explained by the complex, decentralized structure of shipping companies (Ettlie, Bridges, and O'keefe 1984).

5.2 Locked-in Heavy Fuel Oil

Another complicating factor for the operational adoption of wind power arises from the habitual use of heavy fuel oil (HFO). It has been the main choice of fuel within the shipping industry

for more than a century because of its energy density and low costs (Jacoby 2022). Through the theory of path dependency, it can be evaluated how past actions and decisions determine future decisions. According to this logic, historical conditioning has led to the persistent use of HFO in the shipping industry (Schreyögg and Sydow 2010). Arthur (1989) relates this development to economies of scale, which explain why HFO remains the dominant fuel, even though it is increasingly criticized and more sustainable solutions, like wind power, exist. These dynamics indicate that HFO has entered the lock-in phase of path dependency. Inflexibility due to the wide adoption of HFO does no longer allow for a switch to alternative propulsion solutions. Thereby, the sustainably inferior fuel HFO remains the accepted industry standard, although more sustainable alternatives exist (Liebowitz and Margolis 1995). As a result of path dependence, the development towards sustainability is not a streamlined, simple process, since various elements and actors are locked-in by their routines and interdependencies (Klitkou et al. 2015).

5.3 Gradual Industry Reorientation

The above discussed dynamics of change and the stability of the sociotechnical systems, which persist in the maritime logistics industry, form part of the MLP. The framework allows for a structured understanding of the different actors involved and the needed actions between the levels of actors for successful sustainable transitions. Currently, wind-powered cargo vessels, like the Oceanbird, form part of the MLP niche level, where they are developed in a protected environment (Geels 2002). However, according to Geels (2002), for wind propulsion to become widely adopted, it must transition to the ST-regimes, which entails incumbents of maritime logistics and their dominant practices. Flettner rotors as wind-assist solution already entered the transition phase from niche to ST-regime, as their adoption by shipping companies is gradually increasing. While the sector is conservative in its actions, established shipping companies, like Alfa Laval, Wallenius and Maersk, slowly start to engage in wind power. Although, incumbents

who operate at ST-regime level tend to be reluctant to radical innovation (Geels 2011), a slow paradigm shift can be observed, and shipping companies realize that the future of propulsion is multileveled. This requires a mental change, which is influenced by niche actors (Hörisch 2015). Additionally, even though it is the hardest to transform (Hörisch 2015), the ST-landscape is starting to convert as the society becomes increasingly aware of climate issues related to supply chain emissions. Environmental regulations, like the SFDR, are adopted within maritime logistics and shape the operating landscape of shipping companies. Industry experts consider these regulations to be the driver of change for sustainable transitions, as they shape the societal and sectorial external influences on wind-powered cargo vessels. Nonetheless, these dynamics are only happening slowly, as maritime logistics are a complex, entangled system. Wind-assist solutions pave the way for wind-powered solutions, which remain at niche level.

6. Conclusion

This research study investigated the dynamics of the maritime logistics industry and their challenging effects on the operational adoption of wind-powered cargo vessels. Three main dynamics were identified using the multi-level perspective with its analysis of change dynamics and industry stability. Firstly, managers remain skeptical of wind-powered cargo vessels, as they present radical innovation that would disrupt familiar operational processes. HFO remains the preferred choice of fuel, as it is locked-in as the dominant propulsion solution. Through the analysis of the MLP level interactions, it became apparent that wind-powered solutions are still discussed on a niche level. Nonetheless, a gradual shift towards wind energy is happening not only on a sectorial, but also on a societal level, as wind-assist solutions become more prominent among incumbents. This study did not include the perspective of policy makers but focused on industry experts. The analysis of regulations would allow for a more holistic insight and quantitative studies could help to get an understanding of the perceptions of crew members, who eventually need to work with the above discussed propulsion solutions.

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Appendix

[Appendix A – Wind-propulsion solutions](#)

Table A1 – Flettner Rotors

Table A2 – Airseas' Seawing

Table A3 – Oceanbird's hard sails

Table A1 – Flettner Rotors

Topic	Explanation
Functioning	- Flettner rotors are named after their innovator - Flettner rotors are vertical cylinders and spin to create lift due to the Magnus effect
Benefits	- Flettner rotors reduce the energy consumption of a ship - Existing ships can be retrofitted with Flettner rotors
Risks	- Flettner rotors can only be used as a wind-assist solution - Maneuverability depends on wind speed and wind direction - Flettner rotors may decrease the stability of ships, which must be accounted for in the ship design - The effectiveness of Flettner rotors depend on weather conditions, as well as the trade route

Source: (Interreg 2022)



Source: <https://www.stormgeo.com/assets/ArticleImages/E-Ship-Rotos-Sails.jpg>

Table A2 – Airseas’ kites

Topic	Explanation
Functioning	• The technology of kites is combined with an automated flight control system • The hardware consists of three parts: 1) a monitoring system, 2) deck equipment, which allows for the tack-off and landing of the parafoil wing, and 3) the flying equipment
Benefits	• Existing ships can be retrofitted with the kite system • Emissions can be reduced by about 20% • Cost savings due to higher efficiency
Risks	• Kites depend on wind conditions • Kites can only be a wind-assist solution, but are not able to fully power cargo ships

Source: (Airseas 2022)



Source: <https://www.offshore-energy.biz/wp-content/uploads/sites/6/2022/12/Seawing.jpg>

Table A3 – Oceanbird’s hard sails

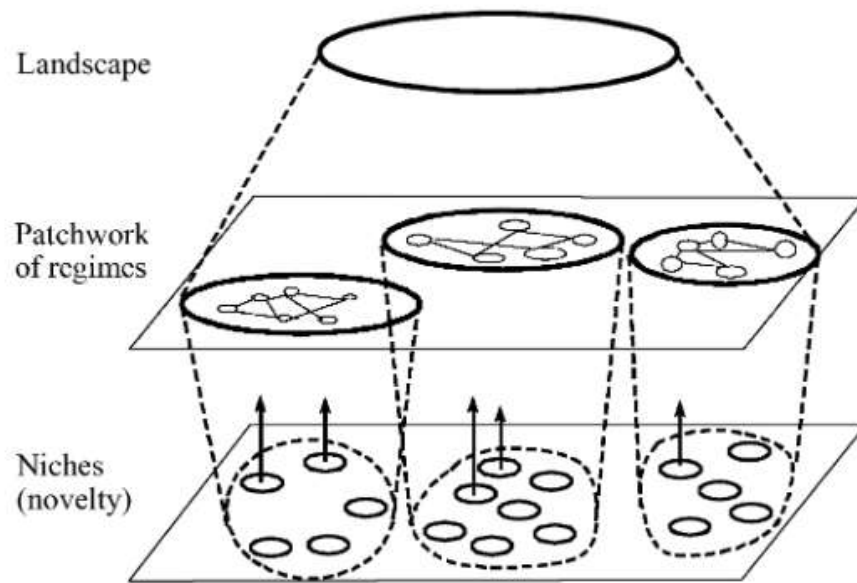
Topic	Explanation
Functioning	• The concept of Oceanbird includes recommendations regarding the speed and routes that should be taken by vessels that are powered by hard sails from Oceanbird • The hard wings are using similar aerodynamics than airplane wings • The hard wing consists of a main sail and a flap • The hard wings can be folded when necessary
Benefits	• Existing ships can be retrofitted with hard wings • Studies have shown that the use of hard wings can significantly reduce emissions of vessels • Vessels can be fully powered by hard wings; thus this propulsion method is not limited to being a wind-assist solution • Wind-powered vessels will reduce sound in the ocean, which is beneficial for animals living in the sea
Risks	• Experts within the shipping industry raise safety concerns, as the ships are more exposed to natural forces like wind • The sails might also lower the safety of the crew in case of emergency and during storms • Crews need to be trained to operate the hard wings under extreme conditions

Source: (Atkinson, Nguyen, and Binns 2018), (AlfaWall Oceanbird 2022)



Source: <https://www.theoceanbird.com/wp-content/uploads/2021/11/Oceanbird.jpg>

Appendix B – The Multi-level Perspective



Source: (Geels 2002)

Appendix C – Interview grids

Table C1 – Interview grid 1: Prof. Dr. Max Johns, Vice President Research & International Affairs, Head of MSc Business Development & Maritime Business School (MBS)

Table C2 – Interview grid 2: Niclas Dahl, Managing Director, AlfaWall Oceanbird

Table C3 – Interview grid 3: Marcel Blaß, Market Analyst, Hapag-Lloyd AG

Table C1 – Interview grid 1: Prof. Dr. Max Johns, Vice President Research & International Affairs, Head of MSc Business Development & Maritime Business School (MBS)

Topic	Questions
Sustainability strategy	1. What are currently the most promising sustainable innovations in the shipping industry to reduce CO2 emissions? 2. How relevant is the issue of sustainable alternative energy currently in the cargo shipping industry? 3. What aspects determine the selection/implementation of innovations in the cargo shipping industry? 4. How aware is the cargo shipping industry of the environmental issues of its operations and how actively does it address them? 5. How do shipping companies address sustainability in their daily operations? 6. What is the importance of wind propulsion to the cargo shipping industry today and in the future? 7. What are your views on wind-powered cargo ships as an alternative to fuel-powered/heavy oil-fueled ships? 8. What do you see as the advantages and disadvantages of wind-powered cargo ships in operational service?
Problems of wind-powered cargo vessels	9. What factors complicate the development of wind-powered cargo vessels?
Costs	10. Is it more expensive to use wind-powered transportation?

	11. Does it take longer to transport goods via wind-powered cargo vessels?
Change management	12. Which stakeholder do you consider most important to advance the development of sustainable energy in the shipping industry?

Table C2 – Interview grid 2: Niclas Dahl, Managing Director, AlfaWall Oceanbird

Topic	Questions
Background on Oceanbird	1. How did the business idea of Oceanbird and the creation of a wind-powered prototype evolve? 2. What is your main motivation? 3. How is the concept of Oceanbird different to other wind energy solutions in the shipping industry? 4. Why did you decide to build a car-carrier as a prototype?
Benefits of wind-powered cargo vessels	5. What potential does the operational adoption of wind-powered vessels have? 6. Do you consider it to be the most promising solution as an energy source? 7. How do you perceive the discussion regarding wind-power in the shipping industry? 8. What do you observe to be the main factors for choosing to implement an innovation? 9. Incremental and disruptive innovation?

	10. How important is wind energy in the shipping industry today? 11. How are you planning to change that?
Problems of wind-powered cargo vessels	12. What factors complicate the development of wind-powered cargo vessels? 13. What challenges do you face in the operational adoption of wind-powered cargo vessels? 14. In previous interviews, safety concerns were raised regarding the operation of wind-powered cargo vessels. Did you face those concerns already? How are you solving/addressing those concerns?
Costs	15. Is it more expensive to use wind-powered transportation? 16. Are you planning on addressing that issue with the Oceanbird? 17. Does it take longer to transport goods via wind-powered cargo vessels? 18. Is this a concern for potential customers?
Change management	19. What do you think is needed to advance the development of wind-powered cargo vessels as the main shipping method? 20. What are potential drivers of innovation? 21. Which factors are central to the operational adoption of an innovation in the shipping industry? 22. Is there a need for a mindset change regarding the implementation of innovation in the maritime sector?

	23. How do you view the future of wind-powered cargo vessels?
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Table C3 – Interview grid 3: Marcel Blaß, Market Analyst, Hapag-Lloyd AG

Topic	Questions
Sustainable innovation	1. With your insight into market developments, what are currently the most promising sustainable innovations in shipping to reduce CO2 emissions? 2. Which factors are central to the operational adoption of an innovation in the shipping industry from a market point of view? 3. What are the reasons for the adoption of other sustainable propulsion solutions instead of wind energy? 4. What role do wind-powered cargo vessels play in the market today and in the future?
Problems of wind-powered cargo vessels	5. What factors complicate the development of wind-powered cargo vessels? 6. What challenges do you see in the operational adoption of wind-powered cargo vessels?
Change management	7. Which stakeholder do you consider most important to advance the development of sustainable energy in the shipping industry? 8. What are potential drivers of innovation?

Appendix D – Interview summaries

Table D1 – Interview summary 1: Prof. Dr. Max Johns, Vice President Research & International Affairs, Head of MSc Business Development & Maritime Business School (MBS)

Table D2 – Interview summary 2: Niclas Dahl, Managing Director, AlfaWall Oceanbird

Table D3 – Interview summary 3: Marcel Blaß, Market Analyst, Hapag-Lloyd AG

Table D1 – Interview summary 1: Prof. Dr. Max Johns, Vice President Research & International Affairs, Head of MSc Business Development & Maritime Business School (MBS)

Topic	Content summary
Sustainable innovation	• Sustainability is the most prominent topic in the shipping industry • There is a multitude of sustainable options: ammonia, LNG, methanol, and the question is whether those are future proof • Wind propulsion is a long-discussed topic, but started to be an increasingly realistic propulsion option only recently • Flettner rotors become increasingly adopted, thereby also more trusted. However, they still represent a niche product and are not widely adopted
Sustainable innovation benefits	• Adapting the routing of ships might be in general beneficial for the maritime logistics industry to pre-calculate any weather effects • Longer shipping time because of wind-powered vessels can save storage costs on land
Sustainable innovation concerns and risks	• Wind-assisted solutions like AirSea's kites were not reliable in the past, as they tended to break

	• Wind-powered solutions are difficult and costly in their realization as maritime shipping companies need to train their crews to be familiar with the new operational system • While technology is no longer an obstacle, two main concerns remain: security concerns and concerns regarding the inflexibility of the operational usage • In the past, wind power was replaced as sails increase instability and thereby made operations more dangerous • The implementation of wind-assist and wind-power solutions limits resale options for maritime shipping companies, thus a great investment risk is connected to wind propulsion • Reduction of storage space for cargo ships
Incumbents' actions	• The overarching topic is economic and concerns the increasing of ship efficiency to reduce costs and as a result carbon dioxide emission. The focus is put on optimizing the engine • Slow steaming is discussed, which means the reduction of speed to reduce emissions. • The industry is currently trying to understand the complex web of alternative energy solutions • A paradigm shift can be observed: in the past, shipping companies used to move as a cohort, but companies start to realize that there will not be a single universal solution

	that fits all in the future. Instead, solutions will be multifaceted and hybrid solutions can be an option • These developments describe a mental change among ocean freight companies
Regulatory actions	• Regulators are increasingly intervening in the maritime logistics sector and a potential speed limit for cargo ships is discussed • Regulations are regional and national • The International Maritime Organization (IMO) focuses on regulations to reduce CO2 emissions • Regulations can be considered an innovation driver as they create the necessity for transition
Societal actions	• A consumer related push towards sustainable operations can be observed • Business clients have their own sustainability agendas, which they need logistics companies to comply with

Table D2 – Interview summary 2: Niclas Dahl, Managing Director, AlfaWall Oceanbird

Topic	Content summary
Sustainable innovation	• Great concerns regarding CO2 emissions can be observed, which are closely related to new fuels • However, while biofuels have a great exhaust, they currently still produce CO2 emissions in their production

	• It is highly important to understand the different solutions at hand, as well as their differences to choose a sustainable innovation that fits the needs. There will not be one solution for everyone • Discussed innovations are slow steaming and wind-assist, both are not optimized • Currently, wind propulsion still needs to proof its reliability and security
Sustainable innovation benefits	• Hard wings, like the ones Oceanbird is implementing, can operate under almost any wind condition • Flettner rotors work well as a wind-assist • Hard wings can potentially lower costs, if used on the right routes • The increasing fuel price and the insecurity of fuel prices can be avoided through the implementation of wind propulsion, which is free and does not need an additional infrastructure
Sustainable innovation concerns and risks	• Flettner rotors are limited to being a wind-assist option and cannot power ships on their own • Ship operations for wind-powered vessels differentiate from fossil-fueled vessels and an understating of the complex performance of wind is crucial • Biofuels are low in efficiency and high in costs

Incumbents' actions	• Maritime shipping companies like Alfa Laval and Wallenius are increasingly investigating sustainable propulsion solutions • However, the ocean freight industry is a highly conservative industry and companies are reluctant to make the first move
Regulatory actions	• Regulations are an important innovation driver
Societal actions	• Business clients are heavily concerned about their environmental impact and put pressure on shipping companies to operate sustainable

Table D3 – Interview summary 3: Marcel Blaß, Market Analyst, Hapag-Lloyd AG

Topic	Content summary
Sustainable innovation	• There is a multitude of potential sustainable innovations that can transform the maritime logistics industry • Currently, shipping companies make use of transitioning fuels like LNG • An aerodynamic ship design is used to become more efficient
Sustainable innovation benefits	• Small innovations are needed to achieve the bigger goal of sustainable operations
Sustainable innovation concerns and risks	• Wind-power solutions reduce the capacity of container ships, thereby highly costly

	• For ship crews to be able to operate wind-powered vessels, new trainings are needed • Ship crews might face a greater risk of insuring themselves on wind-powered vessels, as they are not familiar with wind propulsion • Employees and managers are overwhelmed by the complex options of sustainable innovation
Incumbents' actions	• Regulations have increased pressure on incumbents to change their processes and transition towards sustainable alternatives • The maritime shipping sector takes inspiration in other industries, like aviation, which are more advanced in their sustainability transition processes • Leading carrier companies, like Maersk, make first steps towards sustainable propulsion by for example ordering methanol powered ships, although this solution is not yet fully developed • A granular transition processes can be observed
Regulatory actions	• The legal framework is becoming stricter regarding sustainability in industries • From the 1st of January 2023, the SFDR will apply to the logistics industry

Societal actions	• Society reacts to innovation that is tangible, thus the slow adoption of wind-powered solutions and biofuels creates an increasingly resonance among the population
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Appendix E – Color-coded interview transcripts

Figure E1 – Color-coding legend

Table E2 – Interview transcript 1: Prof. Dr. Max Johns, Vice President Research & International Affairs, Head of MSc Business Development & Maritime Business School (MBS)

Table E3 – Interview transcript 2: Niclas Dahl, Managing Director, AlfaWall Oceanbird

Table E4 – Interview transcript 3: Marcel Blaß, Market Analyst, Hapag-Lloyd AG

Figure E1 – Color-coding legend

Color	Cluster
Green	Sustainable innovation
Turquoise	Sustainable innovation benefits
Red	Sustainable innovation concerns and risks
Pink	Incumbents' actions
Blue	Regulatory actions
Yellow	Societal actions

Table E2 – Interview transcript 1: Prof. Dr. Max Johns, Vice President Research & International Affairs, Head of MSc Business Development & Maritime Business School (MBS)

Carlotta Rehrmann: Thank you very much for taking the time for this interview. Can you start by giving me an insight into your professional career and describe your current position?

Prof. Dr. Max Johns: I started in the shipping industry in 2005 and worked for the German Shipowners' Association. There I was responsible for everything to do with shipping policy, which included a lot of environmental issues, as well as social policy. I was the press spokesman and managing director there for many years and then, at the same time, I started teaching at the HSBA on the topic of shipping. In 2015/2016, I took over a chair there and since then I have also been in charge of the bachelor's and temporarily also the master's program in shipping and am now responsible for the Maritime Business School there.

Carlotta Rehrmann: Thank you very much for the overview. I am particularly concerned with sustainability strategies and more specifically with the sustainability of wind-powered

cargo ships. Nevertheless, can you give an overview of other possible promising innovations in the shipping industry that deal with the reduction of CO₂ emissions?

Prof. Dr. Max Johns: Well, first of all, sustainability is, I would even say, the predominant topic in shipping at the moment, so how to reduce fuel or CO₂, which is directly correlated.

The employment is on different levels. Once regulatory very strong, because there are regulatory interventions. There are also strong savings needs, on the part of the industry and therefore there are also many, self-motivated savings and that blends together. So there are a lot of operational considerations, for example, how to manage routes better and other aspects in that direction, so issues that initially have nothing to do with the system ship at all, but simply have the better management of the ship in mind, revolve around management issues accordingly. Then there are many technical issues that deal with everything from hull shape to propeller shape and all the way to the engine as a central unit, to make these points more efficient, all the way to the funnel. It's all about how to emit as little exhaust as possible through the smokestack, or filtering and binding that appropriately. And then there is the very large area of policy, which is national to a very limited extent, but is mainly driven regionally. That means by the EU or in the South China Sea or around North America. Then there is also the IMO [International Maritime Organization]. Everybody is hoping that then really big great regulations will come out of the IMO. These are the various political dynamics that are going on, which are not at all interested in the efficiency of ships as such, so that shipowners can save more money, but which are exclusively concerned with the efficiency of CO₂ emissions. That correlates strongly, but not completely.

Carlotta Rehrmann: What factors, apart from efficiency, are particularly important when it comes to selecting or implementing innovations? Are there other criteria that are used to decide which technologies or even innovations should be used operationally?

Prof. Dr. Max Johns: Between 2005 and 2020, there was a big focus on getting the ship in better shape and optimizing it with all the details that go with it. Originally it was about emitting less sulfur, but now it's very much driven by saving CO₂. In 2012/2013, that shifted strongly towards the engine and that since then people have been thinking about whether they can't reduce CO₂ with better and fewer fuels. As I said, that all blends together a bit. In between, there was a phase in which it was discovered that you save an incredible amount of fuel if you drive more slowly. That's when the topic of slow steaming came up again, which still runs a bit diagonally through all the discourse. When there was way too much ship space available, it was beneficial to just slow down with all the ships. But then, especially in the last two years, there was too little ship space especially in terms of containers. As a result, everyone suddenly went much faster again, consuming exponentially more fuel. That's why the idea of speed limits on the seas keeps coming up from different, sometimes surprising sides, which might then be differentiated according to ship types. In this way, it would probably be possible to save 30 to 40 % of emissions by having everyone drive more slowly. So you wouldn't have to change anything technical, nor renovate anything, but simply introduce a speed reduction. The same applies to driving a car: if everyone drives at 180 km/h, everyone consumes a lot more than if everyone drives at 100 km/h. Emissions don't go down in a linear fashion, but really exponentially. And that's exactly what you end up doing demand-driven on the seas. In shipping, the points of discussion are different, but the most central point at the moment focuses on fuels. There's a meta-discussion about which section you're actually discussing exactly, i.e., whether you're only discussing the ship itself, the

engine, and what comes through the top of the smokestack, or whether you should look at the entire raw material extraction process. In the case of traditional fuel, it would then be about the drilling and pumping of the gas or oil, through the refinery to the moment when the power arrives on the propeller. In addition, some experts argue that you also have to include the construction and recycling of the ship to see how efficient the use of the ship is, thus looking at the holistic picture. This discussion describes the meta-theme. The other topic is now concrete and also the one that most shipping companies are currently dealing with intensively in operational terms, and that is then again more economically driven. Namely, do I use methanol or something else and what can I possibly use one day? Is there a possibility of going in the direction of hydrogen or bonded water, for example with ammonia or bonded hydrogen? Or will LNG [liquefied natural gas] perhaps remain a transitional technology for much longer than is currently believed? Those are the real economic decisions that have to be made today. With every ship you order right now, the question is: what engine do I put in there? Is it dual fuel or triple fuel? And then what fuels do I really want to use for it? Or do I just install one of these engines so that it sounds great and I can write something great on the back, and then in the end I continue to use heavy fuel oil. That's the real question that everyone is dealing with at the moment. And everyone is now trying to understand the quite complex different fuels and is getting deeper and deeper into the really green fuels, into the gray fuels, which sound good, but are actually produced in the classical way again. And that's why it's actually very worthwhile to broaden the horizon a bit, to take a closer look at how the fuel is actually produced. Is green then green or is green actually gray? Is a gray fuel better than LNG? This is the focus of the political and operational debate at the moment.

Carlotta Rehrmann: So it seems that the debate is mainly about biofuels. To what extent is wind an issue then? Wind is a long discussed topic but the implementation keeps getting delayed. To what extent is wind an issue as an energy source today and in the future?

Prof. Dr. Max Johns: It always remains an issue and it's always coming up and becoming more and more realistic at the moment. It's been believed for a long time, but there are actually real projects now. So it was around 2007/2008, I think, at the time when stunt kites were the big thing, when they started to appear a bit on the beach and a lot of people had their own stunt kites. That's why everyone could practically imagine how much power such a small stunt kite alone, which is only one square meter in size and where you are sometimes lifted up even as a full-grown person. There was a lot of activity for Skysails in Germany to implement this on ships so that it would be automatic. However, the Skysails then broke relatively often, and in the end it wasn't quite worth it. But there are still a few projects that are still using it. Strangely enough, what is becoming much more popular at the moment are these Flettner rotors. Completely absurd-looking technology. The fact that you put these huge, thick tubes there, but in fact it's now installed on several ships and has proven itself for several years. As incredible as it looks, it works. There are relatively many shipbuilding orders at the moment that are in the process of being filled, which want to continue to install or set up the Flettner rotors. This does not have a mass effect, but it has already developed a certain broad impact. So there are more than two test ships. Then there are also a lot of projects, and I've now seen the first two or three orders, that are using adjustable sails, which are mostly made of metal or carbon or similar materials, and set up. That seems to be becoming more and more of a reality now. And, at least according to the brochures, then also saves significant proportions of the fuel.

So we are moving in the direction of reality, which for 50 years was always just a dream.

Such projects have been developed since the Second World War and have never been realized.

I also know of projects from the 1980s with very big signs and a lot of hope, but which never even came close to real development. But now there are real orders. In this respect: yes, but it is on a very small level. So it's not the world savior, but there are always a few who really do it and use it.

Carlotta Rehrmann: When you say it's not the world's savior, that probably means it will always remain a niche product. How do you view wind as an alternative to other fuels?

Prof. Dr. Max Johns: I think we are seeing a paradigm shift in shipping at the moment. Shipping has gone ahead and always in cohorts. It's always been actually everybody doing the same thing. Everybody used to sail, and then everybody used coal, and then everybody used diesel first, and then everybody used dirty heavy fuel oil. And the most important change that's actually happening mentally right now is that slowly everyone is realizing that the next step is going to be multifaceted. There definitely won't be one solution, there will be a whole range of solutions. There will be hybrid solutions on many ships, and not just as a transition either, but probably permanently. That's slowly sinking in. That's a painful realization because it's probably also an expensive realization because it also means that the crews on board will have to be trained and capable differently and even more diversely. No one assumes that in 20 or 30 years we'll have the silver bullet solution and then everyone will be driving around with the one engine again. Instead, everyone assumes that we will then probably be driving around with 6, 7, 8 or ten mixed solutions. Then everyone will have to decide. This will vary according to the region of the world and the area of operation. Wind will then actually come

into play, and that makes it much more likely, mentally and practically, that wind will perhaps become a component to be taken seriously.

Carlotta Rehrmann: What are factors that you see right now that still make it difficult for wind-powered cargo ships to be used? What are the hurdles that you still see in particular then?

Prof. Dr. Max Johns: So the most important hurdle is no longer the technology, which is conceivable, developable and realizable. An important hurdle is the safety and inflexibility of the areas of application. Anything that is powered by wind, so whether it's kites or rotors or big sails, everything always has to go up and down and make the ship vulnerable. And that's actually the nice thing since we don't have sails on board anymore, that at least in a storm, the ships don't have that much attack surface. And if I'm using wind in a small area where I can judge everything very well, then that's okay. But if I'm zigzagging all over the place, I can't assess all the different sailing areas, and that makes it more unsafe or dangerous for the crew again. That's why that hesitation factor is particularly big, that you say, "These are always such massive things that I have to put on out there, it feels dangerous at first." And it probably is to some extent. The other point is that when you look at the overall shipping fleet, you have to strongly differentiate where and how it's deployed and where and how the initial investors see the lifecycle of the ships. There are investors or shipowners who say they only want new ships anyway and will use their ships for five to ten years at the most and then sell their ship on. This is a classic mentality issue. With German shipowners, for example, it's a bit of a new-car mentality, where everything always has to be new and nice and shiny. When it's no longer so shiny, you can sell it on the secondary market. If you know that from the start, then of course you limit the resale or resale possibilities extremely. If I

have such a gigantic wind turbine on it that hardly anyone can handle. Even if I say I can save 5% fuel with it. If I can't handle that at all, then it's the opposite, then it's just a hindrance. So I'm probably reducing the residual value significantly with that. That's a problematic question when I look at it from an investor's point of view. Then you also have to see structurally that there are two completely different approaches in the shipping sector. You are probably familiar with this: liner shipping and tramp shipping. Ultimately, either I own the ship and rent it out to someone else who operates it, or I own the ship and actually operate it myself and transport cargo. If I just own it, and I want to rent it out, I probably won't put a sail on it because I don't even know where it's going to be used. And then I can probably only rent it out to very few people. That makes the investment calculation very difficult because then I actually have to have very long-term preliminary contracts. So if I know that I can only use it in the North Atlantic because that's the only place with the right wind, and then suddenly the market there is dead and I have to rent it out somehow to the Pacific, then I can't rent it out there because of the winds. So that poses a significant investment risk. If I'm a line, so whether that's a container line or some other line, it doesn't matter, but if I'm in some regular operation, then the likelihood of using wind energy becomes much higher. Then I also know which trade lane, that is, then I know pretty precisely what kind of winds are there and then I can also calculate to some extent how wind technology is usable there. So if I always have my line in the famous lulls around the equator, then that's not going to benefit me. But if I'm in other areas, it can be sensationally great. I need to know that, too, and I need to know how long I might be operating there.

Then there are the more trivial operational issues afterwards. If I have a large, possibly even a fixed sail on board with masts, then they might get in the way. Would I be obstructing the loading operations or possibly also significantly limiting the cargo space? This is particularly

relevant for container ships. That would be very expensive if I could load 100 or 200 containers less because of it.

Carlotta Rehrmann: So costs are a big factor. What about the type of goods? Can wind-powered cargo ships also only be used to transport certain types of goods?

Prof. Dr. Max Johns: Probably not. If I buy a ship and assume that I can transport 200 containers less on my ship and calculate that over 25 years. I have to set these opportunity costs against the savings. If there were a reduction in cargo, that could of course significantly reduce the appetite for investment.

Carlotta Rehrmann: And because there is also a discussion at the moment about limiting the speed of cargo ships, would it not be a problem if a transport with wind took longer?

Prof. Dr. Max Johns: This is discussed more as helpful. But I can't exactly distinguish whether that's more of an academic discussion or a real discussion. But there has been a discussion for some time whether everything should be broken down into A and B transports. Goods are still transported quickly, especially in containers, so that they arrive in a calculably short time, at least on the classic routes from Asia to North America or to Europe, where the cargo is often technology or fashion. But there are also other goods where it doesn't matter when they arrive. So whether they take six weeks or 18 weeks would hardly make a difference. Maybe even the opposite. I would even save storage time on land and thus save storage fees, thus save costs, if I have a longer delivery time. If I then put the goods on my A route or B route, which is like taking an ICE or regional train, only on a very long route, then in the end it doesn't matter at all. Of course, there are goods where that doesn't matter at all.

They just have to be pre-financed at some point. Whether they then arrive one or two months later or earlier is irrelevant, I only have to get the longer storage time financed and that can be negative or positive. But there are enough goods where that would not matter.

Carlotta Rehrmann: Who do you think is responsible for driving the change towards wind energy. Who are the innovation drivers in the cargo ship industry that have to take the first step in the direction of wind energy? Who do you see as being responsible?

Prof. Dr. Max Johns: I am a strong believer in the free market. I believe that the market remains the most important driver. As soon as things pay off, as soon as a mitigation of costs can take place, in other words, as soon as opportunities arise, many people jump on board quickly. We also see that there are increasingly investments on board that pay off pretty quickly and are then also quickly adapted by many. That's certainly the most important thing. If I realize that fuel costs remain enormously high and I can save 2 to 10% of that by some means, and that's only over five years, then everyone who comes across such a device will buy such a device, whatever such a device might be or even a technology. That's the most beautiful change that happens when the market itself judges it. You will only wait a long time if you hope that at some point the market will lead the emissions to zero. Then people would probably still be discussing it 100 years from now. Therefore, the second important driver of innovation is probably regulation. Something will have to be done to introduce certain constraints so that some investments will start to pay off. I have relatively little faith in subsidies. I don't think it usually leads to very much, except for great and often overpaid pilot projects. That's sometimes helpful, that you can see such a thing in reality and what all works, really and not just on the drawing board. But it doesn't take billions in investment to bring about innovation. Regulatory pressure, for example by putting a price on emissions or the

like, then leads quite quickly to more and more of the currently still too expensive solutions paying off. This can be done fairly intelligently. That the industry - I myself am one of the lobbyists, or have been for many years - then asks for a lot of money and subsidies for it, that's clear. That's a natural reflex of industry, but it doesn't necessarily lead to a lot of innovation. That is perhaps the part that is not necessarily citable, but that would still have to be proven. A few pilot projects, yes, but not too much. So that's not the key driver.

Carlotta Rehrmann: I have a meeting on Thursday with the Managing Director of Oceanbird, which is also a pilot project. What do you think are the critical questions that should be asked in order to understand whether this is a concept that can prove itself?

Prof. Dr. Max Johns: What exactly do they offer?

Carlotta Rehrmann: By 2026, they will build their own container ship that transports cars and is powered by wind. The ship will have stable sails on the deck.

Prof. Dr. Max Johns: I think these are exactly the right projects. The car carriers already look bizarre, but it can't get much worse aesthetically. So I think **the most important thing will be safety**, that I trust seamen on board. Because it's already relatively uncomfortable to sail on a car carrier, because they already offer a huge sail area and are very light at the same time, because they transport a lot of air. So cars are not very dense. So if I compare them to throwing a lot of coal into a ship like that, I've almost filled every cubic centimeter. And with cars, they consist mainly of free space. And that's the problem. That's why I have to build these ships so high that I can get at least a fair amount of weight in there. And that makes the ships very unstable. I have very little draft and an insane amount of what's above the water.

And that's a matter of taste, whether you want to sail through a typhoon with something like that. If there are sails on top of it, I imagine it to be even more uncomfortable. Because that increases the center of gravity again significantly. So they've certainly done the math, but I would feel very uncomfortable. I would actually be very interested in that.

And the other thing that I'm very interested in is how and whether the ships are tailored to certain routes or on which routes Oceanbird expects that to work well, knowing very precisely when, where, what the winds are in the year. And whether that then again has an impact on the ship maybe not really being usable on some trade lanes.

Carlotta Rehrmann: Thank you for this interview.

Prof. Dr. Max Johns: Yes, very nice. Then I also wish you all the best with the master's thesis.

Table E3 – Interview transcript 2: Niclas Dahl, Managing Director, AlfaWall Oceanbird

Carlotta Rehrmann: Can you give a bit of insight on your position and career in the shipping industry?

Niclas Dahl: Yes, so Oceanbird is a joint venture between Alfa Laval and Wallenius. I come from the Alfa Laval site. So, I've been working for Alfa Laval for about 25 years and always in the marine industry. When I started there, a new legislation was coming up for Ballast Water Treatment in like 2010/2011. So, I started the pure ballast system. It was a similar joint venture where you work with sustainable products and how you can clean out ballast water. Then I've been working with the more traditional Alfa Laval where I worked with new types of fuel because Alfa Laval works quite a lot with fuel conditioning systems. So, with these

new fuels there is a lot of talk about the CO2 emissions and simultaneously about ammonia, methanol, and LNG. So that's my background. Then last year, a joint venture was coming up, Oceanbird. I thought it was super exciting and interesting and that I want to be part of that. Today, we have our one-year anniversary for Oceanbird as a company. So, it's really like the first of December last year, I went in as a Managing Director for Oceanbird. We were four persons starting it and today we are maybe around 15 people in Oceanbird that are full time employees and maybe around 15 people working as consultants or from our mother companies helping us. So, it's around 30 people in this. The first year now has been about how to build up the company and how to build up the product. I thought that the product was a little bit more ready when I came in. But basically, the first thing we said was that the first Oceanbird wing doesn't really work. It was a telescopic wing that you would fold down and which was 80 meters high; it was almost a different product. So, we needed to make something different. So, we started off to make a design that would be more feasible for the market. The idea of Oceanbird started in Wallenius and Wallenius is one of the shipowners that has been extremely focusing on environmental developments. 10 years ago, they started to look at how to utilize wind. At that time, it was not really like a firm project. So, it's been more like an idea. Then in 2019 they got fundings from the Swedish government to make a research program project. So, it's been a research project with Wallenius and KTH the Royal Technology Institute in Stockholm and SSPA in Gothenburg. So, they've been working since 2019. And then basically last year they said we've come so far, let's make a product and let's commercialize that product into the market. So that is a little bit the background of Oceanbird.

Carlotta Rehrmann: And what was the main motivation to use wind?

Niclas Dahl: From their perspective, it's been really like, what is sustainable shipping in the future? I think from Wallenius' side, ammonia is not an option. There is a lot of other things, and all these new types of fuel are good for the exhaust, but when you look at the whole lifecycle process of it when you're manufacturing because also ammonia and methanol, it's okay if you're using green methanol. But how will you do that? How will you get the power? For them, it was not really like a full solution. So that's why wind was a quite natural way of going. And I think that also goes a little bit the same with the car technology, I mean, the first car was an electric car, and it didn't have the technology. So, people didn't know how to charge batteries, you know how to handle all of that. So, it became not practical. I mean, of course, wind is not a super new thing to use in the in the shipping industry. We really have that history with wind. But of course, there were practical problems with wind sails. You can't have 40 persons handling the sail and operations. Today, you have more technology and address the question: how can you make this a fully automated system? How can you take the sails down without having a lot of people now that technology is more available and ready for it? So, in that way, I think it made very much sense for Wallenius to really investigate that for the future.

Carlotta Rehrmann: How is the concept of Oceanbird different to other wind energy solutions in the shipping industry? Why did you decide for this strategy?

Niclas Dahl: I think there are a few different technologies, as you say. You have these huge kites, and they work a little bit differently. We investigated several different possibilities you have the kites, and then you have the hard wing sails, which we also have, and then you have these Flettner rotors. And then you could also say you have this suction wings, that this creating like an under pressure, and then you will get the lift. And I think when it comes to

suction wings and Flettner rotors, it's very difficult to go to fully sailing. They work quite as good as a wind assist, but I think for Wallenius it was really like: "Okay, we maybe need to take small steps in order to get there. But the goal is really to make a fully functioning sailing ship and utilizing that." Then we saw these technologies that are the most promising to get there. There could be some routes that would be preferable or maybe lower cost in some segments and for the other parts. Because for them the main thing with the sails is that when the wind comes directly from the front, then it becomes a little bit difficult with sailing. Then we talked about what angle you can operate within. And we say hard wings are by far the ones who can operate with the wind, when the wind comes the furthest from the front. And that's the most common wind that you have. Because what you need to take care of is the apparent wind. I mean, what you really feel there is a little bit like when you drive your car, and you take out your hand. It's very rare that you feel that you have the wind coming from behind. So, the faster you go, the more the wind will come from the front. So, the efficiency must be there. The kite sails have difficulties because as soon as the wind come from the side or front, they can't use it. They need to have the wind always from the back to move forward and that's very rarely that you have that kind of wind. The Flettner rotor is also a little bit the same that they have a limited span of operation. They are extremely good when the wind comes from the side or from the back. But they are very bad or even have a negative impact when the wind comes from the front unless you take them down. So, for us to look at an overall solution, we thought, we think that this is the best way going forward, because we have the most operational time that we can utilize the propulsion solution.

Carlotta Rehrmann: So, with those wings, you can use the wind that comes from the front because you can adapt them accordingly?

Niclas Dahl: For us basically, how it works is that you have a true wind speed and a true wind angle, if you play with the idea that this comes from the front, then when you set some speed on the vessel, the wind will move more to the bow. I mean, that would be just natural as I explained with the car, and then what we do is that we create an angle of attack to where the wind comes from. So, we need to know where the wind comes from which direction and then we move the wing in that direction **to create a lift and a drag**. You want to have as much lift as possible and as little drag as possible when the wind comes from the front side. It looks like an airplane wing, and it also is like an airplane wing that you put on top. And with an airplane wing you of course want to create as much lift as possible. And for us, since we put it upwards, we also want **to create as much lift as possible** but then that becomes the thrust going forward instead. So basically, here you will have a thrust, the lift minus the drag, and if you take the other technology, they normally have a very high lift, but they also have a very high drag. And when the wind come from the back, then then it will be a little bit different because then you will have both the list and the drag, which contribute to a positive thing. That's when other solutions are very effective, because they have a very high lift and drag. So, in that way, you will then end up with more thrust going forward. This is the wind direction around the world. The shape of where the wind comes from all around the world shows that the wind is quite evenly distributed, that comes from all angles and all directions. And if you take this one and then apply speed to that, now we move in here, then suddenly these changes. So, these are **the position where the wind come from, mostly the front**. So of course, you want to be as effective as possible in the front of the shape because that's where you have all the wind probabilities. If you then take 12 knots, the wind moves even more to the front, and then you will be less able to utilize your wind propulsion solution unless you're active in that area where the wind comes from the front. So, this is how you can play and how you can understand the difference of it and the different technologies. And that's why

it's so important what kind of route you have for your ship because if you have a lot of wind coming from the side and from the back, depending on where you operate, then maybe a Flettner rotor is more effective than a hard wing. I think there are different technologies who respond to different needs and that's why it's important to understand the different solutions and choose depending on your needs.

Carlotta Rehrmann: And why did you decide for a car carrier as a prototype?

Niclas Dahl: Wallenius is a ship owner, and they have 130 car carriers. Since that is our mother company, it became quite natural to go with a car carrier. But our ambition is more to start there since we have access to the ships. We do the wings, but we don't do the car carrier. So, for us, when we design that, we design only the wings and then the full concept of the sailing ship is done by Wallenius themselves. Another reason why we selected car carriers for the beginning is that different ship types have different problems, and some things are simpler, and some things are more difficult. Car carriers have the great thing that they always have the bridge at the front. So, these things regarding the discussion about line of sight meaning that you can see in front of you, that doesn't apply for a car carrier, because you will always be in front of the sails. Another good thing with car carriers is that there the deck level is very high. Because otherwise you have this what's called green sea that when you have very rough sea and the waves are going over the deck, then you need to design your equipment, so it can last for a lot of loads from the water. But since they are so high up, then you don't need to design for that. So, it makes it a little bit simpler in that way. The downside with a car carrier is that it's quite unstable. From a stability point of view, you need to be a little bit more careful how you interact and handle the ship. And then how will you reinforce

the big haul. How will you reinforce it to use the power that you get from the wind moving forward.

Carlotta Rehrmann: How are you ensuring stability with the hard wings?

Niclas Dahl: We have some good experts in the team who are naval architects. So that's a very narrow study. You need to go in regarding the effects if you put one or two or three wind sails on an existing ship. How will you handle that? Ship operations also become a bit different because you need to investigate the router. We also need to investigate how much it allows for us to list. I mean if you take a normal sailing vessel when you are sailing then they are always laying on the side quite a lot that is not very nice when you're on a on a ship. We can have a maximum list of five degree, which is quite small so they [the ships] are not working like a normal private sailing boat because these cargo vessels will be still very stable and standing up so that's why we need to calculate otherwise you can get cargo issues, meaning that cargo moves around and people who work on the ship they don't like when it's constantly in that list position.

Carlotta Rehrmann: What potential does the operational adoption of wind-powered vessels have?

Niclas Dahl: I've been working quite a lot with other solutions in the past. And it's always easy to get a little bit blinded with what you do yourself. I have always been a little bit reluctant to both methanol, and ammonia, because there are several reasons for those that I don't really see the clear way forward. I mean, what everyone talks about now, when they are reducing CO2 emission is either you go with the new fuels, or you reduce the speed for the

CII. Or you could go with a wind solution. Then you have carbon capturer and other things. But that's a little bit more unknown technology, I would say. So, we're not there. But for the other parts, I think there are still quite some big question marks. **how do you produce these new fuels?** What will be **the price for them in the future**, and the **efficiency** of those. **Methanol has half of the efficiency** basically, which means that you need to have double the size of the tanks. Ammonia is a little bit the same. If you talk about one or 2000 Euro per cubic per ton of fuels, you need double the fuel, and the **price will be quite substantial**. Wind has great potential in that way, when you have wind, of course it's not very good when you have no wind. So, you have those kinds of **combinations**, I think one will enable the other because if you're going to run it complete on ammonia, then you will have a lot of problems going with that from a cost perspective. If you **go only with wind and have nothing else, it's very difficult to have a fixed arrival time**. So, I think, to do a little bit of both, that will be a very good combination in the future. **It's not one silver bullet that will just take over everything**, in my view. And then of course, you have biofuels, which is interesting. I would expect that **with biofuels, it will be very difficult for everyone to get a hold of them** because that will be very much used on land base. So where will that come from? I think that's maybe a trickier one. And then there is the question of **reducing the speed**. From a CII perspective, it makes sense. But I don't really understand how they calculate the effect. I talked to one owner, and he said, okay, if I'm going to reduce the speed with 1.3 knots, **I need to build 10 new ships, if I still want to do the same amount of cargo handling**? And is that good for the environment that you build 10 more ships? So, speed is of course an important factor in in this as well.

Carlotta Rehrmann: You worked with a lot of like different innovations. What are the main factors you observe that are important for choosing an innovation and implement it? And how is this regarding wind energy? What is the response in the industry?

Niclas Dahl: The safety aspect is by far number one. **Cost and safety are the two focus points.**

When you investigate it, what is the return on investment? And you want to make sure it's safe. I think that goes a little bit against ammonia, because if you have a small leakage, I mean, it's a real nasty thing to handle. But also, for wind solutions. I mean, that is also for us, we need to make **sure how do we get down the sails**. I mean, we are sailing up to 20 meters per second or around 14 knots. Above that, then we fold them down. So, we need to show from **a safety perspective**. How will you fold them down when you have a speed of 20 meters per second? Can you fold them down even if something breaks or if you have a blackout on the ship? So, it's about building up **a safety policy** because I don't think you want to have the big sails up when you have a big storm then you would feel safer when you get them down. I must say that **the marine industry is maybe one of the most conservative fields or industries**. And many owners I talked to say: **"I would really love to just continue as I've always done."** And that is always the perception of it. Because that you know, it's working, and it's something you're used to. I think, in this case, you need to do something, that's not an option. And that also opens the possibility for new kinds of technologies to come in. Because that would mean that you can't continue the way you used to. So, you now need to select if you want to buy ammonia or if you want to buy wing sails. So, it's easier than to discuss new technology.

Carlotta Rehrmann: Since you already mentioned that it's quite conservative in the shipping industry, are there other challenges that complicate the development, because it's a nonconventional approach?

Niclas Dahl: Legislation is a major driver, and of course also high fuel price. Then it becomes very interesting to use wind. We want to change the world, we build up the whole company, but we don't have the humble approach, we will want to change everything. And I think if you're going to do that, it must be a good incentive for others to use that. I mean, you must make money on it as a buyer and user, and we must make money on it. So, it's a win-win situation. If it is only banning or legislation then in the long run, you will always find a solution. But if you can really show that this is profitable for you, because the fuel price is a huge part of the cost for a ship. And it's very difficult to beat free energy. I mean, wind is there, and it's free. Unless someone finds a really good way how to tax wind in the future, you will always have free energy. And I think that's one of the strongest sales arguments that you can have. And that means that you're less dependent, the new fuels have a price, but then it's also about building up logistic. I mean, when everyone started going with LNG, then you need pressurized tanks, you need to know how to handle all of that you need a fuel distribution. Here, you harvest the wind directly, and you take it down and you get 100% power out of it in the shape. So, you don't need the infrastructure. You don't need all of that. So, those are, I think, great things that are beneficial in wind compared to the other solutions.

Carlotta Rehrmann: And are there any challenges that you face in the operational adoption of wind-powered cargo vessels?

Niclas Dahl: We have the advantage that since we are owned by Alfa Laval and Alfa Laval owns a company called StormGeo, which will do the routing for the ships. So of course, we work quite close with them to set up the routing. Normally when you route the ship, then you would route it to avoid wind. So, I told them to do as you always do, but the opposite since we want wind. And then that's of course, a challenge. And there are, of course, a lot of

different types of challenges in how to operate, how to fold the sails down, how to work from a technical point of view and safety point of view, and how to handle the stability and all of that. Basically, you could say that anyone can do the wing, but then how do you operate that because it's the performance of the wind. It has very much to do with, how good are you at measuring where the wind comes from. How good are you to optimize the usage of the wind present? All these control systems, how it works in an automatic way. I think that is one of the biggest challenges to find the optimum for it. You will get a lot of stress going forward even if you're not optimal, but better to take it to the next level. How do you know whether you have the right angle of attack for the wind? Our wings 40 meter high and even so if you have a 40-meter-high wings and you measure the wind, the wind will come from different direction and different heights. How do you optimize that? There are of course some challenges how to optimize the system and trim the system. It's very few products that work perfectly the first time they come out. We will learn more and more during this process.

Carlotta Rehrmann: Are costs also an issue? Is it more expensive or is it even less expensive to go with a wind-powered cargo vessel?

Niclas Dahl: I mean, if it's not less expensive, it's out of business in the in that way, so it depends a little bit on what to calculate into that. So of course, the investment cost is normally going to be higher, but you will save money since you have no fuel costs. If you think back on methanol carrier or propelled ship, I think they normally talk about 5 million euro as an extreme investment because it's around 3 million more for the engine and then you have systems around it for 2 million Wing sails would be less than that and then you'll save half the cost of the fuel. So, it depends on what to calculate into the business case. If you take one ship that goes today on oil, and you put in a wing and ask how fast I can get the return on

investment then it depends very much on which route you're going. If you're going a lot on open sea, it will go quite fast to get return if you go a lot in the Baltic Sea or Mediterranean where quite little wind it will most probably take a very long time before you can say you have earned back your investment.

Carlotta Rehrmann: Are you planning on always using the ships on the same route?

Niclas Dahl: I think this is what's interesting with the car carriers. Because if you take the car carrier, they normally have a fixed route, so they normally go to South Korea and pick up and then they go to Japan, and then they go over to the US, and then they go to Europe. So normally, they have like 10 or 15 different passages, and some of them are good in wind, and some are not so good or they're too short. In those cases, you might not even put up the sail. That is something we're discussing. You have vessels going on these rounds in the Atlantic where you have very good wind conditions. And then you take other vessels from the point where no wind is available. So, I think that will be those possibilities going forward that you will optimize it. If you have long routes over open sea and far away from the equator because the equator you have very little wind. So, I think that would be one way to make sure that you can use all routes.

Carlotta Rehrmann: But then you always considered hybrid solutions, right?

Niclas Dahl: Yes, you will always end-up in that because you also need electricity on board. So, I mean, you always need some kind of engine to do it. And you will have times when you have no wind. And I think very few want to sail into a port and stuff like that, just from a safety perspective. What can really make a difference is that maybe then it's okay to have a

much smaller engine than you have today. Today, when you talk about wind assist, you have a fully proportional engine and then you put up a sail to reduce the usage a little bit. So, it's not really optimized for yet. But in the future, if you have a newbie then you can decide in the beginning that you take a smaller engine to be able to reduce CO2 emissions further.

Carlotta Rehrmann: What do you think is needed to advance the development of wind-powered cargo vessels? What are main stakeholders that you think need to adopt the innovation for it to become more used?

Niclas Dahl: I think legislation is very important, for sure. I also think people because one interesting part with the car carriers, is that the car manufacturers like BMW, Mercedes, Volvo are then our customers. And they love to show that they have electrified cars that are also transported with a minimal impact on the environment. And I think there is a wow factor with a wind solution where you have a big interest from the consumers. Because with cars it is not that important whether they arrive a few days later. It can take one year when you're ordering a car and then it's not important that it goes 12 days over the Atlantic instead of nine days. I think this is also to get the consumers understanding that what is most important is to have an environmentally friendly logistics chain. That could be one thing on how to drive the implementation. I think consumer are very important in this because they will then put the pressure on the car companies, and they put the pressure on us. I think that is a very important part. For us, it's also very important to show that this is reliable, and the technology is ready today. Everyone talks about the future, but this is a technology that is already here. And it's now. So don't wait because the only way we develop things is by trying things, learning, improving. Alfa Laval will not say that this will be the first wing and that will be the best solution that you've ever had. I mean, there will always be more to learn and then you will

interact. But if no one wanted to be the first one, it's very difficult to develop it. So, I think that is one of the key factors that need to give the assurance and show that this is the way forward and we do it in a serious way.

Carlotta Rehrmann: That's a good summary of what needs to be done. Just to sum it up: What do you think is the future of wind powered cargo vessels?

Niclas Dahl: Of course, we would like to see an armada of wind-powered solutions, but to be realistic, I think there will be a lot of the wind-powered assist. It makes very much sense. I think it's also important to have other solutions to use also as a complement to other technologies. Because you want to change it, change the shipping, and want to change the work for a better environment and sustainability. And we need to be open and look at all different solutions and make the best out of where it makes most sense. You can say that wind will take over completely, but I don't think that's the right approach. I think we need to look at it from a more practical perspective and that means we will have hybrid solutions.

Carlotta Rehrmann: Thank you so much for taking the time and answering all those questions.

Table E4 – Interview transcript 3: Marcel Blaß, Market Analyst, Hapag-Lloyd AG

Carlotta Rehrmann: Could you introduce yourself and your role a little bit in more detail for me?

Marcel Blaß: Yes, sure. So, my name is Marcel Blass. I work with Hapag Lloyd now for five years and I'm in the market intelligence team of Hapag Lloyd. So that means that we are

looking at the market and not at internal figures or something, but rather, try to find out what is the market doing what current developments out there either supply related or demand related? And in the end, we bring that together with internal views so that we get a view, how does Hapag Lloyd stand regarding competition topics?

Carlotta Rehrmann: So, what are current market developments that you observe regarding sustainable innovations in the shipping industry?

Marcel Blaß: Currently, we are in a very exciting phase, I would say, because there's a sustainability push on two sides. One is, of course, the consumer related sustainability push. So, our customers are actively asking for sustainable measures. And the other side is the legal framework that is changing. So, there's kind of the force to change, which is also good, from my perspective, because otherwise, you have the chicken egg problem. So, who's changing first? So, the industry or the regulation? What is out there, from my perspective, there is no such things as one solution that currently exists that would solve all our problems. So, they're all small working streams, and the ones that I'm most familiar with are of course, what type of fuel should you use. So, the developments around different types of fuel like transitioning fuels like LNG, which reduce emissions a little bit but do not work perfectly, because they also emit some CO₂ or other gases and so on. There is ammonia, it's just a different fuel, which also has pros and cons. There's methanol, so another fuel, which you could produce CO₂ free, but which is currently not yet produced CO₂ free. So, there are a lot of small projects around this. And other than that, there are of course a few projects and topics around, how you can make a ship more efficient. So that means by just looking at the design, for example, you could also change the design a little bit, and then you would save something

like 10 to 20% of the emissions that you currently have. And a lot of startups arising in this sector and coming up with new topics, and a lot of research is done.

Carlotta Rehrmann: What do you think are factors that are central to the adoption of those innovations? Do you have any insight on that?

Marcel Blaß: That's a difficult question to answer because that's also a little bit about the strategy of each carrier company. And when I talk about the shipping market, the shipping market is more or less the container shipping market. So, I know there are other ship types out there. And for other ship types, there are also other solutions out there. But when I talk about the shipping market, I mean the container shipping market in general. And regarding your question, it depends a little bit on the legal framework and the strategy around that. So, I think currently as I said this is a very exciting phase because now with the start of 2023, there are especially in the EU some regulations coming into place and there's also a new regulation that the container shipping would fall under the EU quota system. So that means you would have to deal with CO2 licenses in the end. And this is something that forces carriers to act because now suddenly, there's a price tag attached to it. Not only a price tag that could happen in like five years or something like this, but it's an actual price tag for next year. And so, this heavily influences the behavior, also the attitude regarding innovative solutions.

Carlotta Rehrmann: What do you experience, because now you talk more about biofuels, methanol, and so on, what are the reasons that those are more investigated than wind energy solutions?

Marcel Blaß: When we are looking at container shipping, again, the issue is that there are a lot of ships and a lot of containers that are moving around. At least what I know about wind solutions, you always have the struggle that you must place it somewhere on the boat, because you must put the solution somewhere. And then container shipping, it's all about getting bigger and getting more efficient, being able to transport a lot of containers. And as soon as you implement the wind power solution, you would dramatically reduce the capacity of a ship. And compared to if you drill down the costs of a voyage per container, it increases dramatically. Because if the bigger ships can carry like roughly 24,000 tons of useful small containers. And if you would install on such a big ship, the Wind Power Solutions, at least from what I heard, you would reduce the container capacity, and cut it by a half. And this, would lead to the fact that it's much more expensive. And it's not even sure that such big ships would be able to just be powered by wind. But I'm not so deeply into the technical details there. That's just what I heard in the industry. And because there were several projects around this and all the time this idea comes up again, because it's an old idea to sail the ship by wind. But in the end, they always fail to integrate it at least in container shipping.

Carlotta Rehrmann: So, there is a difference between container ships and car carriers?

Marcel Blaß: Yes, exactly. So, I mean, of course, also, container shipping is looking at different sectors, just to make sure that you also search in other industries, for example, also aviation industry, of course, but also other shipping sectors. Is there a good solution that you could somehow adapt and apply to container shipping? But all those wind solutions that are out there, or another solution would of course be an electrical propulsion, or nuclear propulsion or something like this, the ideas are all there. But so far, they are not applicable to container shipping, just because they need so much space, or the risks are so high, or for

example, with electric propulsion, you would need so much engine space because it's a lot of capacities and the container carriers are going all around the world and not just like a ferry in between two ports, but rather, they're also around the world loops that take 120 days.

Carlotta Rehrmann: We already talked a bit about the problematics with the wind energy solution. What factors complicate the development of wind-powered cargo vessels?

Marcel Blaß: At least for some old solutions that were presented, there were some risks attached to the crew of the vessel because, of course, they would need to be trained in a different way. That's also true for alternative fuels like LNG and methanol, and so on, because they all have different regulations. And so, you need to train the staff. But I think there's a higher risk that they could injure themselves. And then it gets more complicated to hire those crews, and then it gets more expensive again. And so, this would be another factor. And I guess the biggest factor next to the space is also that container ships are quite heavy and quite big. And so, from an engineer perspective, it must be very complicated to find the proper solution how to do that with wind turbines or kites or whatever solutions are out there for ships.

Carlotta Rehrmann: What about routing? Is that also more complicated for wind energy solutions since you might have to adapt routes according to the wind.

Marcel Blaß: I guess that would be a problem because it's sometimes also about transit times, which play a factor. So, in case you would have one carrier that only uses wind and another one that uses another propulsion, you would have to not only compare, like the costs per container, but also how fast can you ship and how reliable can you bring cargo from one place

to another? Because a lot of supply chains are designed in a way that it needs to function every week. If you then just skip one week or two weeks, just because there was no wind and vessels sailing somewhere on the ocean, then it gets complicated also to sell containers.

Carlotta Rehrmann: With your insight into the market dynamics, can you observe a push from a specific stakeholder? Like consumers, businesses or so?

Marcel Blaß: Most of the cases, it's B2B, so business to business. Our biggest customers they are not the ones consuming the products, but rather, they are offering products to the end customers. So famous examples, like IKEA, would be a customer for us as a shipping company. And they are also pushing for sustainable measures. Probably because the end consumer also wants to see something. But some companies also have their own sustainability agendas, and so they are pushing in shipping. But next to it, there are also some carriers within the shipping industry that keep pushing on sustainable goals. Because, as I said earlier, there's the chicken egg problem. So, if there's no worldwide regulation some carriers will just offer the cheapest solution and if other carriers go for the sustainable solution, then the question is: is someone willing to pay for that? And if the answer's no, then there must be a regulation that everyone must be to some extent sustainable. Otherwise, no one will change because you will get pushed out of the business. Then the interesting new phase because now some carriers are ordering ships for green methanol, which is not yet there. So, it's not yet produced, the fuel does not exist, but they ordered the ships already, because also there's the chicken egg problem like what must come first the demand because there are vessels out there that are demanding the fuel and so the infrastructure must be built up. Or should the infrastructure come first and then the vessel demand will come and everyone will bring vessels into the service. So far nothing happened over years. But now

carriers decided to go for it and order vessels, and it probably takes like three to five years until they are ready because they need to be built. So, it's not something like you decide today and tomorrow you get the ship. It's rather a big project and they must be build. So, we now have three or four years until infrastructure must be ready so that the vessels can go on such few types of energy.

Carlotta Rehrmann: Is Hapag Lloyd also exploring those options?

Marcel Blaß: Yes, but there are carriers that are more aggressive. So, the most famous example is **Maersk**, it was, for several years, the leading shipping company in terms of size. Now, they are only the second place in terms of size, but they are the ones **that ordered the most methanol vessels**. So, it's basically a strategic decision also, because the question is: do you go for one specific fuel type? Do you go for several? Do you wait until someone else does the first step? So, there are **a lot of differences between the carriers. Hapag Lloyd is naturally not really a first mover**, but regarding sustainability, they do a lot. But such a big step like ordering ships without the infrastructure that's not the Hapag Lloyd way of doing it.

Carlotta Rehrmann: Who do you generally think needs to do the first step to make space for innovation?

Marcel Blaß: I think someone and that's the big challenge. So, I would not say that it must be the carriers all the time, or the suppliers or the customers, it must be someone. And when someone does the step, the others must follow very soon, and they in the end everyone must agree on that. Because if someone out of the whole cycle says nice idea, but I wait a little or I still purchase the cheapest option, then that comes the big question. Do others follow?

Because they see, like the example of Maersk, they invested it now and then the ships are ready, but there's still no infrastructure and three or five years, then of course, it will be harder for everyone else to follow. Because they say, you invested \$100 million, but now your ships are not sailing, because they don't have the fuel.

Carlotta Rehrmann: So, it's a lot about looking what others do and then following in case it works out. But there must be one person taking the initial risk.

Marcel Blaß: Exactly. It's a little bit like game theory or decision games. So, the question is, who moves first? And what are the others doing? And are all keeping their promises that they do now? I think a **very big role must play worldwide regulation, because otherwise it will get really complicated to get a good result for everyone.** Because then **carriers** they come from **very different cultures and countries.** The word of shipping is worldwide, it's globalized and need to work everywhere.

Carlotta Rehrmann: How do you perceive the reaction to this? Is there any reaction internally of people who probably have to change their own working routine?

Marcel Blaß: Definitely. There's also some excitement around this, because it's a new topic, you can do a lot of research. But you can get **overwhelmed** very quickly **because there're so many solutions.** And then there's the question, **what brings the solution for us.** Every time there are news about sustainable projects in our internal intranet tool, there are a lot of likes around that and a lot of reactions because people also identify with the company in case you do a lot and such things. And recent examples are **that Hapag Lloyd decided to upgrade the fleet. So, 150 ships will get into the repair yard over the next years, and we'll get efficiency**

measures so could be something like a new propeller. And such a small thing sometimes saves up to 15% of fuel consumption and therefore also CO2 emissions. That's getting a lot of attention. And it can be both overwhelming and fulfilling the desire to finally make a move towards innovative sustainable technology.

Carlotta Rehrmann: How do you imagine the future regarding propulsion types? Before the industry used to move all together from sailing to fossil fuel. Will this type of movement remain?

Marcel Blaß: I would expect more granular approaches. So, in the sense that there's no one size it fits all solution like today, it will be rather very specific for trades, for vessel types, and so on. At least, that's my impression right now, because there are also a lot of development streams around that. In the very early development stage, you already see advantages and disadvantages that apply to certain extent to certain areas of the world, to certain countries, to certain vessels. In the end, it might happen, that the infrastructure will be slightly different than today. The question is always with infrastructure that it's not so fast to change. So, the question is, who's doing the first step there again? So, is it the countries and the infrastructure, the port and terminals that change? Or will it be the ocean carriers or the consumers that demand something? We have some systems where we can look up some things. And then just because I was curious, I also looked up in the non-container shipping market, how many vessels are there currently that are using wind propulsion? It was currently 20 large vessels in the sense that they are not so small that they only go from one port to the next river or something like this. But it was interesting to see that there are already 20 large vessels, but mainly tankers bulk carriers and vehicle transporters. Those are basically the ones that are not using the open space on top of the ship. Because then they can place something there

since it's not used. But that does not account for container shipping. It's also not only the propulsion all the time where wind plays a role. If you have containers stacked on your boat, and they are, I don't know how many meters high, but quite high. When there comes wind from the front, it also hinders you to go forward, because when you have wind coming from the front, then you need to use more fuel to have the same speed. And there are also solutions out there that are just placing like a plane in the bow of the ship. So basically, something that is more aerodynamic than the containers that are placed in front of there. So, you get a shield. That is also supposed to save some fuel and CO2 emissions. It's a small innovation, but at least it's an innovation.

Carlotta Rehrmann: So, it's usually small innovations and implementations that are done to move towards the bigger goal, right?

Marcel Blaß: Exactly.

Carlotta Rehrmann: Do you have anything else to add that I didn't ask and that you feel is relevant for the discussion?

Marcel Blaß: Maybe the only thing that I can also add because I also thought how is the container market actually doing compared to a few years ago, and how we can be save CO2 emission. And another very simple solution, it's not innovative, but a simple solution is to go slower. With slowsteaming, ships are now going slower by 20%, compared to, you know, 15 years ago. And that's also something which people don't realize because there are more and more ships out there. But they are all going a little bit slower. And that saves some energy. So sometimes simple solutions have a lot of impact already.

Carlotta Rehrmann: Thank you so much for all these insights, it was helpful to get a better understanding.

A Work Project, presented as part of the requirements for the Award of a Master's degree in Management from the Nova School of Business and Economics.

The Future of the Logistics Industry in the European Union

An outlook to 2032 supported by current and upcoming market trends

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Work Project carried out under the supervision of:
Professor João Silveira Lobo

Abstract & Acknowledgments

Abstract

This work project develops an outlook for the future of the logistics industry in the EU until 2032 and provides strategic recommendations for logistics managers. An analysis of the transactional and contextual environment is conducted based on primary and secondary research to generate future scenarios. The stability of the geopolitical and economic landscape and the density of the technology network are identified as critical uncertainties. Based on that, future scenarios are developed. Strategic short- and long-term options are recommended for different scenarios. Finally, early indicators are developed, helping industry stakeholders to monitor the environment and anticipate which scenario unfolds.

Keywords: Strategy, Strategic Foresight, Scenario Planning, Logistics Industry, European Logistics Industry.

Acknowledgments

This endeavor would not have been possible without the support of several people. We express our gratitude to Professor João Silveira Lobo for providing us not only a sense of orientation and technical expertise but also for his invaluable patience and feedback. We also thank all the interviewees who took the time to provide insightful testimonies and who contributed so thoroughly through their deep expertise and perspective.

“Logistics is notorious for being an old-fashioned business, but changing shipper expectations, new market players, and eroded margins have prompted industry leaders to reassess strategies.”

- Zvi Schreiber, Freightos

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01

Introduction

Problem Statement and Relevance
Research Methodology
Focal Question and Time Horizon
Project Scope



In times of rapid change and critical uncertainties in the EU logistics industry, strategic foresight & scenario planning is helpful to develop robust strategies

PROBLEM STATEMENT AND RELEVANCE

- The European logistics industry and logistics service providers (LSPs) are being shaped by various trends in society, technology, the economy, the environment and politics, as well as by changes in the industry itself (STEEP+I drivers of change).
- Today and over the next decade, logistics companies will be challenged by several drivers of change and uncertainties which they need to be aware of.
- Scenario planning, based on critical uncertainties with high impact, provides a powerful strategic foresight tool for logistics companies to imagine alternative futures and develop strategic recommendations.
- Scenarios are the basis for strategy formation while early warning signals can help players to foresee changes in the industry and adapt to them by identifying the best set of strategic options.
- A monitoring system tracking the development of relevant drivers of change aids LSPs to better predict disruptive forces and transform successfully.

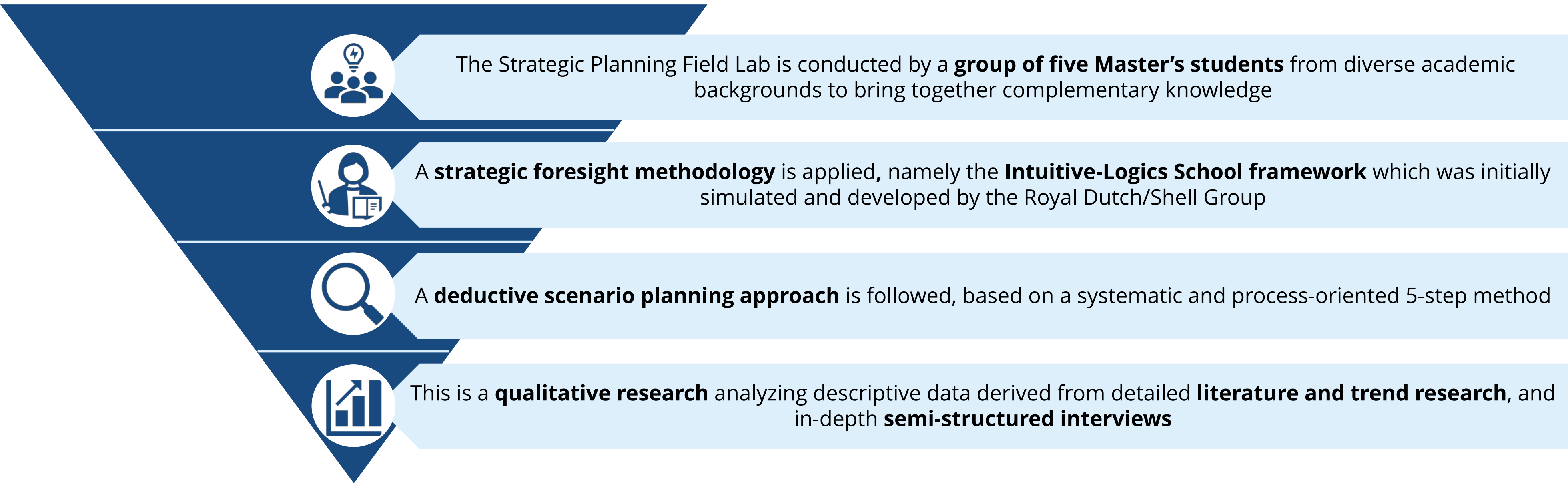


The research methodology is based on a pragmatic stance and follows a foresight methodology through a deductive approach and the analysis of qualitative data

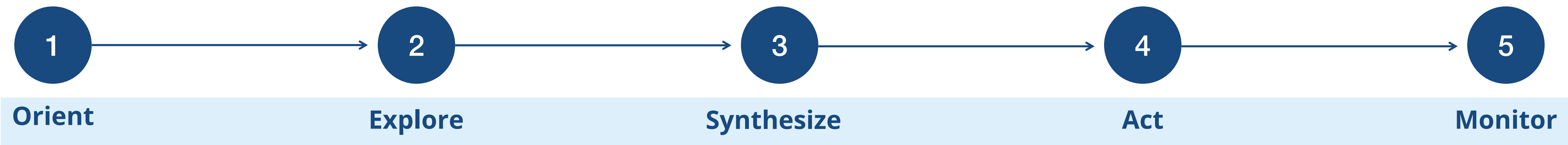
Research Paradigm

A **pragmatic research paradigm** is relevant for qualitative research on organization processes. It puts an emphasis on actionable knowledge and analyzing the value and meaning of research data by examining its practical implications.

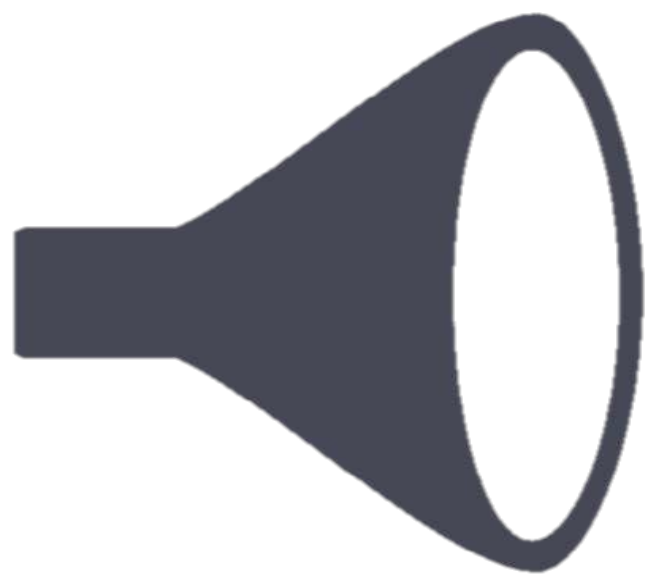
Research Approach



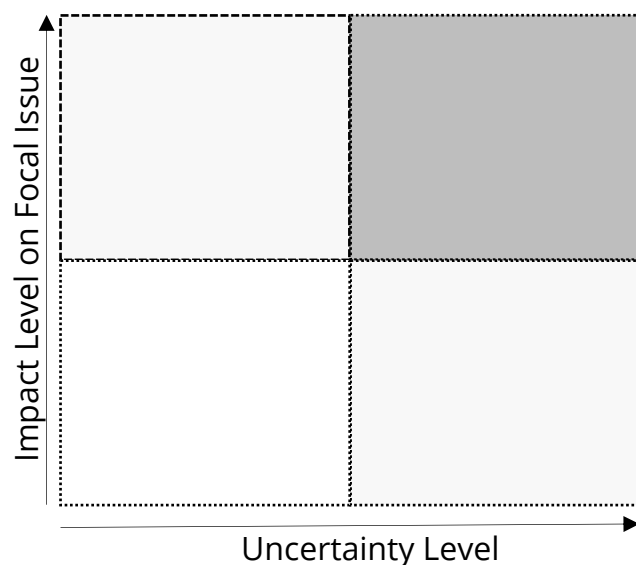
Scenarios for the logistics industry are created based on the Intuitive-Logics School in a process consisting of five consecutive phases



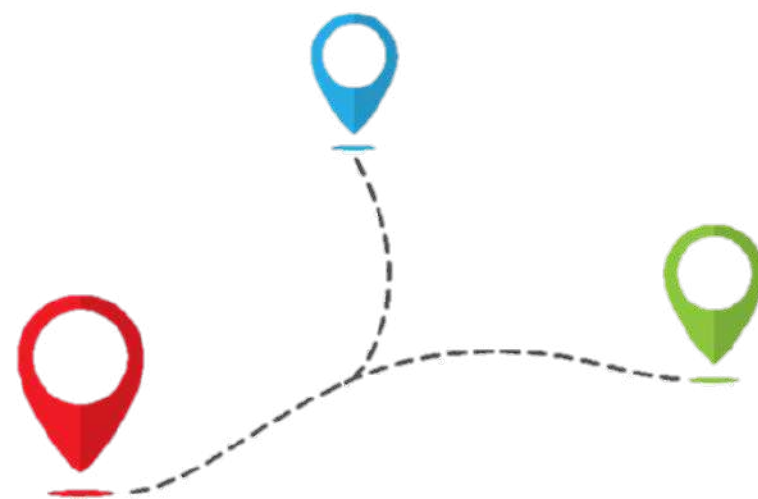
Clarification of the strategic focal issue and time horizon.



Identification of drivers of change including trends, weak signals and wild cards. Determination of critical uncertainties and predetermined elements.



Identification of two key uncertainties with their configurations. Combination of these two key uncertainties to create a scenario matrix with 4 scenarios.



Based on the four created, distinct scenarios, consideration of threats, opportunities, strategic implications and options for logistics companies.



Identification of early indicators and corporate KPIs to anticipate the development of each scenario.

This research report is based on the qualitative analysis of 1) literature review and 2) expert interviews with relevant company representatives

To ensure an in-depth research, we consolidated the published literature and conducted interviews for direct industry insights. In the selection of expert interviewees, we aimed to cover **three relevant areas** within the industry, which encompass: 1) **Operations**, 2) **Research and Development**, 3) **Management**

Literature Review

- Incorporation of >200 sources
- Profound Forecast of Future Outlook of Industry
- Identification of 47 drivers of change
- Well-founded technological and political context, shaping the scenarios



Secondary research to establish the industry status quo, and analyze the contextual and transactional environment

Expert Interviews

- Controlling Manager, DSV
- Pathways Operation Manager, Amazon
- Supply Chain Manager, Global 3PL
- Operations Manager, Kuehne+Nagel
- Team lead Operations Development, Logistics Start-up
- Vice-Chairman, The Global Research Network Belt and Road Initiative (GRN-BRI)
- Consultant, DHL Consulting
- Director of Transport, Logistics & Mobility, PwC
- Tender Manager, DHL



Primary research to support our analysis, validate the critical uncertainties and generate new findings

The research aim is to conduct an in-depth analysis of the logistics industry in the EU, its transformation until 2032, and implications for logistics companies

Focal Question

How will the logistics industry in the EU develop until 2032, and what strategic implications and options arise for logistics companies?

Geography

European Union

- The European Union (EU) is the world's largest single market area.
- The Trans-European Transport Network (TEN-T) is an initiative that aims to create a single European transport area, providing a complete, integrated and multimodal transportation network.
- After Asia-Pacific (APAC) and North America, the EU forms the third-largest trading bloc in the world.
- The global largest logistics services companies are mainly based in Europe. The EU logistics industry has well-established players but is facing disruption by new entrants and business models.

Time Horizon

2032

- A 10-year horizon is chosen to analyze medium to long-term changes:
- The core network of TEN-T is to be completed by 2030 to facilitate EU trade.
 - Geopolitical tensions cause long-term shifts in global trade: from dependence to diversification and from globalization to regionalization.
 - The future position of the EU relative to APAC and North American dominance in world trade.
 - The pace of technological advances and their adoption across industries is expected to rise even faster.
 - Alliances and acquisitions close knowledge gaps and are expected to channel decarbonization and digitalization efforts.

Supporting Questions

STEEP - I

- How will capital, jobs, and entire economies be impacted?
- What will be the pace of digitalization and innovation in frontier technologies (group of new technologies: AI, IoT, Blockchain, Robotics, Drones,...) to drive efficient processes?
- What will be the consequences of geoeconomic and political issues on global supply chains and the logistics industry?
- What effect will the rise of APAC have on European logistics?
- How will sustainability trends impact logistics operations?
- How will new industry players shape and transform the industry? How will M&A activities change the competitive landscape?
- What are the strategic implications and options for a third-party logistics (3PL) company?

The trend analysis, scenario planning, and strategic recommendations are focused on 3PL companies in the EU

The report refers to the logistics industry in the European Union (EU)

- ✓ The analysis is carried out by means of Third-Party Logistics (3PL) companies , that perform transportation and warehousing services.
- ✓ 3PL companies must be distinguished from other-party logistics providers (1PL, 2PL, 4PL, 5PL), which differ in the degree of service integration.

In-Scope of the report

- ☒ **3PL**
(3PL is a logistics provider hired by the manufacturer)
- ☒ **Across client industries**
(Pharmaceutical, automotive, consumer goods etc.)
- ☒ **All modes of transport**
(Rail, water, air, road)
- ☒ **B2B market**
(The exchange of products, services or information between businesses, rather than between businesses and consumers)

Out-of-Scope of the report

- ☐ **1PL, 2PL, 4PL, 5PL**
(Self-delivery, Courier delivery, Supply chain management providers)
- ☐ **Automation software providers**
(Companies that offer to consult, implementation support, or ongoing management to automation projects)
- ☐ **Strategic sourcing process**
(Procurement process that connects data collection, spend analysis, market research, negotiation, and contracting)
- ☐ **B2B2C market: last-mile delivery and parcel companies**
(Transportation of merchandise from the nearest distribution hub to the final destination)

02

Transactional Environment

Overview of the Logistics Industry

3PL Close up

Competitive Landscape

Movements in the Logistics Industry



Logistics is composed of five service streams which are often not fully performed by a company itself, but being outsourced to external service providers

Logistics Management



STORAGE, WAREHOUSING & MATERIALS HANDLING

- Enables steady stream of products
- Storing excess goods until they are demanded by consumers



PACKAGING & UNITIZATION

- Care and condition of a product
- Unitization assists storage and transportation



INVENTORY

- Controlling flow of goods by analyzing past sales data to predict upcoming demand
- How much stock to hold



TRANSPORT

- Includes all modes of transport including road vehicles, freight trains, cargo shipping and air transport



INFORMATION & CONTROL

- Key to forecasting of demand and inventory
- Support of control operational procedures and information systems

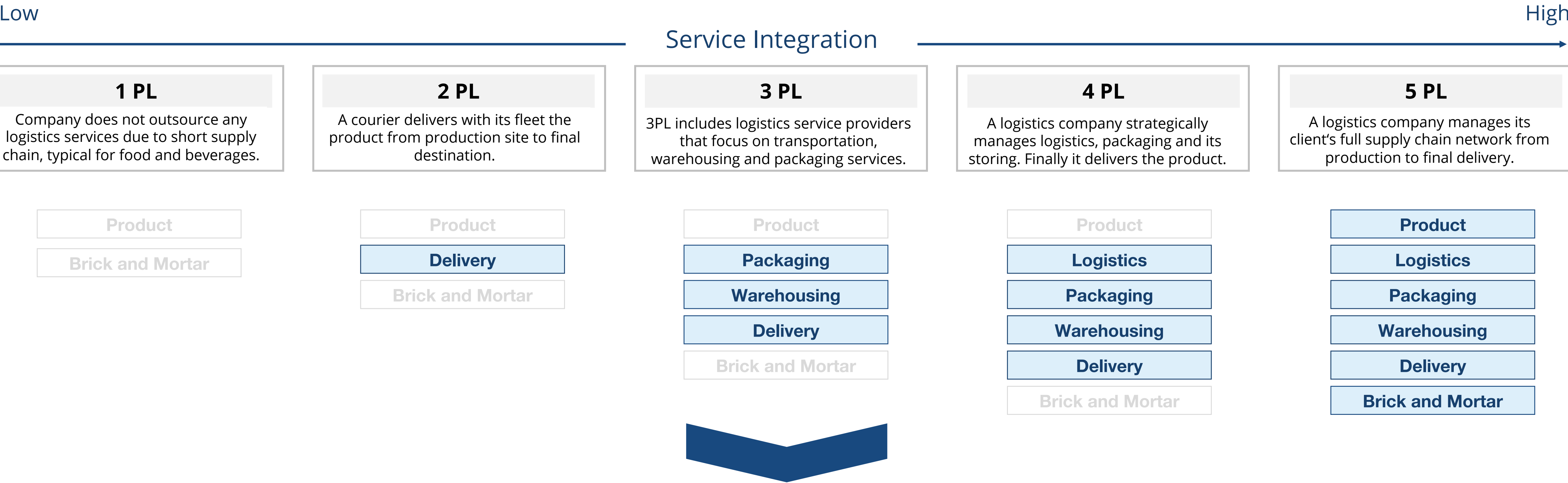
Contract Logistics

Not all companies fulfil all tasks on their own, but outsource services to external providers. This process is called **contract logistics**.

Contract logistics is the outsourcing of resource management tasks to a third-party company. They take on activities such as designing and planning supply chains, scheduling facilities, processing orders and collecting payments, warehousing, transporting and distributing goods, managing inventory, and even certain aspects of customer service. The service provided by contract logistics companies differs heavily in the degree of integration, going from 1PL to 5PL. The latter is illustrated on the following slide, demonstrating the service integration from low (1) to high (5).

Manufacturers often do not fulfill all areas of the supply chain themselves, but outsource resource management tasks to external contract logistics providers

The following illustrates the dimension of services offered by Party Logistics (PL) providers. The steps marked blue display the service included in the pool of management tasks provided.

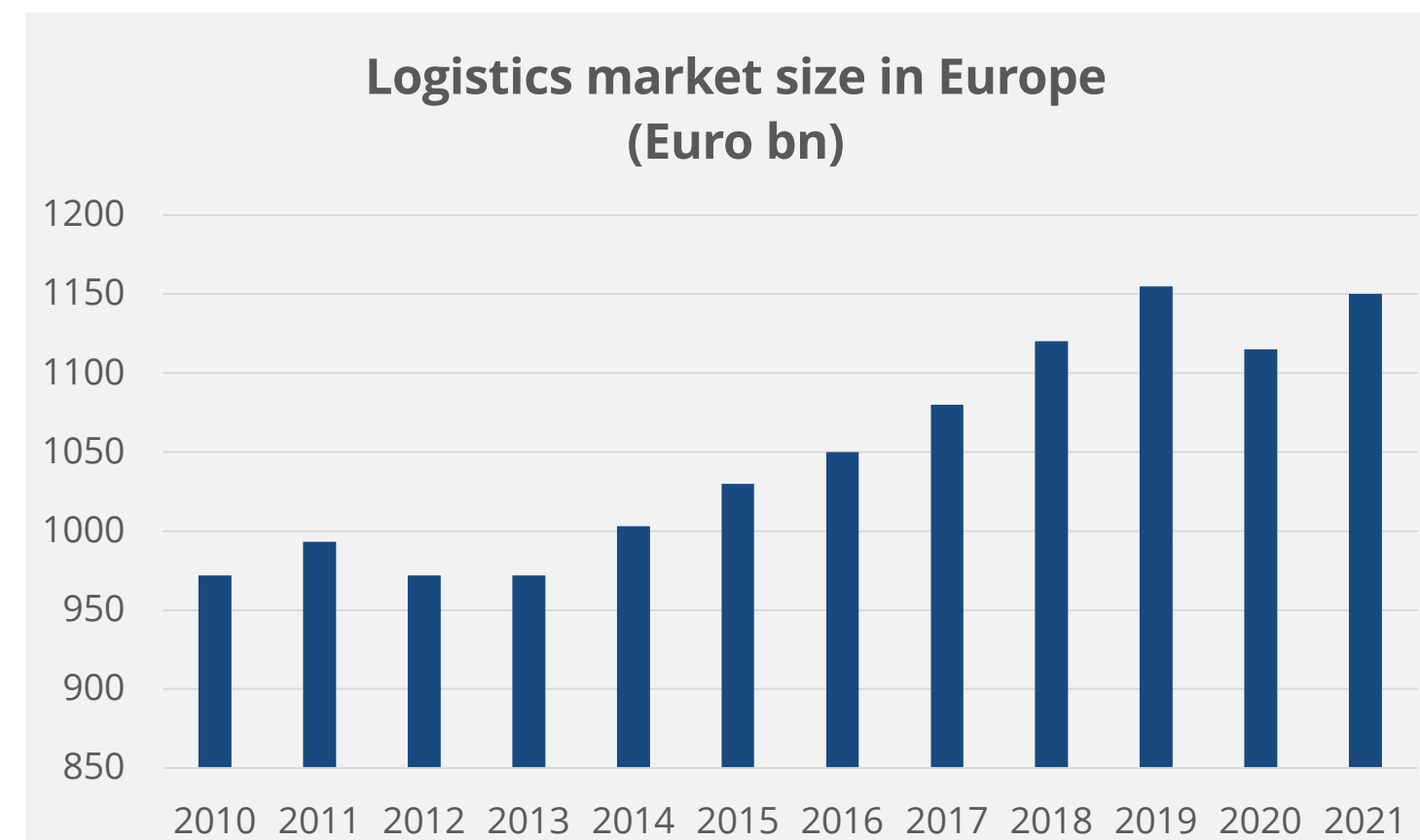


This study of scenario planning is conducted based on
Third-Party Logistics Providers (3PL)

The European logistics industry is expected to grow significantly, includes some of the largest global 3PLs, and is confronted with changing customer needs

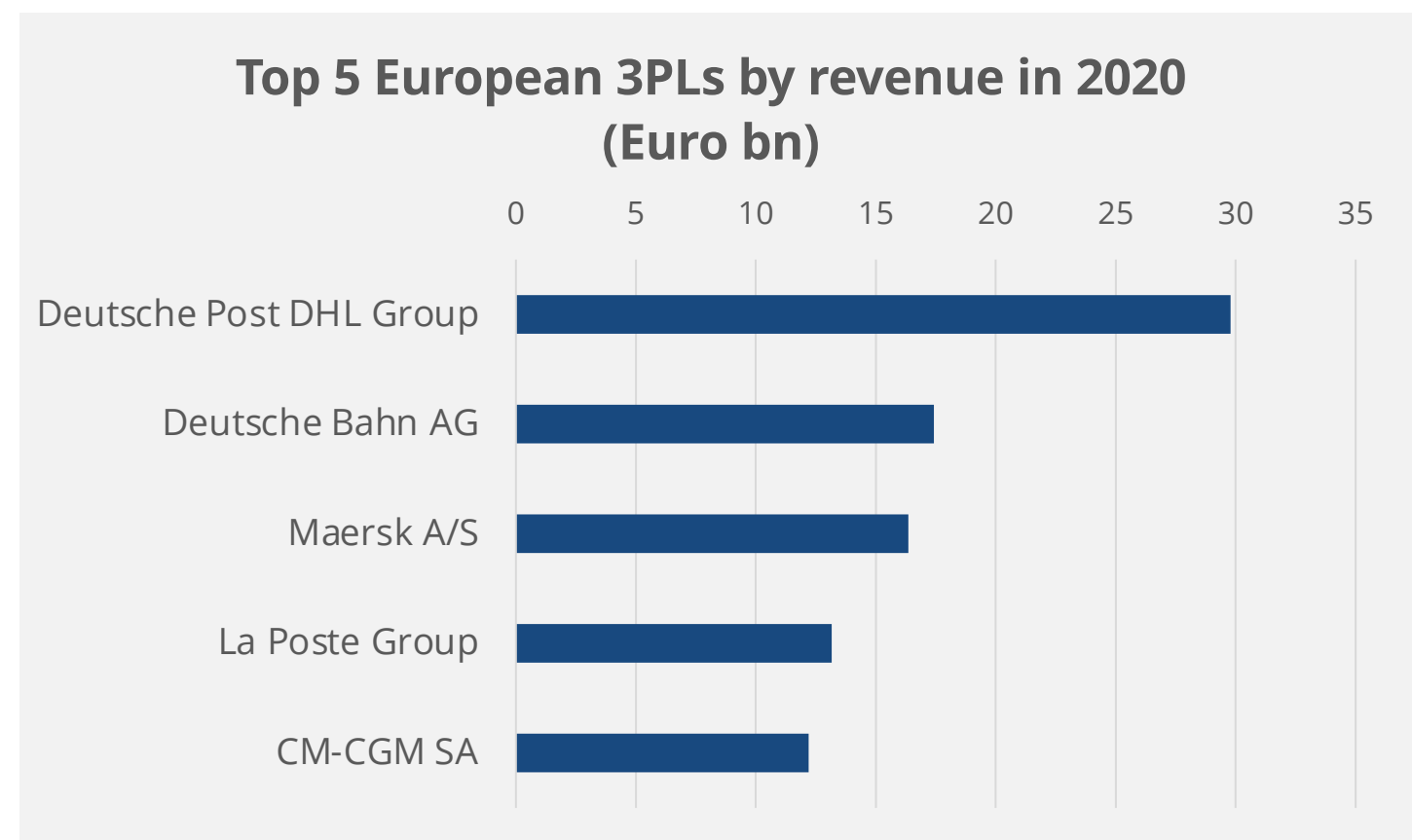
Key figures

- **173,8 billion USD** 3PL market size in 2020.
- **+ 4,47% CAGR** (estimated) until **2024**.
- **Revenue** went **down** in **2020** due to **Covid-19** causing disruptions in the supply chain and driver shortage.
- The logistics industry showed resilience to the economic difficulties and **recovered quickly in 2021** as a result of an **increase in the e-commerce market**.



Major single players in 3PL

- The **global largest logistics service companies** are mainly **based in Europe**.
- The German 3PL company **Deutsche Post DHL Group** is the **largest** industrial transportation company in Europe and the second largest 3PL worldwide.
- Deutsche Post has grown immensely since **merging with the express service DHL**, thereby becoming a leading logistics company in the world. The **express segment is the company's most profitable** division, accounting for almost 30% of total revenue in 2021.

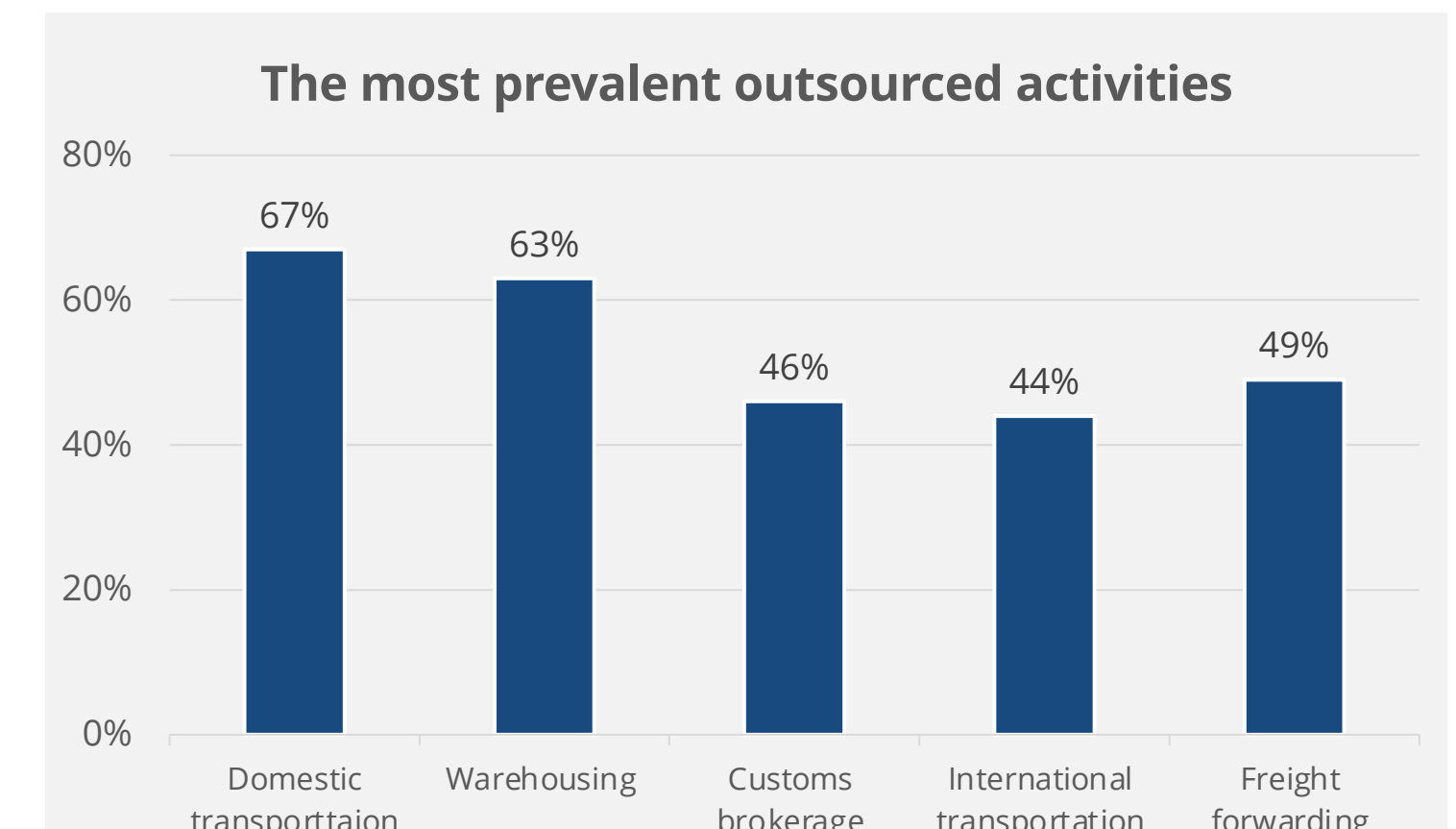


Customer overview

The services used most by 3PL customers are **transactional, operational and repetitive**.

However, customer expectations* regarding the process are changing significantly.

- ✓ Logistics should be **transparent** in its operations and **less complex** for customers to follow
- ✓ **Tracking** of shipments should always be available
- ✓ Logistics should be **flexible and reliable**
- ✓ **Sustainability** becomes increasingly important

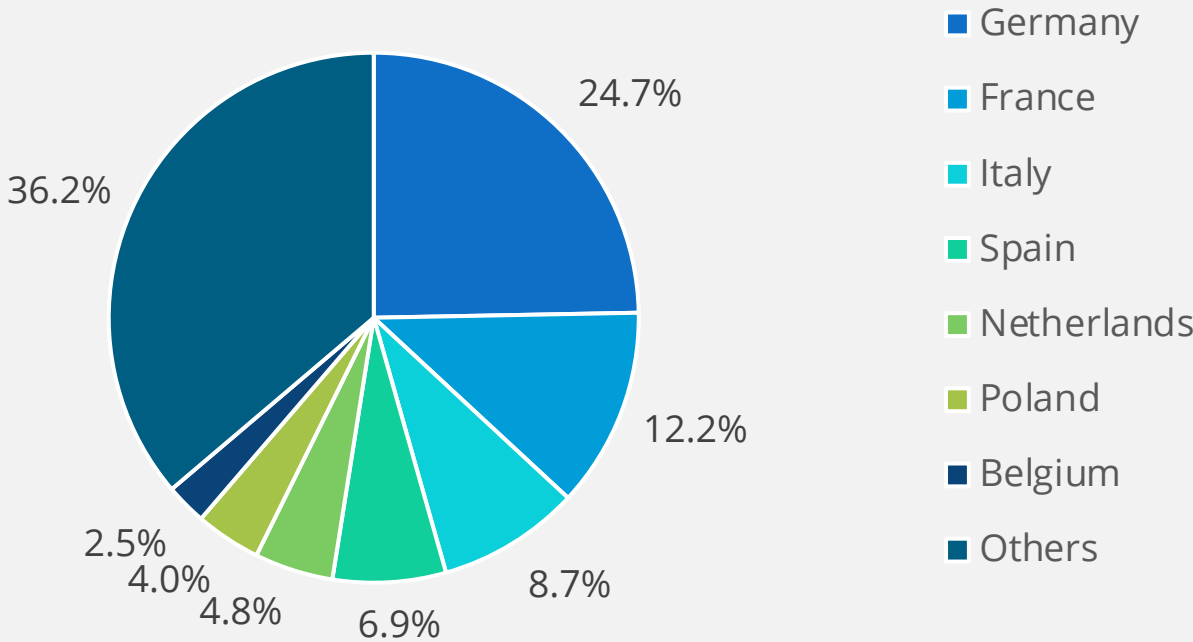


* B2B market

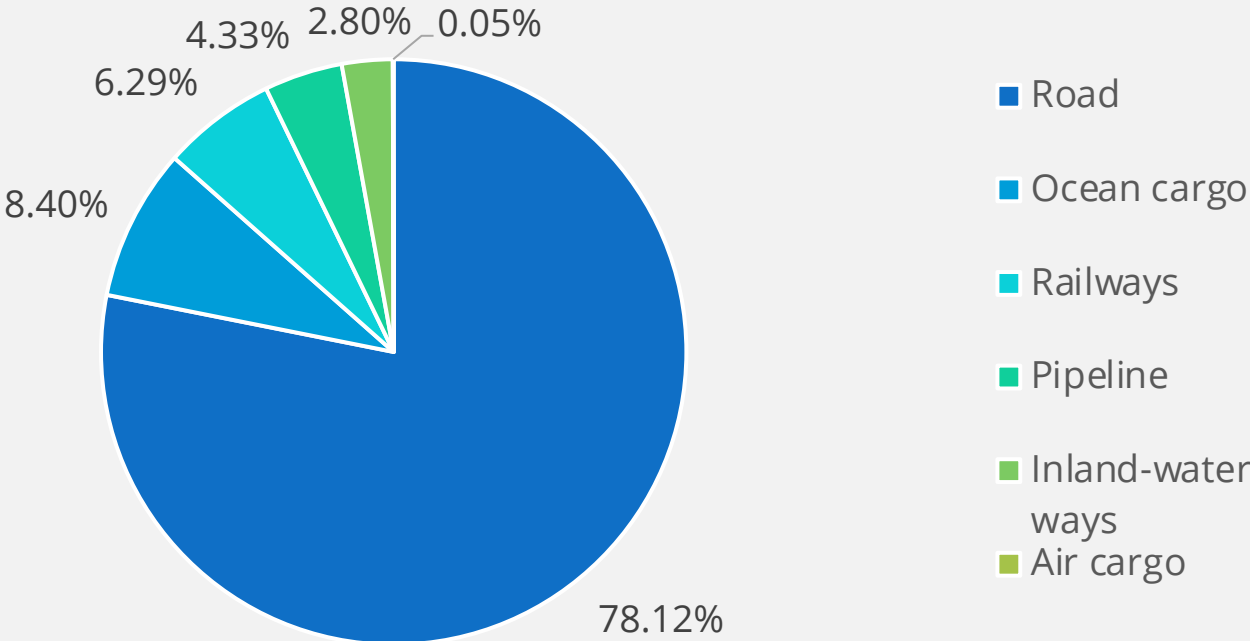
In the EU, Germany presents the biggest logistics market, and the European logistics industry is dominated by road transportation and 3PL companies

Market shares in logistics

Market shares in the European logistics industry by country in 2016

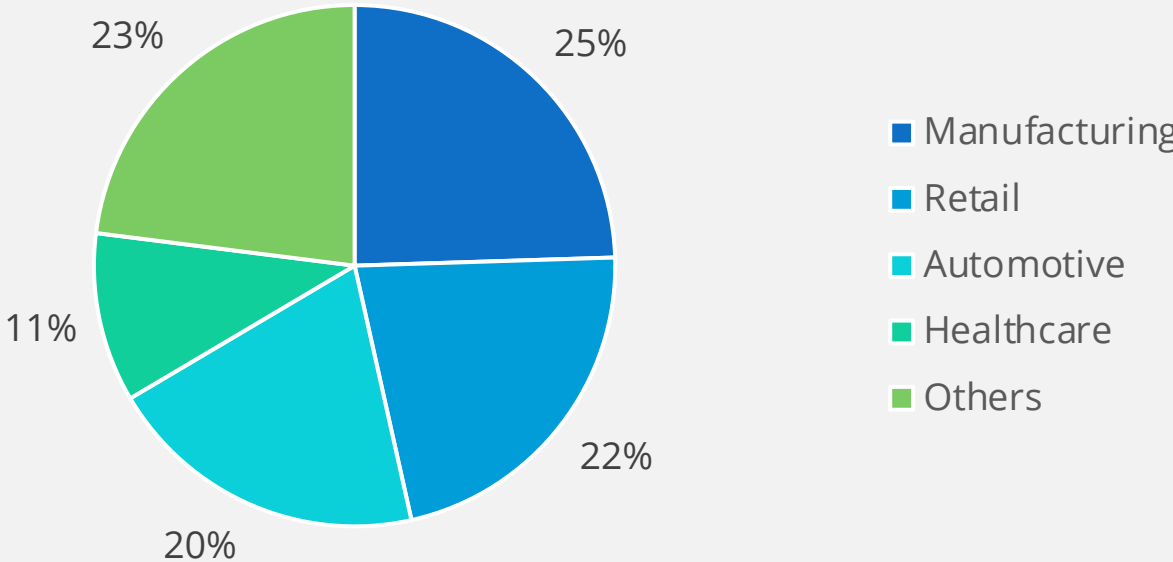


Market shares in the European logistics industry by mode of transportation in 2016



Market shares 3PL

Global market shares in 3PL by type of end use in 2021



3PLs have the **largest market share**

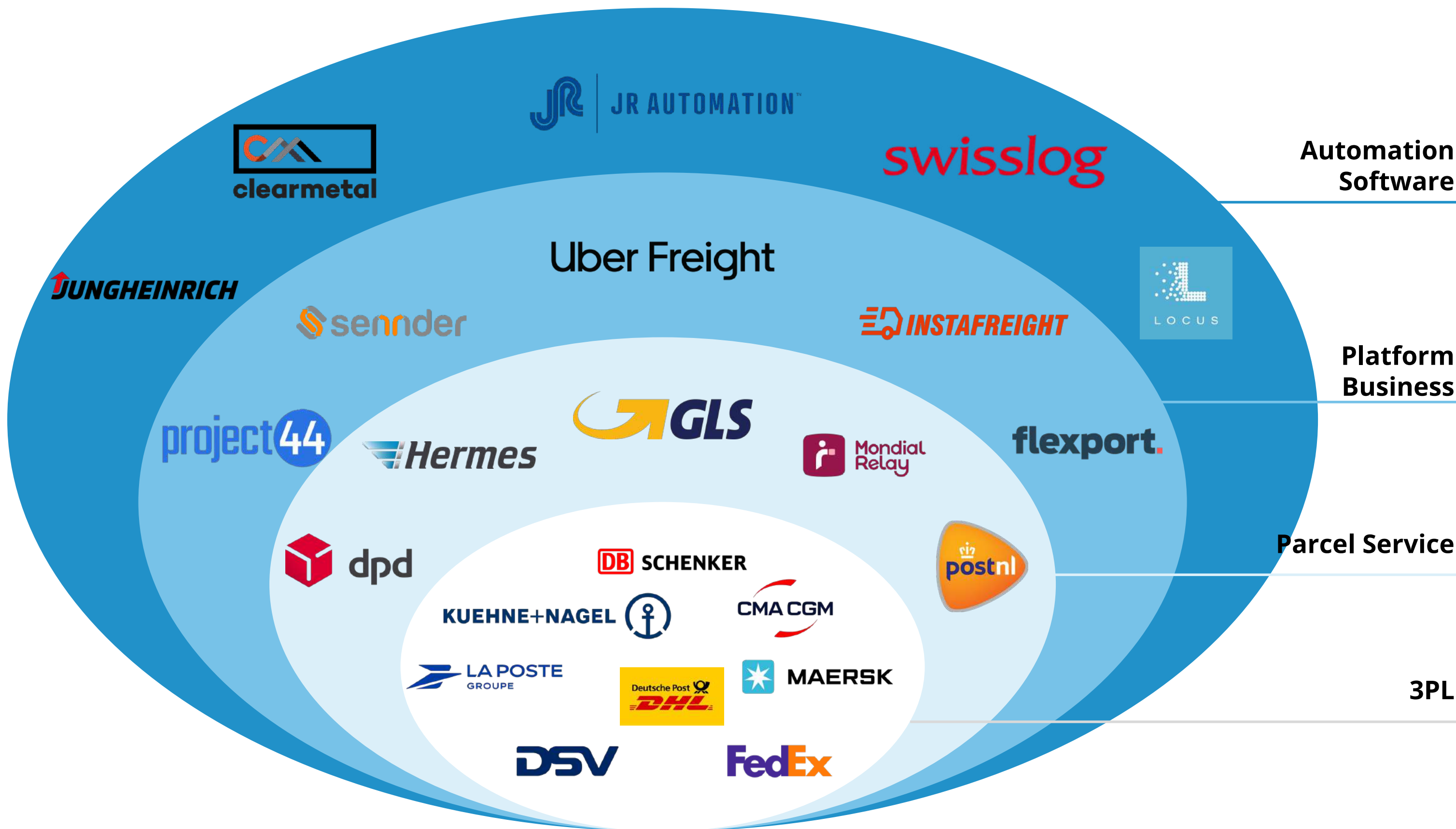
while **4PL** have the **second largest market share**

Comment

- Six countries out of the global Top-10 logistics companies are EU Member States. **Germany representing the largest logistics market** with 259 bn euros in 2016.
- The mode of transport in the EU is dominated by **road transport with 78.12%** of the total market share.
- The logistics industry is **highly fragmented** in terms of service offer, with the **3PL market** presenting the **largest market share**.
- With a revenue of 90.04 bn euros, **Deutsche Post AG** is the **leading 3PL** company in Europe in 2022.
- In 2021, **manufacturing** accounted for the **largest revenue share in 3PL with 24.5%**. An increase can be observed in the retail sector because of the **growing e-commerce sector**.

The logistics market is highly competitive and fragmented in nature with new business models based on technology, which challenges 3PL companies

Competitive landscape



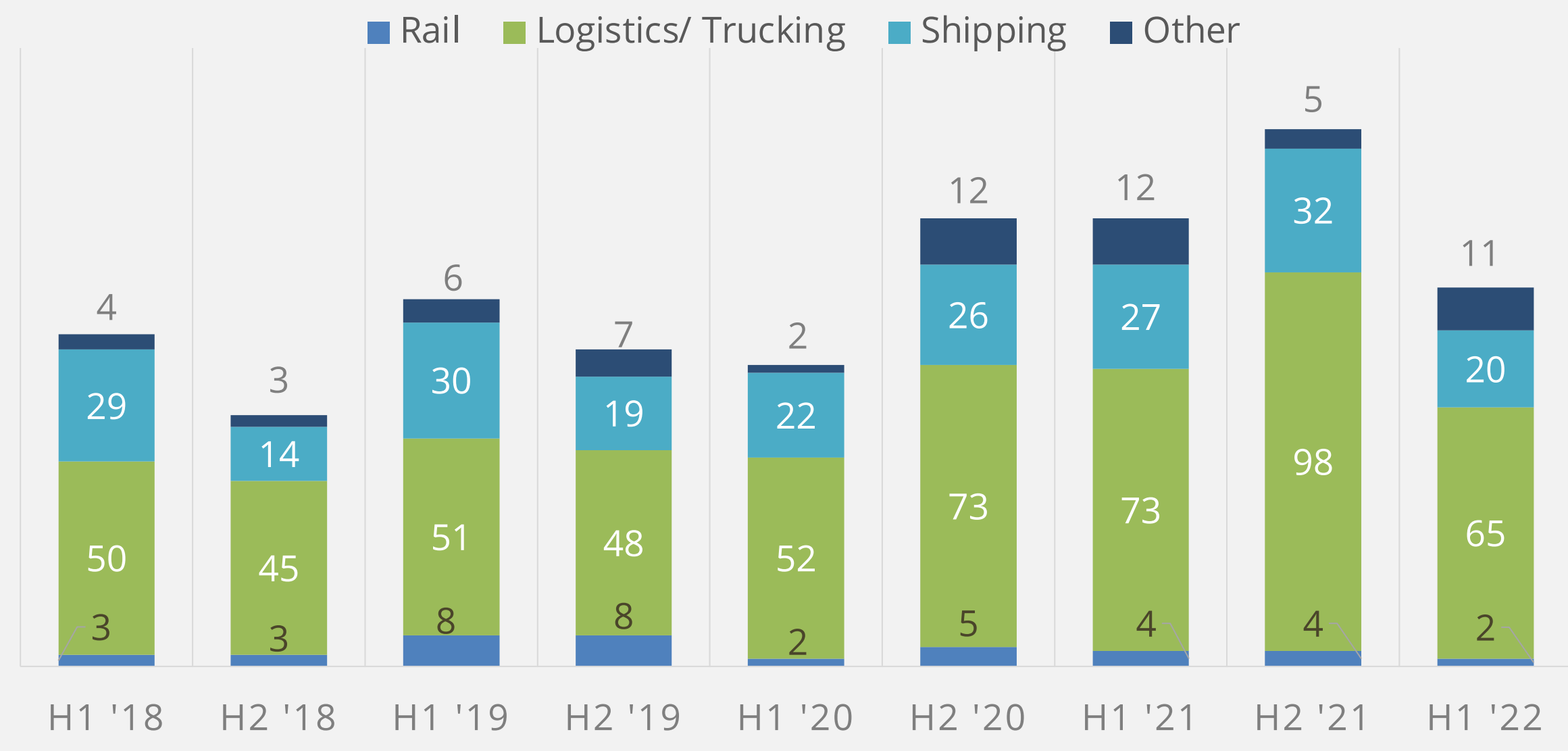
Comment

- New entrants that focus on **automation software** and **crowd-sharing solutions** challenge the conventional 3PLs and force leading companies to **reshape to remain competitive**
- **Platform businesses** with digital solutions often **cut out freight forwarders** as middle-men, offering customers a **one-stop solution** with full transparency along the supply chain
- **Parcel service providers** currently form **part of the transportation chain**, but are starting to widen their services to include 3PL activities
- **3PL companies** generate the **greatest revenue** and are the most common form of LSPs, however the great number of competitors does not allow for dominant players

Mergers and acquisitions in the logistics market are mainly driven by the need for enhanced resilience and improved supply chain control

Movements in the logistics industry

Number of global transportation & logistics M&A deals by sector
2018 – H2 2022



The number of **M&A deals** reached a **new high** in 2021 with more than twice as many megadeals (>\$1bn) than in the previous year. Also the **funding for logistics start ups** reached a **peak in 2021**, with focus on last-mile, parcel, and freight platforms.

Primary causes for M&As in logistics

- Organic growth is difficult due to **labour shortage, lack of required infrastructure or limited access to freight**.
- Logistics service provider increasingly **invest into digital transformation and infrastructure** to reduce dependency and gain more control over the supply chain.
- Companies see the urge to **diversify** their business through M&As to **expand their market share, network coverage** and portfolio of **service offerings**.
- Strict **decarbonization requirements** are one of the main causes for acquisitions or alliances, as logistics provider attempt to **acquire know-how and capabilities** they themselves lack.
- Major players from other industries are moving into the logistics sector, such as **Amazon** who is turning into a **competitor of UPS and FedEx** by handling orders outside of its own platform.

03

Contextual Environment

Macrotrends Identification through STEEP+I
Weak Signals, Wild Cards, and Black Elephants
Trend Impact and Uncertainty Assessment



The contextual environment analysis identifies drivers of change and uncertainties which form the basis for scenario planning

Contextual Environment

1 **30 trends** are identified though the use of the **STEEP+I framework**. **Interviews were conducted** to gain insights on current trends and uncertainties.

Trends & Uncertainties	According to the interviewees, the economy is driven by three central trends : 1) Climate change and awareness, as sustainability is a major concern among governments, regulators, and the private companies, as evident by their carbon footprint measures, 2) Digitalization via technology such as reducing the market, and 3) Increasing energy prices and also the fuel cost rise. Further, the main uncertainties are mentioned: 1) Volatile geopolitical developments , shortage of truck drivers in logistics that might lead to capacity shortage in the industry. Additionally, the interview partners describe the logistics industry to be highly "fragile".				
	#	Trend	STEEP+I Category	#	Trend
	1	Change in Workforce - Aging & Immigration	Socio-Demo	16	Peak Globalization and Rise of Asia
	2	Growing Population & Urbanization	Socio-Demo	17	Increased Manufacturing Investment in China
Socio-Demo	3	Changing Purchasing Habits	Economic	18	Rise of Sustainability and Neo-ecology
	4	Change in Consumer Values & Increase in Digital Goods	Economic	19	Shift to Remote Work
	5	Shift to Remote Work	Socio-Demo	20	Shortage of Qualified Labor
	6	Technological advancement in the logistics industry remains low, as automation and AI. Additionally, a certain level of automation towards automation, especially regarding sorting and handling, is the innovation of automation towards digitalization and automation and reduction of human error is equally acknowledged. However, this will have multiple trade-offs, as the main concern is the use of artificial intelligence, such as blockchain, and machine learning. With the increasing importance and implementation.	Socio-Demo	21	Development of Data Security and Privacy Concerns
Economic	7	Development of Data Security and Privacy Concerns	Socio-Demo	22	Lightening Environmental Policies
	8	Advances in Data Analytics & Artificial Intelligence	Technology	23	Shift in Trade Policy Development
	9	Advances in Robotics & Automation	Technology	24	Implementation of IoT and Sensorization
	10	Implementation of IoT and Sensorization	Technology	25	Implementation of Blockchain Technology
Technology	11	Shift in trade policy development	Political-Regulatory	26	Development of Data Security Regulations
	12	Advances in 3D Printing Technology	Technology	27	Logistics Moving Hybrid
	13	Rising diversification	Economic	28	Boom of Logistics Startups
	14	Threat of Recession	Economic	29	Rising Diversification and Restructuring Efforts
Strategic & Regulatory	15	Disrupting Supply Chain Backlogs	Economic	30	Growing Number of Companies with Nearshoring Plans

2 In a next step, **weak signals, wild cards, and black elephants** that support the presented trends are evaluated. All these together form the **drivers of change**.

#	Event	Name / Description	References
1	Weak Signal	The logistics industry suffers from rising transport costs, as prices increase for goods and energy due to limited sourcing options triggered by environmental and geopolitical instabilities.	(DHL, 2022)
2	Weak Signal	Track driver shortage across Europe due to ageing driver workforce, lack of qualified workforce and difficult working conditions.	(DHL, 2022)
3	Weak Signal	The Chinese state-owned shipping company COSCO has a plan to buy a 25% stake in one of Hamburg's three container terminals. COSCO already holds majority stakes in the ports of Bilbao and Valencia. This signals the growing influence of China in European infrastructure.	(Hendricks and Layer 2022) (Pöschner, Krumm and Preussner 2022)
4	Weak Signal	China's tech is trending critical of American tech, such as multiple U.S. export bans, are causing more frequently.	(Meyers 2022) (Krems 2022: 39-42)
5	Weak Signal	The acceleration of digital transformation virtual copies of a physical asset creates new service opportunities for third-party logistics players, such as Micro-fulfillment services, including express delivery and predictive maintenance.	(DHL, 2022)
6	Wild Card	Autonomous ground vehicles are widely used, and supporting infrastructure is established, diminishing the need for human truck drivers.	(Haugen, Hoggan and Raban 2015, 11)
7	Wild Card	Autonomous navigation on sea freight is established.	(Haugen, Hoggan and Raban 2015, 11)
8	Wild Card	AI-enabled and transparent based on renewable energy with wireless charging options integrated in roads allow seamless and fast charging while transporting.	(Haugen, Hoggan and Raban 2015, 11)
9	Wild Card	Adaptation of reverse restoration of digital systems and ICT systems (informatics and communications) technology due to frequent cyberattacks, privacy concerns and tight data security restrictions.	(Haugen, Hoggan and Raban 2015, 12)
10	Wild Card	Some U.S. tech agencies establish a new focus on economic major concerns such as a gas economy.	(Haugen, Hoggan and Raban 2015, 12)
11	Wild Card	U.S. opposition to Chinese control over Taiwan could lead to "Cold War" like situation in South China Sea , compromising trade in the region.	(Center for Preventive Action 2022)
12	Wild Card	Bank of current EU members or even a complete collapse of the EU and the Euro currency .	(European Council on Foreign Relations 2017) (Götschinger 201, 179)
13	Wild Card	Cancellation of economic relations and trade between the U.S. and EU and/or between APAC and EU.	(Haugen, Hoggan and Raban 2015, 13)
14	Wild Card	Major decrease in global freight volume due to localization of value chains and 3D printing.	(Haugen, Hoggan and Raban 2015, 13-14)
15	Wild Card	Global trade volume such as a pandemic.	(Götschinger 2017)
16	Black Elephant	Renewable energy abundance due to technological breakthroughs in for instance hydrogen extraction, decreases companies' pressure to reduce energy consumption in transport.	(Haugen, Hoggan and Raban 2015, 14)
17	Black Elephant	Increased frequency of extreme weather events due to global warming.	(United Nations 2013)

3 The determined trends are evaluated regarding their **level of impact** and **level of uncertainty**.

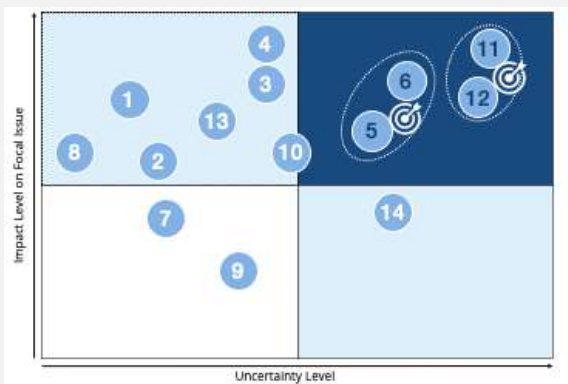
High impact	- Change in the workforce - ageing and immigration - Change in consumer values and increase in digital goods - Disrupting supply chain backlogs - Peak globalization and rise of Asia - Boom of logistics startups	- Shortage of qualified labor - Advances in Data Analytics and Artificial Intelligence - Advances in Robotics and Automation - Threat of recession - Increase of extreme weather events and conditions - Adoption of alternative energy solutions - Development of data security regulations - Rising diversification and restructuring efforts - Growing number of companies with nearshoring plans	- Implementation of IoT and sensorization - Implementation of blockchain technology - Shift in trade policy development - Geopolitical instability
Medium impact	- Growing population and urbanization - Shift to remote work - Long inflation - Shift of sustainability and neo-ecology - Shift of Geopolitical power to the East	- Changing purchasing habits - Advance in 3D printing technology - Lightening environmental policies - Logistics moving hybrid	Development of data security and privacy concerns
Low impact		Increased manufacturing investment in China	
	Low uncertainty	Medium uncertainty	High uncertainty

Scenario Planning

4 The identified **14 highly uncertain and highly relevant drivers of change** are presented in more detail and evaluated more closely regarding their uncertainty.

Low	1. Shortage of qualified labor	High
Moderate	2. Development of data security and privacy concerns	Massive
Slow	3. Advance in data analytics & artificial intelligence	Fast
Slow	4. Advance in robotics & automation	Fast
Few	5. Implementation of IoT & sensorization	Many
Few	6. Implementation of blockchain technology	Many
Unlikely	7. Threat of recession	Likely
Slow	8. Increase of extreme weather events and conditions	Fast
Slow	9. Adoption of alternative energy solutions	Fast
Loose	10. Development of data security regulations	Restrictive
Restrictive	11. Shift in trade policy development	Open
Low	12. Geopolitical instability	High
Slow	13. Rising diversification and restructuring efforts	Fast
Few	14. Number of companies with nearshoring plans	Many

5 The uncertainties are then assessed in a **criticality matrix** to measure their relevance and potential correlations. Thereby, **four key uncertainties** are determined.



6 Eventually, the four key uncertainties are consolidated and form the two axes used for the scenario planning. Based on this, **four future scenarios** are built.

Geopolitical and economic instability	
1 Lone Wolves in safe habitat	2 We are One
While politics and economics are stable in the EU, allowing for growing cooperation between national and logistic companies, technological fragmentation prevents 3PLs from exploiting the full potential of an overarching digital network. Instead, companies work in insufficient silo structures , without knowledge transfer or transparency of processes and shipments. In the absence of pioneers, 3PLs are hesitant to implement Blockchain and sensorization , as it is too complex and qualified labor is missing.	A densely connected, transparent technology network has developed its full potential in a stable geopolitical and economic environment. Cooperation between logistics players and EU nations allows for massive data availability and sharing , which maximizes supply chain efficiency and cost savings for 3PLs. Customer services are optimized due to track-and-trace capabilities, smart contracts, and fast and customized deliveries. Trade and e-commerce are booming due to low trade barriers and peace in EU. The availability of Blockchain reduces bottlenecks, errors, theft and fraud.
3 Back to the Future	4 Wasted Potential
Triggered by geopolitical tensions with trade wars, globalization has been reversed. The EU had to concede much of its authority to its member states and is now just responsible for coordinating the single market. Global trade volumes decreased after most countries established protectionist barriers, shifting to regional trading blocs . Also, technological development is lagging ; there are no scalable autonomous logistics systems on the market and the shortage of qualified technical staff is at a critical level.	Geopolitical instability and limited trading opportunities restrain technology from being fully exploited. While blockchain technology has been widely adopted, unilateral regulations across EU members hinder companies from leveraging knowledge and innovative developments. The regularization of trade leads to a highly competitive environment between incumbents as trade barriers and high data privacy regulations reduce operational efficiency. Companies acquire startups focused on digitization to extend their market share and strengthen their position.
Unstable	Stable

The conducted interviews had four re-occurring themes: observed trends, technological and geopolitical developments, and the strategic outlook for 3PLs

Trends & uncertainties

- According to the interviewees, the economy is driven by **three central trends**: 1) **Climate change** and awareness, as sustainability is a major concern among economists, regulators, and the society. Companies are asked to account for their carbon dioxide emissions, 2) **Digitalization** with technology start-ups entering the market, and 3) **Increasing energy prices** also due to the Russia-Ukraine war.
- Further, **two main uncertainties** are mentioned: 1) **Volatile geopolitical developments** that are destabilizing the economy, 2) **The talent gap**, which especially concerns the shortage of truck drivers in logistics that might lead to a capacity shortage in the industry.
- Additionally, the interview partners describe the logistics industry to be **highly fragmented** with small consolidation movements.

Technology

- Technological advancement in the logistics industry remains low, as automation and digitalization efforts are only slowly developing, especially in global, complex structures. Additionally, a certain level of aversion towards automation, especially regarding autonomous vehicles, can be identified within the logistics industry and among customers.
- Nonetheless, a slow relocation of resources towards **digitalization and automation processes** can be observed, as their need to account for the increasing trade volume and the reduction of human error is gradually acknowledged. However, 3PLs still have trouble implementing the offered solutions as they **lack tech talent**.
- Simultaneously, the interviewees describe the emergence of **technology start-ups** that engage in forecasting techniques, artificial intelligence, automation technologies, sensors, blockchain, and machine learning. With the increasing importance and implementation of technologies, **cyber security** comes into focus among companies, also in logistics.

Geopolitical situation / trade

- Russia-Ukraine war**: Rising prices for fuel and oil, triggered by sanctions and export controls put on Russia and Belarus. Cross-border trade is dominated by increasingly bureaucratic regulations. As a result, many companies withdrew operations from this region.
- Covid 19**: Closed borders and disrupted supply chains lead to full warehouses for 3PLs. If one component of a product is held back in the supply chain, all other products can't be shipped out, thus, a huge stock develops. The zero-covid policy in China hampers global trade, as trade volume goes down and demand can no longer be fulfilled.
- Brexit**: In general, more complex governmental regulations are emerging. Geopolitical situations like the Brexit demand process adaptations, underlined by increased time dedicated towards processes and bureaucratic regulations.

Strategic outlook for 3PLs

- 3PLs must hold up with **technological innovations**, especially to enable technological connectivity with clients. To gain technological capabilities, M&A activities should be reinforced.
- Enhanced digitalization** is needed to stay competitive. Harvesting master data enables 3PLs to keep up with the speed of changing customer demands.
- Besides striving for technological development, the attraction and maintenance of a **qualified workforce** needs be put in place. A lack of staff constrains the operational steadiness of 3PLs.
- Strengthening position in Middle Eastern Asia and **gain market share** in continents that are less dominated.

Together with 30 trends, identified through the STEEP + I framework...

#	Trend	STEEP + I Category	#	Trend	STEEP + I Category
1	Change in Workforce – Ageing & Immigration	Socio-Demographic	16	Peak Globalization and Rise of Asia	Economic
2	Growing Population & Urbanization	Socio-Demographic	17	Increased Manufacturing Investment in China	Economic
3	Changing Purchasing Habits	Socio-Demographic	18	Rise of Sustainability and Neo-ecology	Environment
4	Change in Consumer Values & Increase in Ethical Concerns	Socio-Demographic	19	Increase of Extreme Weather Events and Conditions	Environment
5	Shift to Remote Work	Socio-Demographic	20	Increase of Waste Reduction	Environment
6	Shortage of Qualified Labor	Socio-Demographic	21	Adoption of Alternative Energy Solutions	Environment
7	Development of Data Security and Privacy Concerns	Socio-Demographic	22	Tightening Environmental Policies	Political-Regulatory
8	Advance in Data Analytics & Artificial Intelligence (AI)	Technological	23	Shift in Trade Policy Development	Political-Regulatory
9	Advance in Robotics & Automation	Technological	24	Shift of Geopolitical Power to the East	Political-Regulatory
10	Implementation of Internet of Things (IoT) and Sensorization	Technological	25	Geopolitical Instability	Political-Regulatory
11	Implementation of Blockchain Technology	Technological	26	Development of Data Security Regulations	Political-Regulatory
12	Advance in 3D Printing Technology	Technological	27	Logistics Moving Hybrid	Industry
13	Rising Inflation	Economic	28	Boom of Logistics Startups	Industry
14	Threat of Recession	Economic	29	Rising Diversification and Restructuring Efforts	Industry
15	Disrupting Supply Chain Backlogs	Economic	30	Growing Number of Companies with Nearshoring Plans	Industry

...the 17 uncertain events form 47 Drivers of Change, which are relevant to the future development of the European logistics industry

#	Event	Name / Description	References
1	Weak Signal	A.P. Moller–Maersk and IBM discontinue TradeLens, a blockchain-enabled global trade platform which was started in 2018 and was to become a pioneering blockchain logistics solution. This announcement signals the complexity of global supply chain digitization.	(Maersk 2022)
2	Weak Signal	Truck driver shortages due to aging driver workforce, the Russia-Ukraine war where many drivers are from, and difficult working conditions.	(IRU 2022)
3	Weak Signal	German government allows Chinese state-owned shipping company Cosco to buy a 25% stake in one of Hamburg's three container terminals . Cosco already holds majority stakes in the ports of Bilbao and Valencia. This signals the increasing influence of China in European logistics.	(Knowler 2021); (Posaner, Kijewski and Preussen 2022)
4	Weak Signal	Cyberattacks targeting critical infrastructure, such as multiple U.S. airport websites, are occurring more frequently.	(Aratani 2022; Verizon 2022, 50-52)
5	Weak Signal	Amazon patents floating warehouses : airborne fulfillment center (AFC) utilizing unmanned aerial vehicles (UAVs) for item delivery.	(United States Patent 2016)
6	Weak Signal	The acceleration of digital twins (dynamic virtual copies of a physical asset) creates new service opportunities for 3PLs, such as Aftermarket Logistics Services including remote support and predictive maintenance.	(DHL 2022)
7	Wild Card	Autonomous ground vehicles could be widely used, and supporting infrastructure established, diminishing the need for human truck drivers. Autonomous navigation in sea freight would be established.	(Hauptman, Hoppe and Raban 2015, 11)
8	Wild Card	All-electric road transport fueled by renewable energy with wireless charging options integrated in roads could allow seamless and fast charging while transporting.	(Hauptman, Hoppe and Raban 2015, 11)
9	Wild Card	Abandonment or severe restriction of digital solutions and ICT systems (information and Communications Technology) due to frequent cyber-attacks, privacy concerns and tight data security restrictions.	(Hauptman, Hoppe and Raban 2015, 12)
10	Wild Card	Slow Travel/Logistics could establish itself because of environmental concerns and oil & gas deficiency.	(Hauptman, Hoppe and Raban 2015, 12)
11	Wild Card	US opposition to Chinese control over Taiwan could lead to “Cold War” like situation in South China Sea , compromising trade in the region.	(Center for Preventive Action 2022)
12	Wild Card	Exit of current EU member(s) or even a complete collapse of the EU and the EURO currency .	(Dennison, Leonard and Lury 2019); (Gastinger 2021, 576)
13	Wild Card	Cessation of economic relations and trade between the US and EU and/or between APAC and EU.	(Hauptman, Hoppe and Raban 2015, 7)
14	Wild Card	Major decrease in global freight volume due to localization of value chains and 3D printing.	(Hauptman, Hoppe and Raban 2015, 5–6)
15	Wild Card	Global health crisis such as a pandemic, disrupting supply chains.	(Smith 2021)
16	Wild Card	Renewable energy abundance due to technological breakthroughs in hydrogen extraction would decrease companies’ pressure to reduce energy consumption in transport.	(Hauptman, Hoppe and Raban 2015, 6)
17	Black Elephant	Increased frequency of extreme weather events due to global warming.	(United Nations 2021)

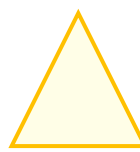
The identified trends are assessed based on two overarching criteria, 1) the level of uncertainty and 2) the potential impact on logistics

Level of Uncertainty	Level of Impact
Course of direction Advance or progression of a trend in a particular direction such as data security regulations are increasing or decreasing.	Impact on the competitive landscape Evaluation of factors that have an effect or influence the industry, such as new entrants, buyers, suppliers, substitutes, and competitive rivalry.
Speed of evolution / adoption Explains how time affects change, e.g., the rate at which new technologies are adopted.	Impact on business and operating models Refers to the impact on business model and operations that are the most common in the logistics area such as sales.
<i>These aspects help us to define the criteria:</i> Occurrence in the past Event that already has taken place in the past, so it is possible to have a notion of its implications.	Impact on customer needs and preferences Refers to the impact customers have such as change in ethical and privacy concerns and the need for security.
Data availability Historical data that helps predicting the probability of the event taking place in the future, e.g., available and discussed assumptions in media.	Impact on cost structure, CapEx and P&L How variables like profit growth, the need for technology investments, or infrastructure alter in response to the occurrences.

The most important trends impacting the logistics industry refer to the shortage of qualified labor, technological innovations and geopolitical tensions

High impact	- Change in the workforce – ageing and immigration - Change in consumer values and increase in ethical concerns - Disrupting supply chain backlogs - Peak Globalization and rise of Asia - Increase of Waste Reduction Boom of logistics startups	Shortage of qualified labor - Advance in Data Analytics and Artificial Intelligence (AI) - Advance in Robotics and Automation - Threat of recession - Increase of extreme weather events and conditions - Adoption of alternative energy solutions - Development of data security regulations - Rising diversification and restructuring efforts - Growing number of companies with nearshoring plans	- Implementation of Internet of Things (IoT) and Sensorization - Implementation of blockchain technology Shift in trade policy development Geopolitical instability
Medium impact	- Growing population and urbanization - Shift to remote work - Rising Inflation - Rise of sustainability and neo-ecology Shift of Geopolitical power to the East	- Changing purchasing habits - Advance in 3D printing technology - Tightening environmental policies - Logistics moving hybrid	Development of data security and privacy concerns
Low impact		Increased manufacturing investment in China	
	Low uncertainty	Medium uncertainty	High uncertainty

 Trends that are **highly uncertain** and **highly relevant** to the focal issue

 Trends that are **highly uncertain**, but not relevant to the focal issue

 Trends that are **highly relevant** to the focal issue, but not uncertain

In the following slides, we will examine the trends that are **highly uncertain** and **highly relevant** to the focal issue.

Jobs in logistics are becoming more technologically demanding and there is a shortage of qualified workers, while at the same time a recession is looming

Shortage of qualified labor

- Despite the rising level of education, the growing skilled labor shortage on the logistics workforce impacts the future of the industry.
- As a matter of fact, 54% of logistics companies anticipate to witness skills shortages by 2024, with drivers, warehouse operatives, and back-office vacancies to fill.
- Major logistics companies currently employ about one-third of workers who are close to retirement age, which is felt strongly in the trucking industry.
- The fact that this workforce is older than usual contributes to the problem of a digital skills gap, making a lack of digital culture and training the main obstacle to digital adoption.
- A shortage of vocational school training is also issue. Modern logistics innovations, particularly those in IT, require new skills that the workforce does not currently possess.

➤ Training and retaining qualified labor is seen as one of the **top challenges for logistics companies**. Labor shortages and resulting higher wages add further pressure on a possible recession.

Impact on Logistics



Uncertainty Level



Threat of recession

- The previous economic downturn, triggered by the pandemic, has impacted the logistics industry positively as consumers shifted from services to materials consumption.
- During Covid 19, consumers increased their spendings on hard merchandise. As prospective customers stayed at home most of the time, the budget was relocated to building materials and various home appliances.
- The population has saved many funds during the pandemics, which will soften the recession.
- However, the negative effects of an economic decline become vivid when detecting supply shortages where the quantity demanded is greater than the quantity supplied. When supply cannot keep up with demand, price increases occur, contributing to inflation which can indicate an impending recession.

➤ The previous economic recession has **impacted the logistics market positively** as consumers shifted from services to materials. **Increased merchandise trade** enhanced the demand for fast and efficient logistics services, **cushioning the impact on a likely event of a recession in 2023**.

Impact on Logistics



Uncertainty Level



Advances in data analytics, AI, robotics, and automation are enabling smarter, more efficient logistics processes

Advance in data analytics and artificial intelligence (AI)

- AI-led automation is used as a predictive tool in warehousing to identify demand fluctuations and prevent shortages or overstocking. Logistics companies can benefit from improved forecasting to scale capacity up or down and plan dynamic and efficient routes.
- Greater inventory visibility and transparency due to data tracking allow improved predictive maintenance and management.
- Industry experts in Transportation & Logistics attribute high importance to data & analytics in the next five years (90% compared to an average of 83%).
- 98% of 3PLs and 93% of shippers believe data-driven decision-making to be essential for supply chain activities.

Significant advances in data analytics and AI can help to **anticipate demand, streamline factory functions and optimize routing.**

Impact on Logistics



Uncertainty Level



Advance in robotics and automation

- Increased application of intelligent robotics & automation in logistics management (e.g. semi-autonomous warehouse machinery and vehicles, drones) result in the reduction of human workforce.
- Operations are no longer fully dependent on the working hours of human employees and can occur around the clock, which results in increased efficiency in warehousing and delivery processes, and lower costs.
- Global warehouse automation market is steadily growing (15 billion USD in 2019, forecasted to reach 30 billion USD by 2026).
- Autonomous mobile robots (AMRs) can improve productivity by up to 50% with point-to-point (P2P) transport, up to 150% for assisted order picking.

The adoption of sophisticated robotics in logistics management will **cut costs, boost output and meet growing customer demands** in warehousing, transportation and last-mile deliveries.

Impact on Logistics



Uncertainty Level



Sensors and blockchain technologies promise a more secure, interconnected logistics network if developed and implemented by many stakeholders

Implementation of IoT and sensorization

- The physical internet is a new logistics paradigm enabling a worldwide open network that is physically, digitally, and operationally hyperconnected. Standardized shipment sizes, labelling, and systems are geared to shrink inefficiencies in global supply chains.
- The internet of things describes physical objects with smart sensors that connect and exchange data with other registered devices. Sensorization is a trend to insert smart sensors in systems to achieve interconnectivity and data transmission.
- Research in 2013: If 25% of US supply chain operated with Physical Internet, profits for participating firms would increase by 100 billion USD and CO2 emissions from road-based freight would decrease by at least 33%.

Sensors registered in the IoT allow the **constant flow of data** between humans, objects, and machines along the supply chain. Self-monitoring supply chains **boost operational efficiency and security**.

Impact on Logistics



Uncertainty Level



Implementation of blockchain technology

- Blockchain is a distributed ledger technology which records transactions between parties securely and permanently. It enables the transition from a centralized to a decentralized and distributed database accessible for all relevant stakeholders, offering intrinsic security mechanisms ("mutualization of data").
- The information flow in international trade is complex, requires the collaboration of many stakeholders and is documentation-heavy. It is so far characterized by low transparency and unstandardized processes due to the fragmented and competitive nature of the logistics industry.
- Blockchain can realize substantial gains in logistics process efficiency by improving transparency and traceability in supply chains, introducing standardized processes, and automating commercial processes with smart contracts that decrease fraud. It can achieve cost savings by promoting leaner, more automated, error-free processes and reduced paperwork in global trade.

Blockchain promises **secure interconnectivity, transparency and traceability** in the logistics network that requires further technology development and collaboration between stakeholders to provide productive solutions at scale.

Impact on Logistics



Uncertainty Level



In the face of increasing data security concerns, stricter data protection regulations are being implemented, slowing down digital innovation in logistics

Development of data security and privacy concerns

- With many companies currently undergoing digital transformation and automation, most of sensitive customer data is stored on internal or external cloud-based systems.
- According to a PwC study, 38% of logistics companies have significant unresolved question surrounding data privacy and security.
- Companies involved in the logistics have increasingly come to realize how important it is to establish and implement cybersecurity policies to guarantee the continuity of daily operations and the security of corporate data.
- The ongoing cloud transitions, which include shifting data outside of an organization's four walls and depending on third-party service providers, are also what is causing the significantly increased anxiety about tech and data rules.

The rising digitalization and automation of the logistics business has made **data protection a major challenge for the sector**. Possible security flaws in the logistics industry's IT infrastructure could result in irreparable risks including data loss, theft, and abuse.

Impact on Logistics



Uncertainty Level



Development of data security regulations

- Growing concern about data security due to cyber risks leads to further data security regulations and data sovereignty goals.
- Growing restrictions of transparent data structures hinder cross-border data transfers. Deletion and transfer of data is seen as the most difficult task among EU and U.S. firms in 2019.
- Different data protection models between political powers (especially Europe, US and China), influence the nations' ability to collect data and dominate the digital landscape.
- Technological developments such as IoT or Blockchain are slowed down due to the General Data Protection Regulation (GDPR).

With the growing importance of **transparent supply chains** and fully digital businesses, logistics **rely on facilitated data transfer across borders**. Data security regulations often **hinder** companies' **developments** in innovative technologies.

Impact on Logistics



Uncertainty Level



Extreme weather events due to climate change are disrupting logistics operations and the adoption of alternative energy solutions is needed to limit emissions

Increase of extreme weather events and conditions

- Climate change leads among others to oceans becoming more acidic, as well as an increase in frequency and intensity of extreme weather conditions.
- These events cause sporadic disruptions in global supply chains, aggravating shortages and delaying deliveries which consequently leads to increasing prices for consumers.
- Heatwaves, drought, and heavy rainfalls have a knock-on effect on the transport industry and the likelihood of conflicts in regions that are disproportionally affected by climate change is expected to increase.
- Extreme weather events increase mortality, reduce productivity, and damage the infrastructure. Currently weather accounts for 23% of all roadway delays in Commercial Vehicle Operation.

With the increase of extreme weather events, the logistics industry will experience **increasing disruption in its operations**. To remain competitive, logistics companies are required to **create robust operational systems** that are adaptable to unforeseen weather events.

Impact on Logistics



Uncertainty Level



Adoption of alternative energy solutions

- The transition from fossil fuels, which are responsible for a great share of emissions accounting for over 75% of global greenhouse gas emissions, to alternative energy solutions is central to address the current climate crisis.
- Renewable energy used to be much more expensive than fossil fuels, but costs have declined by about 70% over the last 10 years. Nonetheless, existing solutions remain more costly than fossil fuels and are not yet available in the quantity needed. Large investments in R&D and infrastructure are required to increase the share of alternative energy solutions. Therefore, alternative energy solutions present only about 20% of the total consumption in the EU.
- All modes of transportation in the logistics industry are affected by the search for alternative energy solutions, while their adoption remains restricted because of high initial investments and missing infrastructure.

With the logistics sector being a **main contributor of CO2 emissions**, which have risen by more than 20% in freight transport since 1995, an **energy shift is central** to be able to align with the European Green Deal for the logistics industry, but its implementation is challenged by **high initial investments**.

Impact on Logistics



Uncertainty Level



While rising geopolitical instability is harming logistics, it remains uncertain how trade policies will develop in the globalized economy

Shift in trade policy development

- Trade wars between nations raise uncertainty about trade policies, particularly China-US economic conflict (the top two manufacturing companies in the world).
- The Regional Comprehensive Economic Partnership (RCEP) presents a newly signed free trade agreement between 15 East Asian and Pacific Nations. It is now the largest trading bloc in the world.
- While members of the RCEP benefit from lower tariffs, the European Union is expected to have the largest export losses in terms of value from this new trading bloc.
- According to the Heritage Foundation's trade freedom indicator, the trend of increased openness to trade began to decrease in 2019.

Governmental reactions to trade wars often lead to **trade sanctions** harming also global logistics players in their business. While the BRI opens new trade routes, **uncertainty about China's involvement in supply chains** dampens hope for new business opportunities.

Impact on Logistics



Uncertainty Level



Geopolitical instability

- Rise of nationalism could lead to protectionist behavior with regionalized supply chains. Higher import duties lead to an increase in trade costs and impact price and quantity of traded goods.
- EU's vulnerability is growing due to the EU's one-sided dependency on the supply of resources. With 44%, China is EU's largest global supplier of critical raw materials (CRM). The nation represents 52% of the total value of EU imports.
- Global rivalry and fragility (e.g., the US-China trade war, Russia-Ukraine war, China-Taiwan tensions) lead to barriers and security concerns. This results in possible supply chain delays or even termination of business in countries of political unrest.
- In PwC's Global CEO Survey, 71% (of 678 US participants) said, geopolitical conflict could inhibit their ability to sell products or services.

Geopolitical conflict counts as a **major factor influencing the industry** on several levels with the **magnitude rarely possible to predict**. Resulting trade barriers and resource price increases directly affect organizations, leading to potentially **lower trade volumes** or the **shutdown of trade routes**.

Impact on Logistics



Uncertainty Level



The competitive landscape is disrupting through the restructuring movements of logistics companies and the rising localization of supply chains

Rising diversification and restructuring efforts

- Companies' ambition to expand their service offerings and have more control over their supply chains drive M&A activities whereas geopolitical tensions dampen the current outlook. While M&A deals in 2021 reached an all time high since 2018, current numbers project a stagnation in 2022 due to geopolitical tensions.
- Shipping companies are driving vertical integration (Maersk, CMA CGM, MSC), increasingly aiming at end-to-end solutions and covering several transport modes.
- With a total of 160 M&As in 2021, Asia remains the region with the highest number of deals. Europe is on rank 2, with a total of 107 deals.
- The market is increasingly consolidating, with incumbents trying to increase their market share/buying crucial digital capabilities from new entrants (start-ups).
- Previous 3PL clients (e-commerce companies) become competitors by insourcing logistics services. New business units e.g. Uber Freight, and Amazon Air.

The logistics industry is currently experiencing **significant movements** in the **competitive landscape**. Incumbents see the need to **acquire external competencies from digital native businesses** while Asia continues to be the most promising market for M&A deals.

Impact on Logistics



Uncertainty Level



Growing number of companies with nearshoring plans

- The pandemic and geopolitical tensions have shifted the focus again towards reducing the dependency overseas.
- In PwC's latest Pulse Survey, 60% of COOs indicated changes in their footprint by nearshoring (27%), reshoring (25%) or offshoring (18%).
- Decarbonization requirements throughout various industries impact the setup of supply-chains, impacting the trend of nearshoring even further.
- Lower manufacturing cost regions, such as China, have experienced a significant wage increase in recent years while consumer preferences evolved towards local production.
- The re-localization of value chains decreases the need for long-distance transportation of goods.

The future shift towards a more **local production** will seriously impact the way global logistics companies operate. Nearshoring supply chains positively impacts the environment, allowing a more sustainable transport and with that the **achievement of ambitious decarbonization goals** for logistics players.

Impact on Logistics



Uncertainty Level



04

Scenario Planning

Uncertainty Extremes and Criticality Matrix
Key Uncertainties Identification
Scenario Narratives
Early Warning Signals
Scenario Personas



Scenario planning is based on the derivation of key uncertainties, which are central to develop plausible and concrete future scenarios

Context of uncertainties in scenario planning

01

Strategic foresight and scenario planning is used to identify **key drivers of change** within an industry and to derive uncertainties, which are then used to develop **plausible and distinctive future scenarios**.

02

Scenarios allow for assumptions about potential outlooks. Nonetheless, the **future remains unpredictable**, because of uncertainties and market volatility and none of the individual scenarios will truly reflect the future.

03

Uncertainties are **essential to scenario planning**, as they increase the further we look into the future. Their **unpredictability** distinguishes them from trends and are the reason for the creation of alternative scenarios.

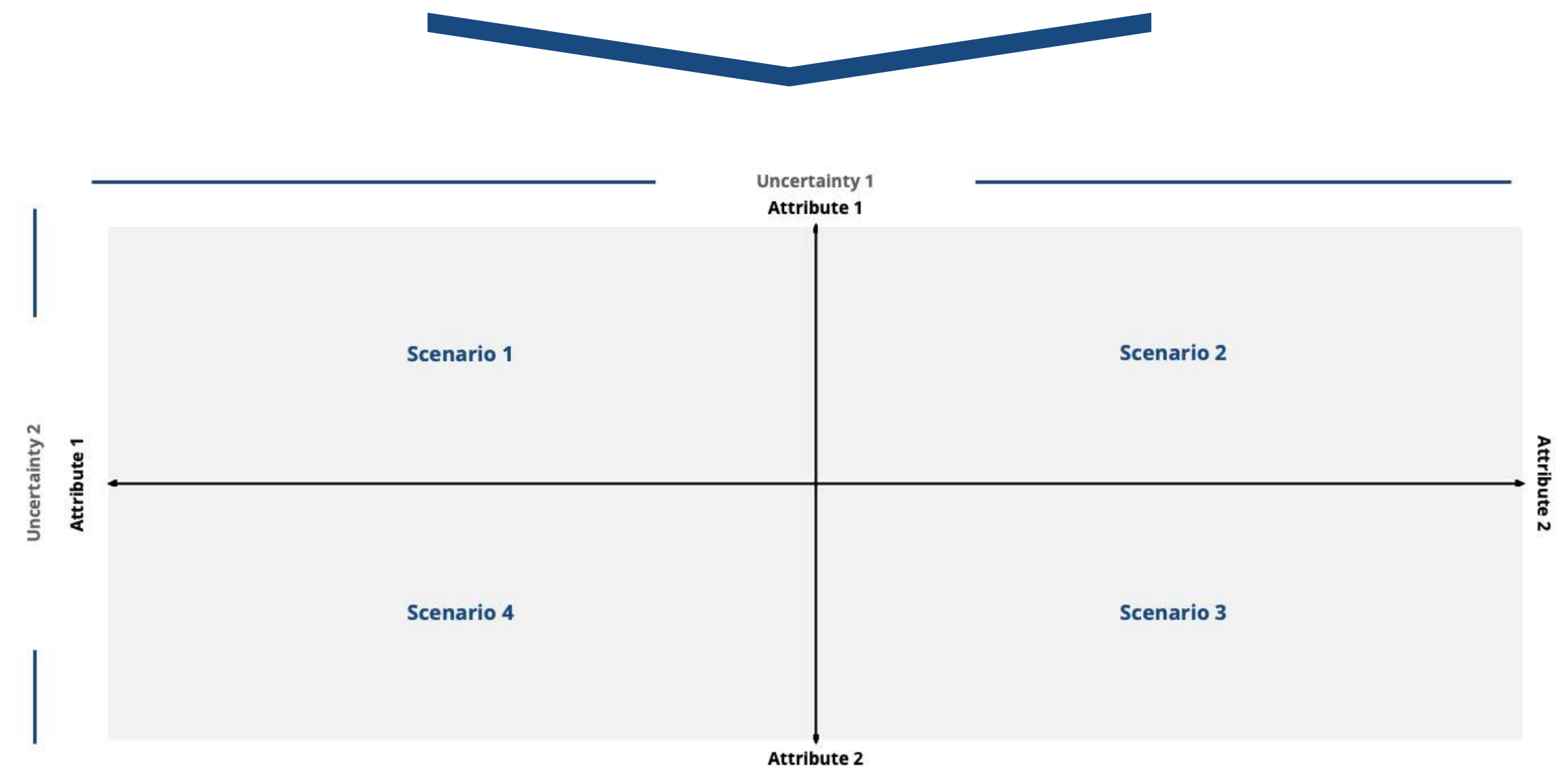
04

From the pool of uncertainties, **key uncertainties** are derived, which form the **basis of the future scenarios** and underlie the argumentation logic.

Building scenarios based on uncertainties

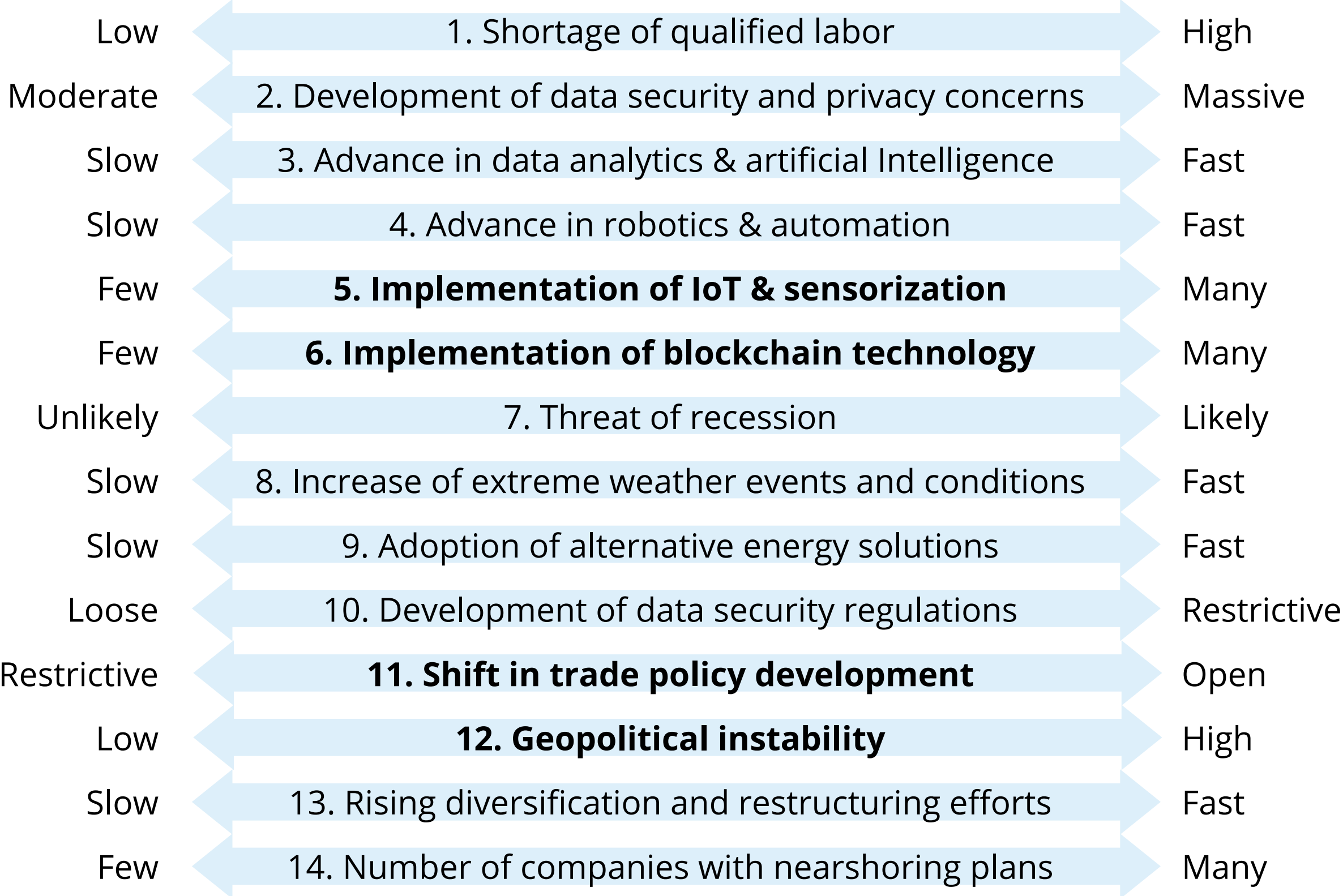
After the **derivation of critical uncertainties** from the drivers of change within the logistics industry, **two key uncertainties** will be defined in the following. Each of them will represent one **axes** with two different potential extremes.

Based on a 2x2 matrix, **four future scenarios** will be created.

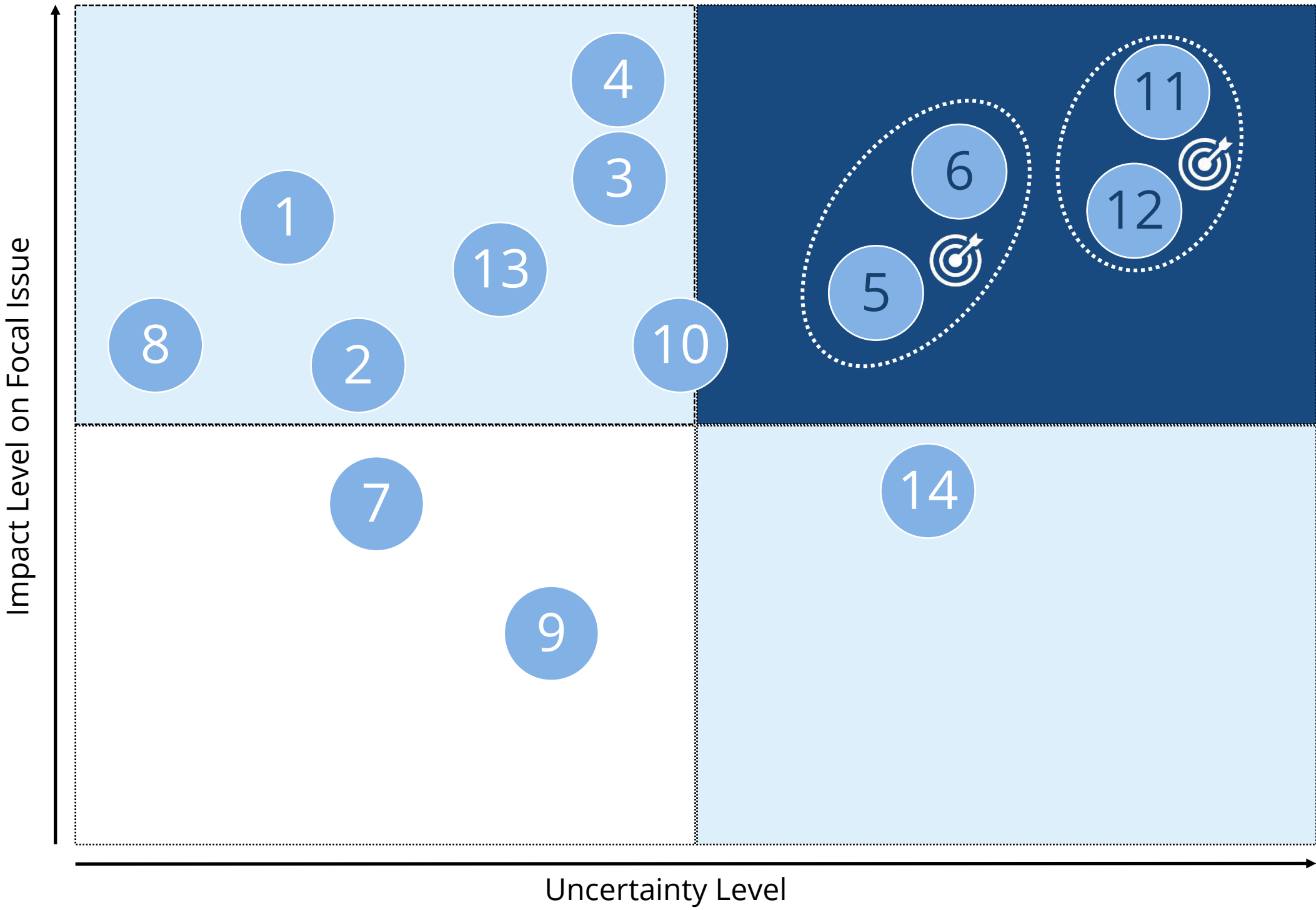


14 critical uncertainties with two extremes were positioned in a criticality matrix and two key uncertainties with high impact and high uncertainty were derived

Critical uncertainties and their two extremes



Criticality matrix and key uncertainties



Indicates the positioning of the two most critical uncertainties (=key uncertainties) which were derived from a merge between uncertainties 5 and 6, and uncertainties 11 and 12.

The future of the logistics industry is analyzed based on the intersection of 1) a technological key uncertainty and 2) a political/economic key uncertainty

Why is technological uncertainty relevant?

- Technology will play a crucial role for most industries in the future.
- In logistics, it is essential for data to be shared along the supply chain and among stakeholders. Blockchain can realize substantial gains in logistics process efficiency by improving transparency and traceability in supply chains.
- In addition, IoT and sensorization achieve interconnectivity and data transmission, turning global supply chains into more self-monitoring and self-maintaining processes.
- Scaled implementation is highly uncertain since blockchain requires further technological development, organizational transformation and collaboration between stakeholders.

5) Implementation of IoT & sensorization

6) Implementation of blockchain



Technology network

Why is political and economic uncertainty relevant?

- Current geopolitical and economic developments heavily influence global trade and thus also the logistics industry.
- Trade barriers including tariffs or customs together with societal pressure (firms stopping their business in Russia) directly impact the operations of logistics service provider.
- Both political and economic developments in terms of trade agreements as well as the role of Asia in global trade are highly uncertain in their direction.
- Geopolitical tensions, like the U.S. – China trade war, affect companies throughout all supply chain steps and are difficult to predict in their level of impact.

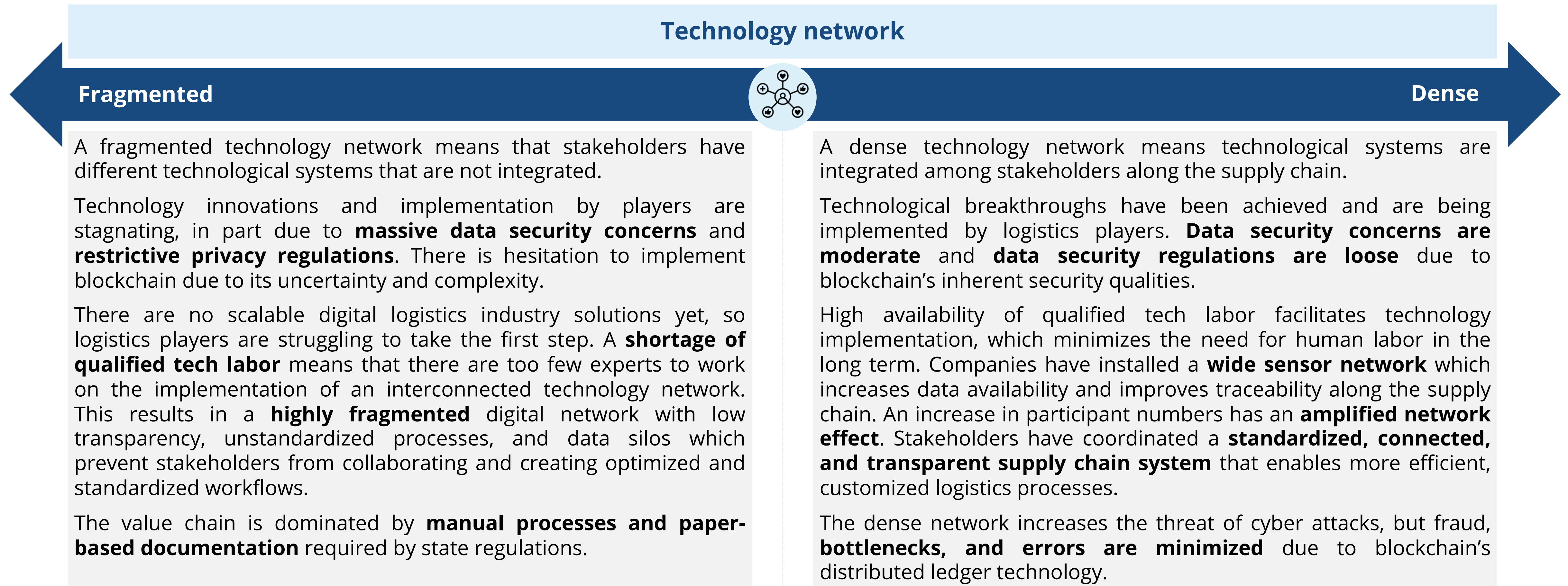
11) Shift in trade policy development

12) Geopolitical instability



Geopolitical and economic environment

The technological axis: Development of technological integration depends on technological advances and implementation by logistics players



To regularly assess the relevance and validity of the technological axis, the Readiness for Frontier Technologies Index can be used

Readiness for Frontier Technologies Index

The **Readiness for Frontier Technologies Index** assesses countries' capacity to use, adopt, and adapt frontier technologies which include AI, IoT, blockchain, robotics, drones and more. The index comprises **five building blocks**, each evaluated individually and contributing to the overall score.

- 1

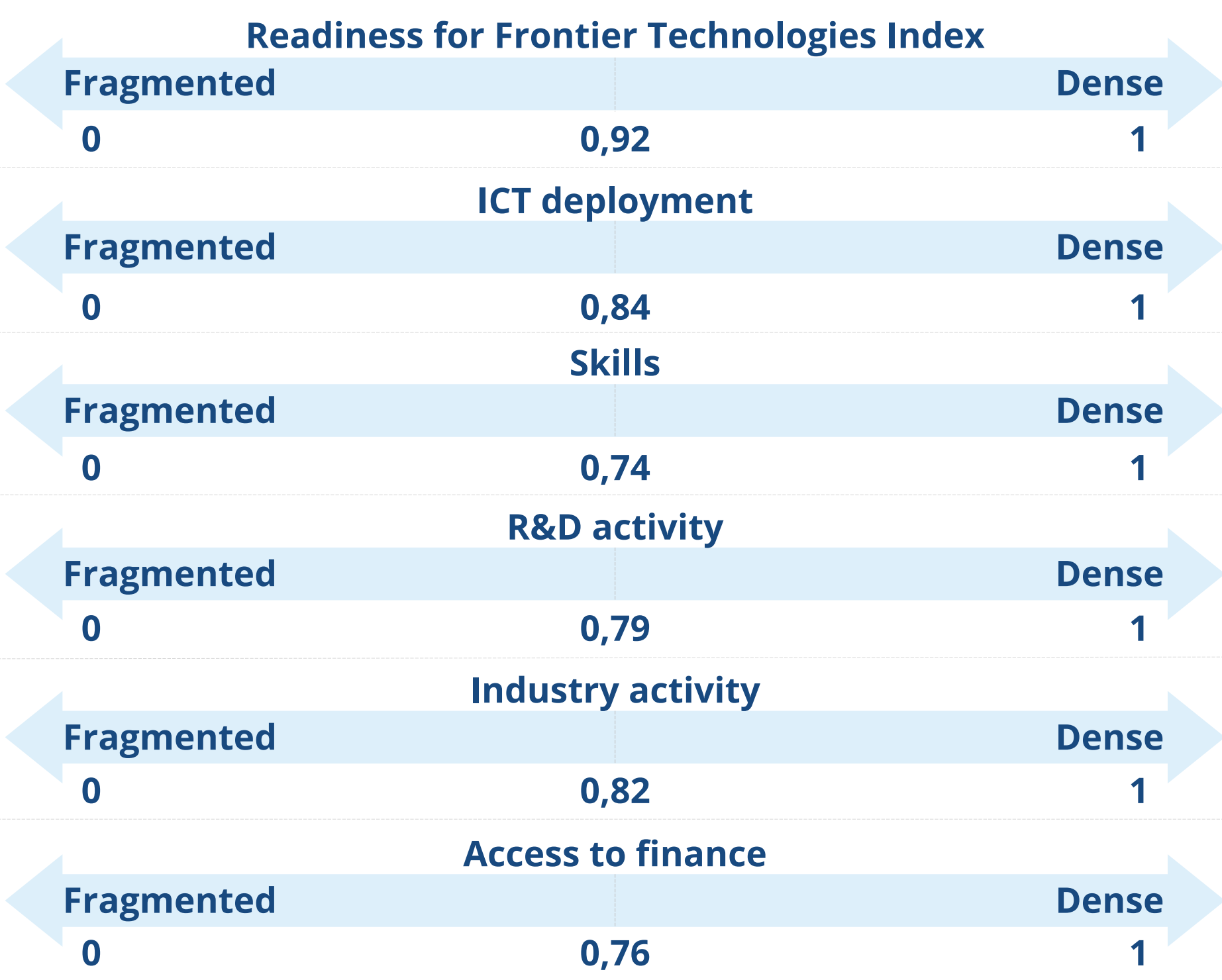
ICT deployment
This building block measures the level of ICT infrastructure which is required for internet-based technologies; the prevalence of ICT infrastructure and its quality are assessed.
- 2

Skills
This index assesses the level of relevant skills for using, adopting and adapting frontier technologies; skills acquired through education and acquired in the workplace are assessed.
- 3

R&D activity
R&D activities are required to use, adopt and adapt frontier technologies. The number of scientific publications and patents filed on frontier technologies are indicators of R&D activity.
- 4

Industry activity
This building block assesses the level of relevant industrial capacity for frontier technologies. Included are high-technology manufacturing exports and digitally deliverable services exports.
- 5

Access to finance
This factor considers the availability of finance to the private sector in the form of domestic credit as a percentage of GDP.



➤ Source to check the index: UNCTAD Yearly Technology and Innovation Report

The benchmark is Germany, a leading industrial nation in the EU.

The political axis: A stable geopolitical and economic environment in the EU would facilitate European and international trade, and benefit 3PLs



EU stability together with **low trade barriers** flourishes international trade and **reduces** the likelihood of **supply chain disruptions**. Cross-border **collaboration** between nations is taking place, especially in terms of transparent trade regulations and sustainability efforts. **Loose policies** and the absence of geopolitical tensions lead to further bilateral trade agreements between the EU and emerging economies, benefitting internationally operating logistics companies. Open borders and a **stable economy** attract international talent and **accelerate innovation** throughout the EU. Overall, a transparent and low-barrier trading bloc with international trade flows is established.

Geopolitical tensions together with an unstable economic environment, evoke **restrictive trade policies** and hamper international trade. High trade barriers lead to aggravated trade between economically important nations and cause supply chain backlogs. The instability causes a rise of **nationalism** with development towards **protectionist** behavior, resulting in further nearshoring activities with regionalized supply chains and thus national logistics. The inherent **increase in trade costs** as well as the price and quantity of traded goods leads to an overall **decrease in international trade volume** and therefore, decelerated economic activities. Unilateralism and the lack of cross-border collaboration threatens to cause an **EU division**. In response, critical talent is fleeing the country and the shortage of truck drivers tightens even further.

To regularly assess the relevance and validity of the geopolitical and economic axis, the Governance indicators and the HICP can be used

Political Stability and Absence of Violence Index

Harmonised Index of Consumer Prices (HICP)

Economic risk can arise from dynamics in the micro- or macroeconomic stability, while political risk is typically a result of governmental activities. To classify whether a nation is in a critical condition, geopolitical and economical indicators are needed.

Geopolitical indicators measure the risk that the government will be overturned through illegal methods, including political violence. The index represents the average of different indexes from groups including the World Economic Forum and the Political Risk Services.

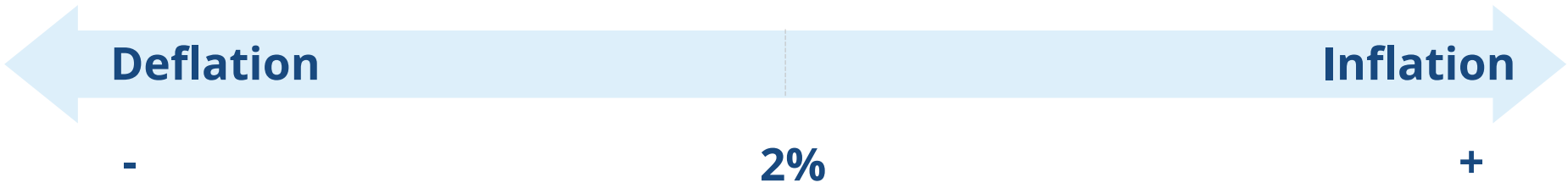
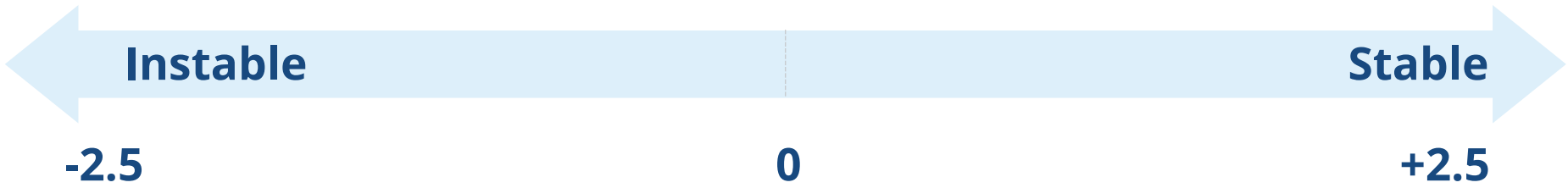
The **Political Stability and Absence of Violence Index**, ranging from -2.5 (weak) to +2.5 (strong) clustered by states.

In a stable economy, an index of **0 or higher**, signifies the tendency towards strong governance performance. The average for 2021 based on 45 countries was 0.55. The highest value for EU member states was in Lichtenstein: 1.64. The lowest value was in Turkey: -1.1. **Based on an educated assumption, an index below 0 indicates potential instability.**

Economic indicators include measures of macroeconomic stability (money supply, central government budgets, and the balance of payments) and performance (such as GDP, consumption, investment, and international trade)

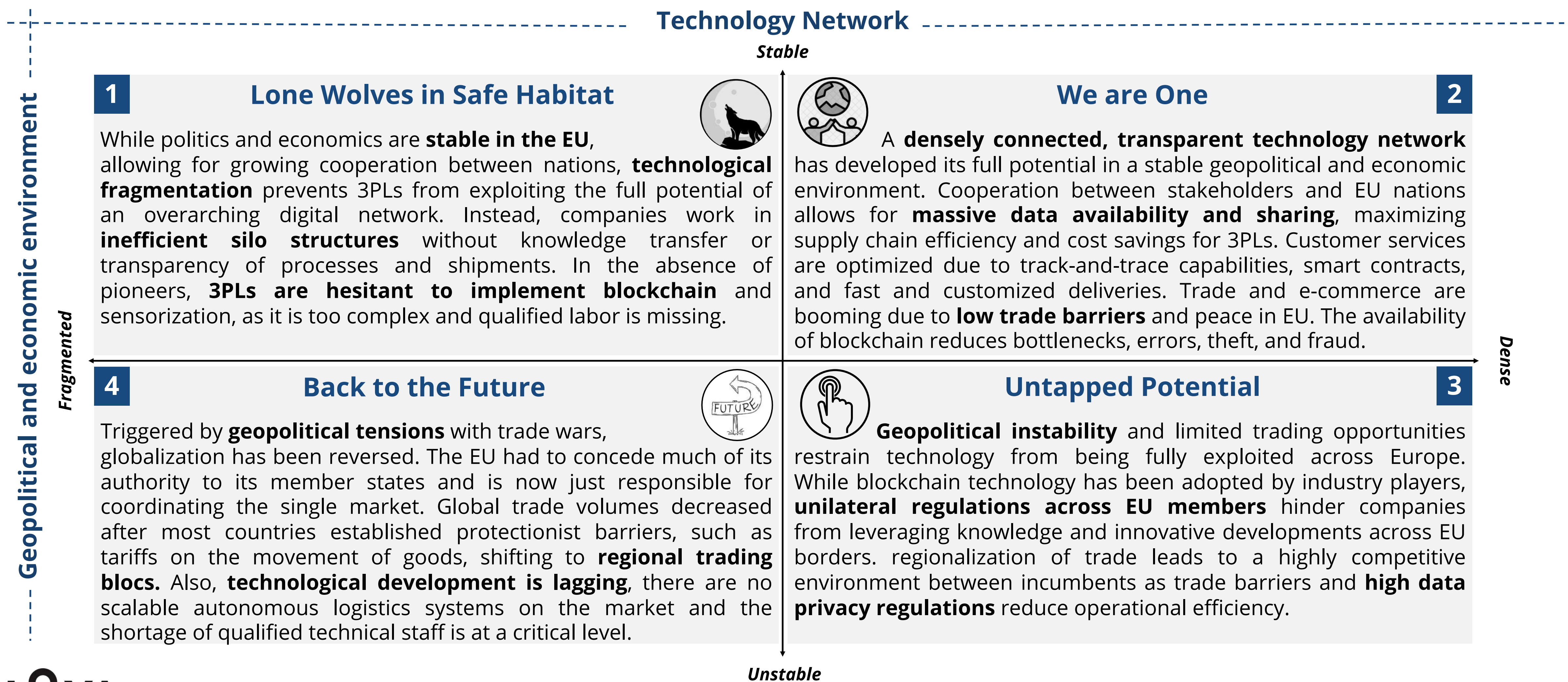
The **HICP**, measures the average annual change in prices paid by consumers for goods and services.

The main task of the ECB is to maintain price stability. Price stability indicates a stable economy, keeping fluctuation in prices to a minimum. Rising HICP reveals higher inflation, whereas a declining CPI reveals lower inflation or possibly deflation. **The ECB's Governing Council states that price stability is maintained by aiming 2% over last periods HICP.**

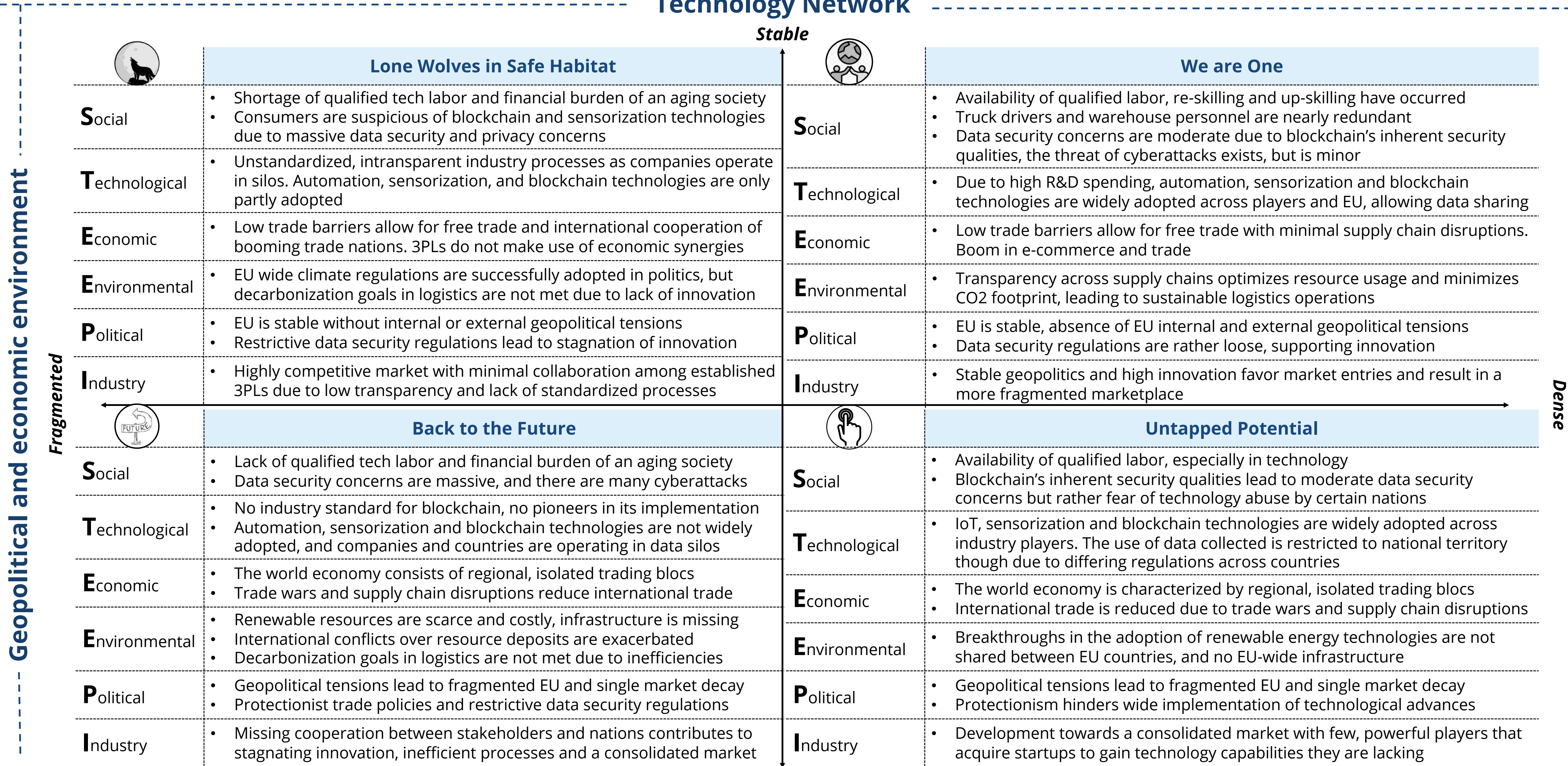


➤ Source to check both indexes: Worldbank (Worldwide Governance Indicators)

Four future scenarios of the logistics industry in the EU were created, based on the two identified key uncertainties



Technology Network





In the “Lone Wolves in Safe Habitat” scenario, political harmony enables growing trade in EU, but low-tech integration restricts collaboration among stakeholders

Early Warning Signals

Le Monde

Increasing data security concerns in the EU

As a result of increasingly strong concerns about data security, the European Parliament agrees on a stricter data privacy regulation package



The Sunday Telegraph

Cross-border trade at its peak

Logistics service companies can leverage cross-border trade due to beneficial trade regulations



Frankfurter Allgemeine ZEITUNG FÜR DEUTSCHLAND

Another setback for the blockchain industry

Adoption remains low and studies show that companies prefer established manual processes



The Guardian

Logistics remains main polluter
Emissions of logistics companies stay high, and companies fail to meet the European decarbonization goals



Daily Mail

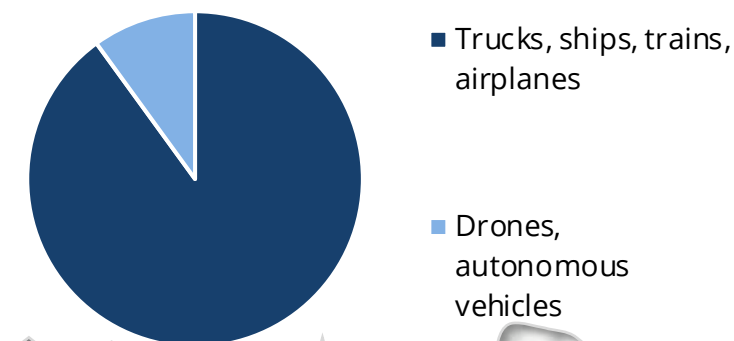
We are losing our tech start-ups
High entry barriers for tech-based start-ups lead to dominance of established logistics companies, preventing technological progress



EL MUNDO

Autonomous vehicles fail to establish their adoption

Traditional vehicles of transport remain dominant and only allow for a small market share of autonomous vehicles.



POLITIKEN

Concentrated power in the European Parliament

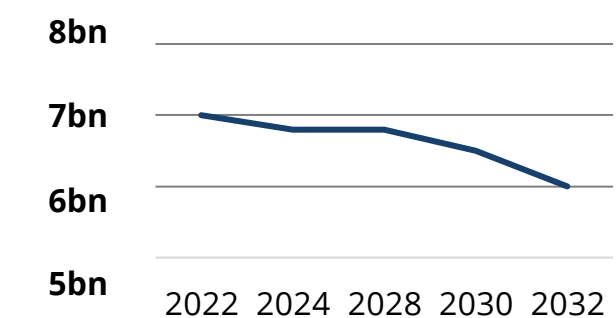
New agreements among nations transfer further legislative power to the European Parliament



Süddeutsche Zeitung

Tech innovation loses funding

Recent developments show that European investment in tech innovation is decreasing





Data regulations are strict and impede technological innovation and integration, thus 3PLs are left to operate in centralized systems

Industry and macro environment

- The EU has fostered cohesion among member states, which led to an increased significance of the EU while nation states' power decreased. As a result of the European unity, the EU is powerful enough to negotiate the suspension of trade barriers with other economic blocks.
- Thereby, the trade volume has multiplied and strengthened the European position in the logistics sector. The resilient logistics infrastructure is the backbone of these developments.
- However, the epicentre of trade and consumption has shifted East for two main reasons: 1. demographic development in the EU leads to an aging population, 2. European 3PL companies fail to adopt technological innovations and are stuck in silo structures, while Asian 3PLs make use of blockchain to create more efficient processes and gain a competitive advantage.
- A strong competitive spirit dominates the European logistics sector and prevents the creation of overarching synergies between companies; thus, the industry remains fragmented.
- Technological development and its implementation in logistics has been slow and progress is achieved through refinement and diffusion, not through pioneering innovation. As a consequence:
 1. Road freight remains the most popular transport mode in the EU, while intermodal transportation has stagnated due to a lack in sensor and RFID technology development.
 2. 3PLs fail to achieve the set recycling goals through reverse logistics and the set European decarbonization goals to keep global warming at a maximum of 1,5°C.
 4. 3PLs are exposed to consequences of extreme weather events and struggle to create resilient systems due to missing technological solutions for agile reactions.
 5. Start-ups who base their business models on disruptive technologies face adoption concerns by traditional 3PLs and high entry barriers due to strict regulations.

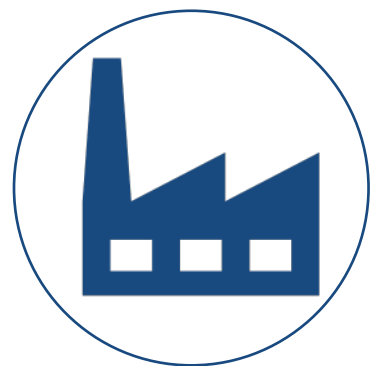
Regulatory Landscape

- The strong European governance has allowed for a harmonized regulatory framework and its implementation regarding a strict European agreement on a more sustainable path for economic development and the advancement of alternative energy solutions and their subsidization.
- Strict data privacy regulations are formulated, which limit the liberalization and implementation of blockchain technology, as it can promote abuse of data collected and other criminal activities.
- Technological innovation is strongly regulated to protect consumers, which keeps entry barriers for technology-based startups high and favors established 3PLs who continue to operate in silo structures.
- Regulations regarding ownership and responsibility for shipments remains complex and untransparent throughout the transportation process.



In this scenario, clients are concerned about data security, accelerating their reluctance to adopt technological innovations

Persona and their expectations



Unreceptive to technological progress

Short term oriented

Tech illiterate

Prefers manual processes

Concerned about data security

- Clients rely on their established technology, being reluctant to extend and adopt technological innovations
- Clients fear cyber attacks; hence they are unwilling to share digitalized sensitive information with partners
- Clients expect to fulfill broad range of end-customer needs by sourcing raw materials from multiple geographical locations within the EU
- Clients rely on a stable economic growth, triggered by unrestricted international trade
- Clients expect full resource availability through unlimited sourcing opportunities
- Clients expect a stable political environment in the future, further accelerating international business opportunities

Exemplary daily routine of a 3PL client in 2032

Persona: Operations Head at German car manufacturer, HQ in Europe, global sales through 3PLs



07.30 am

Mrs. James starts her day by watching the news: the European political stability index reached its all time high. Unrestricted import and export business among EU countries accelerates economic growth. After breakfast, she is off to her first meeting.



11.00 am

Joure Fixe with the company's freight forwarder: forecasted production units, transportation measures and changes about end-customer details are debated. All discussed information is transferred by either mail or call to the 3PL provider.



01.00 pm

After the meeting, 3PL provider signs physical consent form, agreeing to keep company sensitive information to themselves.



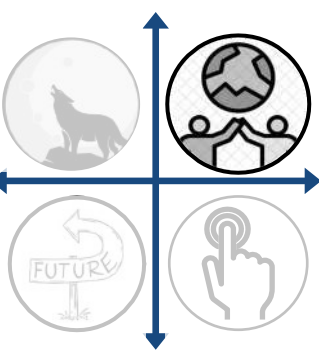
04.00 pm

Mrs. James sits down for the second meeting today. Together with the business development team, she discusses how to enter new markets with existing and future products as the geoeconomic situation favors market expansion.



07.00 pm

Arriving at home, she meets her neighbor in the hallway who tells her about another data security leak at a tech company.



In the “We are One” scenario, blockchain-based applications revolutionize logistics operations and services across EU borders

Early Warning Signals

BUSINESS INSIDER

Blockfreight™ is now the market leader among 3PL service providers

Following its implementation by DPDHL, Blockfreight™ is now the leading blockchain solution for global freight in the market



Frankfurter Allgemeine ZEITUNG FÜR DEUTSCHLAND

Amazon has started its second pilot project of aerial warehouses

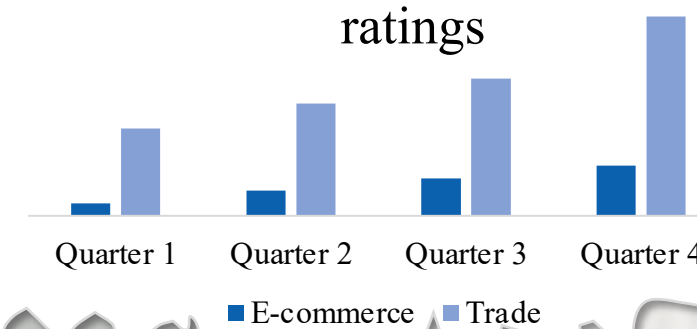
Two aerial warehouses are now floating above Berlin and Madrid and first UAV deliveries are being tested



POLITICO

EU geopolitical stability at peak since its founding years

EU is experiencing significant quarterly trade volume increases as a result of high geopolitical stability ratings



DVZ Deutsche Verkehrs-Zeitung

Digital transparency permeates the industry

Digital supply chains now allow customers to have real-time insight into the status of their order and the performance history of carriers



SPIEGEL ONLINE

Investments in employee development are at an all-time high

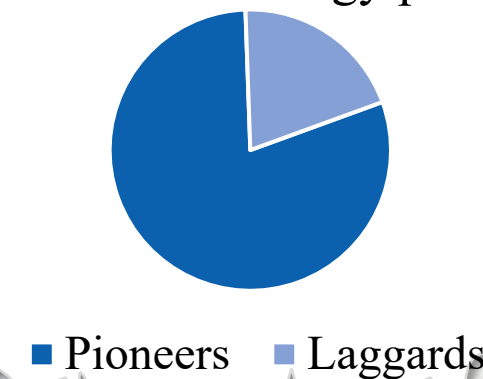
More than 65% of the EU workforce has experienced re- or up-skilling and is equipped to design and operate frontier technologies



FINANCIAL TIMES

Technology pioneers are dominating the 3PL market

3PLs refusing to integrate new technologies (laggards) continue to lose significant market share to technology pioneers



POLITIKEN

EU introduced new cybersecurity regulations to support innovation

The European commission presented a new EU cybersecurity strategy to facilitate a secure blockchain environment

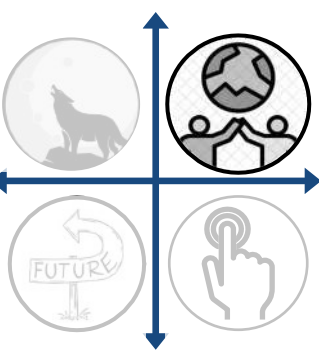


ZEIT ONLINE

Fleet electrification high on 3PLs decarbonization agenda

Increasing investments in green logistics to meet SDG 2030 agenda





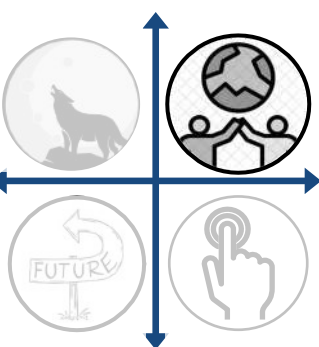
EU investments stimulate rapid technological development and skills building, while policies and regulations foster a safe blockchain environment

Industry and macro environment

- Geopolitical stability within the European Union and stable relationships among EU member states and with international trading partners (e.g. US and China) lead to a secure trading environment. Low trade barriers result in high intra-EU and international trading volumes.
- Technologies have evolved at an enormous pace and an industry-wide blockchain solution Blockfreight™ is implemented across 3PLs.
- 3PLs have standardized processes & documentation across their own businesses and with their clients. Transactions are processed via smart contracts and with digital EUR.
- UAVs and autonomous e-vehicles make up the majority of freight transportation vehicles.
- European Commission invests in re-skilling and up-skilling the workforce to offset unemployment effects in the fourth industrial revolution. Work and services are increasingly going digital, and physical interactions become less important in work environments.
- European Commission allocates significant funds to the development of ICT infrastructure and UAV infrastructure.
- Stable geopolitics, economics and high innovation pose low barriers to entering the market which results in a fragmented marketplace.
- 3PLs collaborate with supply chain partners to develop digital industry solutions and standardized systems.
- Technology innovations facilitate more sustainable operations, for instance, energy-harvesting wireless sensors require no batteries to acquire and send data.

Regulatory Landscape

- Free trade regulations in EU single market area and trade agreements with large trading partners remain active.
- European policymakers recognize the potential of blockchain solutions in making logistics processes more transparent and efficient, thus they develop a clear legal framework to support a safe blockchain environment.
- An official digital EUR is introduced by the European Central Bank to safely facilitate digital transactions. It is different from a cryptocurrency in that it is risk-free and protects privacy and data protection.
- Significant EU funds are allocated to support citizens in skills development for industrialization 4.0, such as programming, data analytics, and blockchain/cryptocurrencies.
- Regulations to meet European Green Deal are strictly enforced.



In this scenario, 3PLs provide smooth and transparent transactions due to blockchain integration and continuous innovation efforts

Persona and their expectations



Interconnected in a progressive, globalized world

Always digitally connected and updated Efficient and smart lifestyle

Prioritize their skill development Ecologically and socially engaged

- 3PLs are concerned to provide full transparency to their clients and only engage in stakeholder relationships where technical integration of systems is possible.
- A high value is placed on the standardization and predictability of processes, as well as on smooth services and user-friendly interfaces.
- As clients prefer digital pioneers and leaders over technology laggards, 3PLs invest heavily in digital solutions that can simplify processes.
- 3PLs trust blockchain technology due to its inherent security capabilities which protect data by means of cryptographic functions.
- 3PLs are dedicated to providing fast and reliable services across the EU which is what customers expect in an interconnected, stable environment.
- 3PLs benefit from a stable economy and free trade policies, in the form of high consumer spending and high inventory turnover.
- Sustainability is an important societal value, thus 3PLs invest in the electrification of fleet and sustainable operations.

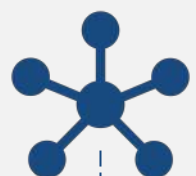
Exemplary daily routine of a 3PL employee in 2032

Persona: Head of Innovation and Commercial Development at a leading European 3PL company



07.00 am

The smart digital assistant Ora wakes Mrs. Hill and reads the news: the economy is booming, and consumer spending is at an all-time high. Ora also provides the daily security update: all digital systems are clear.



9.15 am

Mrs. Hill has a meeting with the company's CTO and CFO to discuss quarterly innovation budget. They allocate funds to further blockchain integration and automation technologies.



11.30 am

After reading the report on four successful drone pilot projects with a pharmaceutical client delivering medical supplies in the Alps, she gives her vote for the company's purchase of two drone hubs in Munich and Bern.



2.00 pm

Due to stable economy and free trade policies with US, the company considers expanding to the States. Mrs. Hill attends a meeting discussing market entry strategies with the company's Growth Manager.



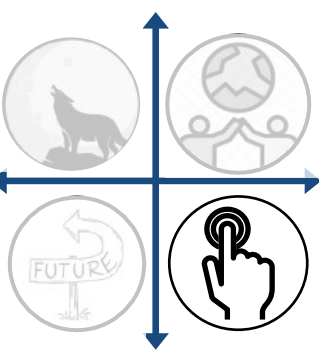
3.15 pm

Mrs. Hill attends her weekly company training and development class. Currently, she is pursuing an advanced programming certificate.



6.45 pm

Notification by Ora that all tasks for the day are accomplished. Mrs. Hill starts her leisure time by tracking down a painting in blockchain that she intends to buy.



In the “Untapped Potential” scenario, geopolitical and economic instability hinder technology from being fully leveraged due to protectionist policies

Early Warning Signals



REUTERS®

Trade tensions between EU and China might develop into trade war

As the EU tries to decouple further from trade with China, companies fear the tremendous costs resulting out of an EU-China trade war.



POLITICO

European Commission reduces the Connecting Europe Facility (CEF) funding

Projects for transport infrastructure development have seen a sharp decline in funding.



Daily Mail

Logistics companies recruit massive numbers of tech talent to tackle digital transformation

Logistics providers are confronted with outdated technology and few digitized processes.



TE

DHL recently announced global implementation of blockchain technology

The logistics company from Bonn is the first to announce the implementation of an industry solution based on blockchain technology.

BUSINESS INSIDER

Multiple European conglomerates announced termination of production focus in Asia

Companies like Nike, Apple or Zara plan to nearshore their business processes and with that, shift their production to neighboring countries.

DVZ
Deutsche Verkehrs-Zeitung

The logistics industry is getting greener

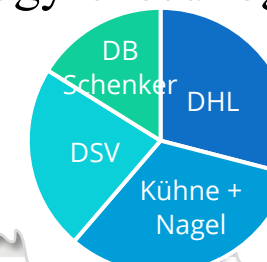
The four leading companies in the logistics market are now using sustainable fuel or electric vehicles as their predominant way to transport goods.



THE ECONOMIC TIMES

Market consolidation developments in logistics industry

Legacy companies like DHL have strengthened their market share through numerous M&As of technology-based logistics startups.

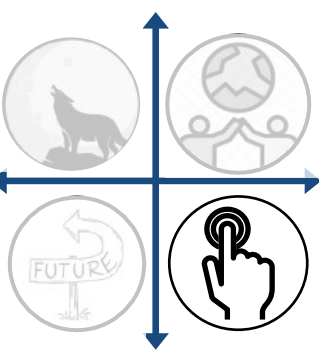


SPIEGEL ONLINE

New EU data privacy regulation

The newly enacted data privacy regulation prohibits companies from sharing customer data across national borders.





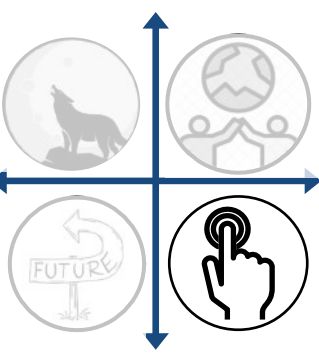
The world is characterized by distrust and division. Nations keep their industry and technology know-how to themselves and make efforts to be independent

Industry and macro environment

- Triggered by geopolitical unrest, nationalism dominates the political landscape. Insecurity about the potential implications of war in Europe dampen the willingness for players to collaborate with stakeholders across borders.
- Trade volumes suffer from the economic instability, with protectionism hindering open global trade and limiting the availability of crucial resources.
- Regional trading blocs are the new normal, restricting data storage and usage to national territory, as data security regulations vary strongly across Europe.
- Countries increasingly need to position themselves when deciding which economic bloc to support in times of geopolitical unrest, further aggravating trade limitations.
- Data privacy concerns are rather moderate due to the security qualities blockchain technology brings along. Clients and end-customers are rather concerned by cyber attacks from other nations.
- High energy prices and scarcities fuel sustainable transformation and with that, Green Logistics. However, conflicts over resource deposits lower international collaboration in reducing CO2 emissions.
- Large incumbents are the only ones with necessary resources and capabilities to implement technological innovations while cushioning negative trading effects. They diversify their business model and adapt to the emerging platform economy in freight.
- While 3PLs benefit from a connected technology network, the outlook to dominating regional transport orders, requires players to stay innovative to competitive in a slowly consolidating market.
- Investments in ICT and UAV infrastructure development are limited to national borders.

Regulatory Landscape

- Regional trading blocs and protectionism fuel restrictive trade regulations, turning international trade into an expensive undertaking.
- As a result, road logistics are marked by long truck queues at international borders, leading to supply chain backlogs.
- 3PLs benefit from loose data security regulations and adopt new technologies to reduce costs and provide customers with traceable and transparent supply chains.
- The fragmented trading blocs and protectionism in Europe lead to a low engagement of the European Union in subsidization of further technological innovation adaptation.



High customer expectations towards speed of transport and economic pressure challenge logistics service providers to provide fast and sustainable logistics

Persona and their expectations



Realistic in economic downturn

Tech-literate

Sustainability advocate

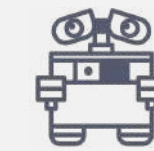
Well-read about economy

Progressive

- Clients expect more than ever a fast and smooth order handling procedure marked by automated processes and a client-friendly interface.
- Transparency in the tracing of transported goods is of extreme importance to the client, as delays can be foreseen and communicated in advance.
- While technology facilitates the order process, clients expect their data to be securely handled by 3PLs.
- As only a handful of 3PLs compete in the fragmented environment, clients expect price advantages from switching from one to another.
- Sustainably friendly transport modes with low greenhouse gas emissions are a must for clients to choose a specific 3PL.
- Clients expect companies to stop any business with nations that initiated geopolitical conflicts.

Exemplary daily routine of a 3PL client in 2032

Persona: COO of Global Chemical Company, HQ in EU, exporting to the US.



07.30 am

A robot named Ze wakes up Mrs. Miller by playing her favorite song. While getting dressed for work, her smart closet briefs Mrs. Miller on daily news where she learns about a new trade war between the EU and the US.



08.30 am

On her way to work in an EV, she contacts her logistics partners to prepare all relevant data for an emergency meeting.



09.00 am

After arriving at the headquarter, Mrs. Miller gets greeted by her staff who present her with estimates of the economic impact of closed borders and restrictive trade regulations between EU and the US.



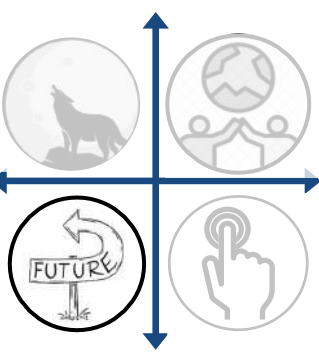
01.00 pm

With the help of transparent supply chains through blockchain technology, Mrs. Miller and her team prepared a report to the CEO of Global Chemicals. The report contains strategic implications and options with exact calculations of the economic harm and supply chain impact of a conflict.



06.00 pm

After a stressful day, Mrs. Miller returns home, with the knowledge that all plausible scenarios were taken into consideration. She knows she did her best in preparing her company for this trade war, but some uncertainty is still left. Ze continues to give her relevant news updates for the rest of the evening.



The scenario “Back to the Future” represents a step back from the logistics industry status quo – traditional, conservative and highly regulated

Early Warning Signals

The Guardian

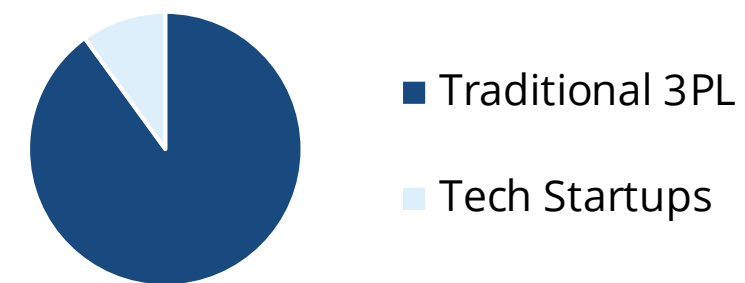
Are we ready for another “Brexit”?

EU is on the verge of rupture as geopolitical tensions increase



Statistics on Logistics

The road is not easy for new players on the logistics sector as they can only have a minor share of the market



Daily Mail

Winning the talent race

Besides the aging problem, companies are now being hit by a lack of qualified workers



BUSINESS INSIDER

The Great Tech Stagnation

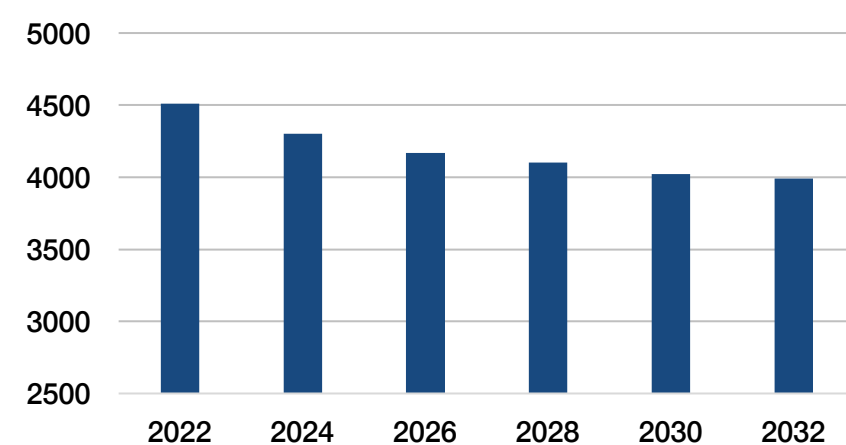
Are IoT, Sensorization and Blockchain stagnated? Or are we going to see any developments in the future?



FINANCIAL TIMES

We are losing companies

Number of logistics companies in EU has been decreasing and is expected to stagnate



Diário de Notícias

Nearshoring is transforming global supply chains

Near shoring activities seem to be increasing as protectionist policies are getting stricter



The Sunday Telegraph

The future is dark as fossil fuels remain the primary source of energy

How can we shift the paradigm if renewable resources continue to be scarce and costly?



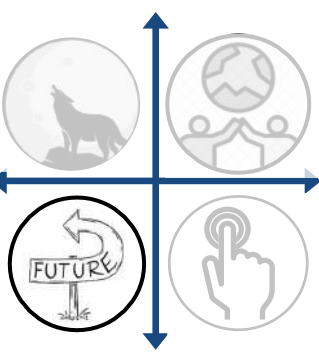
Frankfurter Allgemeine

ZEITUNG FÜR DEUTSCHLAND

Data security or data sharing?

Increased scrutiny on privacy regulations is creating a big wound on logistics companies: no data sharing





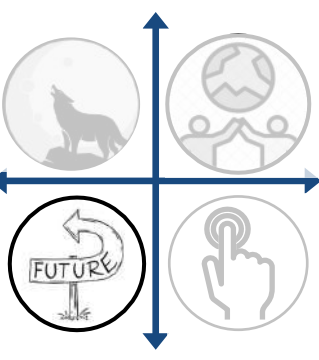
Regulators impose high entry barriers: simpler for major players to maintain and even extend their market dominance since new ones can not survive

Industry and macro environment

- On a socio demographic level, countries are hit by lack of qualified workers, underfunded infrastructure and the financial burden of aging societies.
- People are also more concerned regarding data security, as there is an increase in cyberattacks.
- However, the pace of technical advancement is slow. There is no industry standard for blockchain, and neither are there pioneers in its implementation.
- Automation, sensorization and blockchain technologies are not widely adopted, and companies and countries are operating in data silos. There is also a lack of development of ICT infrastructure and UAV infrastructure.
- International disputes over resource deposits are fueled by high energy costs and severe scarcities. European initiatives to lower greenhouse gas emissions have been dismissed to prioritize economic growth.
- Trade volumes within EU have decreased since most countries increased protectionist barriers. Excessive nationalism dominates much of the political behavior around the world.
- Since markets are geographically constrained, companies need to be more vertically integrated and less specialized than they used to.
- Because of the unfavorable circumstances, high entry barriers, limited profitability, and fierce rivalry, new entrants do not enter the industry.
- Due to the increase in the protectionist barriers, the typical transport distance is also getting shorter. Ocean freight loses significance, but, on the other hand, the importance of regional rail and road transportation grows.

Regulatory Landscape

- The European Union is now just responsible for coordinating the single market after having to cede a large portion of its authority to its member states.
- Introduction of tariffs on the movement of goods between EU countries, thus abolishing free trade in the EU.
- The only political intervention in the economy is through regulation and not financial incentives.
- The primary goal of national transportation and logistics regulations is to protect the security and safety of the cargo being moved.
- The majority of nations have tight government regulation over the Internet. To detect and stop espionage or sabotage at an early stage, data streams are inspected.
- The implementation of blockchain technologies is viewed as a threat since it could encourage illegal activity and is still in development, so regulation is tight.



Employees are not familiarized with change, so they avoid technologies they cannot understand

Persona and their expectations



Locked in their own bubbles

Skeptical and conservative

High data privacy concerns

Live in fear

Resistant to change

- Employees rely on their established technology, being reluctant to extend and adapt technological innovations from others. At the same time, employees have to go through a lot of bureaucracy, due to lack of technology.
- Employees fear cyber attacks; hence they are unwilling to share digitalized sensitive information with partners.
- Employees are aware of disruptions in supply chain, triggered by geopolitical tensions and hence delays in transportation and import and export shipments are common.
- Employees feel demotivated while doing their jobs as there are constant delays due to a lack of infrastructure investment.
- Employees don't understand career goals, due to inadequate training, leading to increased levels of work-related stress.
- Therefore, employees lack motivation and incentives to work, as everything is manual and there are no growth opportunities.

Exemplary daily routine of a 3PL employee in 2032

Persona: Truck driver of a 3PL company



07.30 am

Mr. Smith, a 60-year-old truck driver is awakened by his old radio-clock. While eating breakfast, he reads in the newspaper that some countries are closing borders as a trade war between China and EU is imminent.



09.30 am

After arriving at the warehouse, he starts consulting the paperwork regarding the orders expedited.



11.00 am

He hops on the truck and puts the destination on the GPS: the harbor. He has to get a shipment that comes from China. However, as he gets closer to the harbor, a line of trucks without end seems to be in front of him.



01.00 pm

He gets the information that logistics providers ships are being withheld. Due to the imminent trade war situation, they don't have permission to dock in another country. His manager tells him to go back to the warehouse.



04.00 pm

There is a team meeting, and it is discussed that European countries are introducing higher import tariffs for goods from China, harming the cost structure of the company. They also talk about the complaints from clients regarding the lack of information on routing and shipment, as there's no technology to overview where the cargo is.



10.00 pm

He arrives home and has dinner with his wife. He discusses with her how he wants to retire.

05

Strategic Recommendations

Scenario Implications

Strategic Options per Time Horizon



In this chapter, the implications for each scenario are explored and strategic options across scenarios are provided

Implications per scenario

Strategic options across scenarios

Options assessment

THE FUTURE OF THE EUROPEAN LOGISTICS INDUSTRY IN 2032

IntroductionExternal analysisScenario PlanningStrategic recommendationsMonitoring SystemConclusion

In the “Untapped Potential” scenario, logistics companies require loyal customers and suppliers to offset any negative effects of geopolitical instability

Category	Implications
Strengths	- Process efficiency gains through automated processes lead to cost optimization - Process optimization through transparent and traceable supply chains allows companies to provide targeted services to customers - Availability of highly skilled tech talent to handle process automation and overall digitization - Full digital transformation of business model reduces need for “low-skilled” staff, allowing for cost savings in human resources
Weaknesses	- Regionalized business focus leads to massive fixed overhead costs in depreciation of unused assets (e.g., fleet) - Legacy players need to diversify their revenue stream to stay competitive during economic downturn - Shift of investments into technology as competitive advantage requires massive R&D capital expenditures that now lack in other business units
Opportunities	- Technological advancements can significantly reduce CO2 emissions and lower number of required emission permits in form of certificates - Stagnating external investments into logistics startups enables established players to acquire promising companies that would otherwise go bankrupt
Threats	- A recession due to a trade war lowers consumer demand, resulting in order stagnation and trade volume decrease - Closed borders and tariffs make cross-border trade unattractive and highly bureaucratic, while extending established transport routes by several days - Customers threaten to switch to a competitor due to longer waiting time
Relevant resources and competencies	- Technological know-how and highly specialized tech-talent (data scientists, data engineers) in frontier technologies such as blockchain and robotics - IT capacity, computing power, automation software and other digital assets - Strong supplier relationships to offset negative effects of political instability - Strong customer relationships and loyalty
New entrants	- Companies outside of the logistics industry diversify their business by either acquiring promising startups or building their internal logistics solutions to compete with established players - Traditional logistics service provider focus either on market penetration or market development to keep the risk low
Winners	- Legacy logistics players focused on regional logistics - Large organizations with sufficient financial resources to go into the logistics industry
Losers	- Organizations and startups without digital solutions - Small players that lack resources for diversification

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Source: Graphs and narratives by the authors

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3PLs must prepare for Industry 4.0 by enforcing training programs for employees and data/cybersecurity functions

Time HorizonShort-term: 3 to 4 years

Division	Option	Explanation	Time horizon justification	Scenarios*				
Human Resources	5 Hire and train workforce (re-skilling) for the digitization of business processes and the automation transition	The technology transition entails the administration of mobile indoor robotics, stationary indoor robotics and outdoor autonomous vehicles. The workforce needs to be prepared to use, adopt and adapt all frontier technologies. Therefore, an overall higher rate of IT specialists and tech talent needs to be hired, and high-quality existing staff has to be re-skilled for technology positions instead of laid-off. Considering the shortage in truck drivers, autonomous trucks might be the future for logistics in the long-term. This will create new positions in AI technology development and autonomous truck route controlling.	Action must be taken now in the short-term to prevent competitors from taking away the majority of tech talent. Despite a now looming recession, companies must engage in a hiring effort of tech talents. Additionally, logistics companies must be perceived as pioneers and attractive employers by actively re-skilling their existing employees for the digital transformation. This will facilitate and enable the digital transition.	<table><tr><td>1</td><td>2</td></tr><tr><td>4</td><td>3</td></tr></table>	1	2	4	3
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6 Restructure work processes to enable flexible and remote work schedules	The increasing implementation of warehouse automation technologies requires less employee presence on-site which enables more remote work and flexible hours. For this, IT equipment, digital infrastructure, and clear remote work policies are required. Considering the massive closures and shift in work brought on by the pandemic, many employees continue to expect remote flexibility.	Currently, one of the main perks that employees demand from their employers is work-life balance. Implementing flexible working hours should be adopted in the short-term as it does not represent a difficult process for the company. It is a fast way to achieve higher productivity, enabling employees to produce better results.	<table><tr><td>1</td><td>2</td></tr><tr><td>4</td><td>3</td></tr></table>	1	2	4	3	
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Legal/Finance	7 Create corporate division dedicated towards data protection policies	An increasing amount of data points from customers and other stakeholders is collected and processed, which requires an organizational commitment to data protection and compliance. Creating a division that implements a data protection strategy shows a clear commitment of the organization to safely store and monitor stakeholder data. The department ensures that local privacy laws are in effect and that the organization collects and protects data in accordance with those laws.	This recommendation should be implemented in the short-term but continuously reviewed, as data is becoming increasingly complex which must be accounted for in the protection policy.	<table><tr><td>1</td><td>2</td></tr><tr><td>4</td><td>3</td></tr></table>	1	2	4	3
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8 Increase investments in cyber security platforms and features	With the advent of more digitally connected networks, cyber security needs to be solid. The more information and processes are running digital, the larger the threat of total system breakdown by a hacker. Real-time information on security breaches can also enable the 3PL to respond faster to such threats.	Investments need to be heavily increased in the short-term to enable secure processes.	<table><tr><td>1</td><td>2</td></tr><tr><td>4</td><td>3</td></tr></table>	1	2	4	3	
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No-regret option: Options that are low in uncertainty and have a medium/high impact, thus pay off regardless of future developments.

*The scenarios in which the option is most relevant and feasible are colored in blue. This does not exclude their application to other scenarios.

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Appendix AAppendix BAppendix CAppendix DAppendix EAppendix F

Justifications on Benefits and Risks for each Strategic Options 1/5

Option	Benefits	Risks
1. Offer continuous skills development for employees across levels and departments (up-skilling)	An investment in the skills development of one's human capital is expected to pay off in terms of better operational and financial results, and in terms of employee satisfaction which improves employee attraction and retention rates.	There is a relatively low risk involved with this option since training is expected to directly improve employee performance. However, implementing frequent training programs across departments and levels requires significant resources and planning. There is also a risk that employees might take part in the trainings and then leave the company to apply their gained knowledge somewhere else.
2. Reinforce sustainable accountability among employees	Increasing awareness regarding sustainability among employees allows for the implementation and advancement of sustainability efforts within 3PLs. Further, it will help to achieve the European goal of zero-emissions by 2050.	This option is a low-risk option, as sustainability is a central topic in the economy and society and will remain or even increase in importance. However, 3PLs risk to be accused of green washing, if operational transparency is missing.
3. Put in place truck drivers' retirement schemes	This option provides an additional layer of trust for truck drivers, creating a healthier work environment. It will also make the industry and company more attractive when recruiting and retaining younger truck drivers.	Developing and managing a solid retirement plan for the trucking team will take time and require investment. However, the cost of not doing it could be more expensive in the end.
4. Realign training methods for operational staff to virtual reality training	With VR, employees effectively receive individualized on-the-job training while experiencing what it's like to be in real-world scenarios. As a result, there is less need for long training sessions that include reading through manuals, halting production, walk-arounds, and/or role-playing.	These technologies are still being developed and tested for training and require high investments, with no data proving the return on investment.
5. Hire and train workforce (re-skilling) for the digitization of business processes and the automation transition	Employees need to be equipped to use, adopt and adapt automation and other frontier technologies. Thus, a focus on hiring and training IT professionals benefits the company in the long-run, should automation be increasingly implemented.	This option needs to go hand-in-hand with the automation process to avoid 1) having a fully trained staff when the automation is not realized yet, 2) having automated processes without a well-trained workforce.
6. Restructure work processes to enable flexible and remote work schedules	Employees with flexible schedules may not have to commute to the office every day, which can increase productivity and also reduce some costs for the company. It can also reduce absence rates and support employees' mental health and stress.	Having a flexible schedule can lead to more procrastination, and the line between home and office can get blurred. It is also not possible to apply at every worker, since drivers and some warehouse functions are still very manual.
7. Create corporate division dedicated towards data protection policies	Knowing that their logistics provider is functioning according to a data protection policy ensures a layer of trust for customers/suppliers, knowing that they have legal options to defend themselves against invasions of their privacy.	3PLs bare the risk to have to spend in compliance training, install new data management equipment, and maybe hire additional staff and evaluators in order to become and remain compliant with data protection and privacy legislation, incurring expenditures they did not have before.

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Source: Graphs and narratives by the authors

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Implications for 3PL companies are explored per scenario.

- What opportunities and threats may appear in the industry and macroenvironment? What seem to be the strengths and weaknesses of a 3PL company?
- What are relevant resources and competencies for success?
- How will new market entries look?
- Who will be the winners and losers?

Strategic options for 3PL companies are established.

- What are the strategic options relevant for a 3PL?
- Which strategic options better fit with each of the scenarios?
- How should 3PLs adapt to the four scenarios?
- What are the strategic options in the short-term and medium-to-long-term?

An assessment for each of the options is conducted and can be found in the appendix.

- What value and benefits are delivered per strategic option?
- What are the associated risks for each of the strategic options?

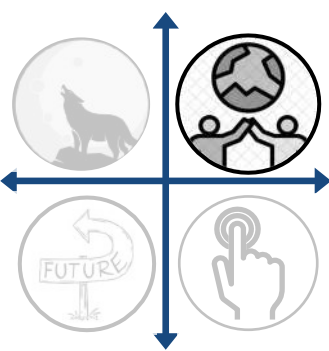
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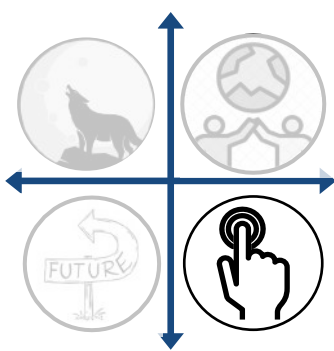
In the “Lone Wolves in Safe Habitat” scenario, 3PLs fail to fully benefit from the strong position of the EU, if they do not tap into the technological potential

Category	Implications
 Strengths	▪ Dedicated and well-trained staff specified on manually driven operations. In case of human errors within manual processes, acceptance of mistakes by those affected is higher than failure in autonomous processes caused by technology. ▪ Acquired strong link with relevant suppliers and regulatory parties. Long-term agreements allow cost mitigation and thus enable higher margins. ▪ Low R&D spending enables the relocation of budget towards processes simplification and position oneself stronger geographically
 Weaknesses	▪ Low intrinsic motivation to expand nodes of technological network, accompanied by missing tech savvy staff to push forward the adoption of blockchain, prohibiting attaining full profitability of European 3PLs. Companies cannot benefit from knowledge sharing, as there is no connection and lack of transparency among organizations. ▪ Manual processes have higher probability of error compared to automated processes, triggered by missing integration of mistake detection ▪ Limited visibility and poor document management. Deficient data collection and missing insights into business processes harms business operations and competitiveness
 Opportunities	▪ 3PLs experience stable trade flows and benefit from trade agreements that are negotiated by a strong EU, which is an essential economic and political partner to other economic blocks ▪ Streamlined EU-wide bureaucratic processes and regulations facilitate and fasten operational and expansion processes for European 3PLs; lower entry and trade barriers create potential for market expansion
 Threats	▪ Tech-heavy American and Asian 3PLs gain a competitive advantage over EU based 3PLs who lack qualified tech labor and innovation ▪ Increased extreme weather events disrupt the operations of 3PLs who lack technological resources to respond quickly ▪ Restrictive data security regulations hinder investment in frontier technologies such as blockchain
 Relevant resources and competencies	▪ Due to established relations with multiple nations spread over many geographical locations, several sourcing opportunities emerge, avoiding the risk of single sourcing and sole dependency on another nation ▪ Free movement of people in the EU creates great pool of talent ▪ 3PLs mainly depend on human talent to fulfill operational work streams
 New entrants	▪ Market development strategy is strong, as European 3PLs expand to other geographical areas within the EU ▪ Service and product development strategy is strong, as 3PLs engage in M&A activities to enlarge their current business portfolio and benefiting from economies of scale
 Winners	▪ Traditional, well-established 3PL companies with EU-wide network
 Losers	▪ Innovative niche logistics companies, tech-based start-ups which are missing investments and trust



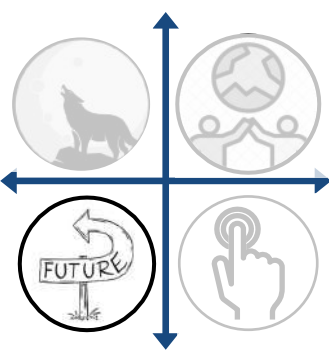
In the "We are One" scenario, companies need to be at the forefront of technological development and operate internationally to remain relevant

Category	Implications
 Strengths	▪ The evolution and application of frontier technologies within 3PLs offer productivity improvements, new growth opportunities and business model innovation ▪ Technologies improve customer experience & speed: optimized document management (e.g. electronic customs filing, smart contracts), transparency & traceability ▪ 3PLs can collaborate with other players to standardize processes along the supply chain to maximize efficiencies and minimize the cost structure ▪ Opportunity to leverage green logistics to use more eco-friendly and sustainable processes which are more energy- and cost-efficient
 Weaknesses	▪ 3PLs, which are densely interconnected technologically with their clients and other industry players, are vulnerable to a total system breakdown caused by a serious hacking threat ▪ Massive investments in IT and HR (technology and staff development) require heavy capital expenditures that will lack in other business units ▪ Standardized processes can lead to decreased competitiveness among 3PLs
 Opportunities	▪ Booming economy: rising income levels and consumer spending contribute to trade growth measured in total exports and imports ▪ Heavy investments in workforce training and development can help to offset the risk of high unemployment rates in industrialization 4.0 ▪ No trade barriers within the EU and trade agreements with other major trading blocs facilitate trade and minimize financial trade burdens ▪ EU subsidies for sustainable investments incentivize 3PLs to invest in the sustainability transition
 Threats	▪ Inequality in technology access and integration across stakeholders could occur due to high upfront investments in technological infrastructure ▪ Low-skilled workforce could become irrelevant and resulting high unemployment rates would lead to massive societal and economic issues ▪ Data abuse in a highly digital and connected world ▪ Environmental concerns can contribute to increase in nearshoring activities which poses a threat to global trade activities
 Relevant resources and competencies	▪ Data scientists and data engineers: programming and engineering competencies ▪ Robotics, smart machines and drones ▪ Automation software and other digital assets ▪ Data security measures to address and offset potential adverse effects of data sharing and technologies
 New entrants	▪ Market development strategy is strong since the focus is on expanding to new geographic markets in a stable geopolitical environment ▪ Service development and diversification strategy are pushed by start-ups (often tech-based) that bring disruptive logistics services to existing and new markets ▪ Traditional industry players expand their expertise and portfolio by acquiring start-ups
 Winners	▪ Digital pioneers which set a high benchmark in harnessing the potential of frontier technologies ▪ Multinational players
 Losers	▪ Digital laggards that are missing a clear integrated digitalization strategy ▪ Regional or national players



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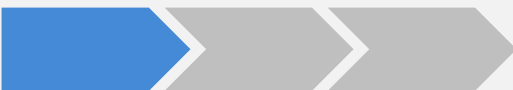
In the “Back to the Future” scenario, high regional market share and a solid customer base is not enough to mitigate the lack of innovation incentives

Category	Implications
 Strengths	▪ Due to lack of technological interconnection with their clients and other industry players, 3PLs are not that vulnerable to system breakdowns from cyber attacks ▪ Possibility of higher investments in business units such as operations and sales, as there is no heavy capital expenditures in IT and personnel development ▪ Repetitive processes lead to a reduction in errors and a simplification of employees’ training
 Weaknesses	▪ Transportation technologies are not optimized; hence technologies are limited since there is a lack of incentive for innovation ▪ The stagnation of frontier technologies and low utilization of IT and data acquisition technologies within 3PLs limits the growth opportunities and productivity improvements. It also prevents European 3PLs to remain competitive compared to Asian ones ▪ Great amount of fixed overhead expenses from the depreciation of unused assets (e.g., fleet) due to regionalized business focus ▪ Consumer pessimism about the state of the economy and decrease in consumer spending and demand due to economic downturn which contributes to an overall decrease in trade
 Opportunities	▪ Due to protectionist barriers, international competition decreases, so there’s opportunity to absorb larger national market share ▪ Possibility of acquiring new startups that most likely would not survive without the proper investment
 Threats	▪ As technological development stagnated, tendency for cyber attacks is growing, causing disruption and temporary shutdowns in the supply chain ▪ Shortage of qualified labor, elevated by the abolishment of free movement of people in the EU ▪ Closing of possible markets due to trade war and government restrictions, so there is a decrease of global operations ▪ Exposure to currency fluctuations, especially given the unstable political environment in many markets around the world ▪ Transition to a system where there’s not a single EU market ▪ Rising energy and fuel prices and higher import tariffs due to unstable geopolitical environment ▪ Due to protectionist barriers, a well-established company is limited to regional services only, losing potential customers ▪ M&A activity is low as investments capacity are reduced
 Relevant resources and competencies	▪ High knowledge of customers and large customer base provides enough customer data to distinctly identify needs ▪ Traditional 3PLs focus mainly on market penetration
 New entrants	▪ Major companies in other industries that engage in a strategy of vertical diversification, that now are logistics providers too
 Winners	▪ Large, well-established regional companies
 Losers	▪ New tech startups that lack the necessary investment

Per scenario, a strategic direction is recommended for 3PL service providers in the EU before diving into detailed strategic options



The strategic options are provided per business division and time horizon

	Short-term horizon 3 - 4 years	Mid-/Long-term horizon 4 - 10 years
Division		
Human Resources	1 Offer continuous skills development for employees across levels and departments (up-skilling) 2 Reinforce sustainable accountability among employees 3 Put in place truck drivers' retirement schemes 4 Realign training methods for operational staff to virtual reality training 5 Hire and train workforce for the digitization of business processes and the automation transition 6 Restructure work processes to enable flexible and remote work schedules	17 Provide visa sponsoring for migrant workers
Legal / Finance	7 Create corporate division dedicated towards data protection policies 8 Increase investments in cyber security platforms and features	18 Apply for government subsidies and funding to fuel innovation
IT and Operations	9 Invest in Next-Generation ICT Infrastructure 10 Integrate a cloud logistics platform into IT data infrastructure 11 Install RFID tags and scanners to establish a dense sensor network	19 Implement big data analytics to optimize decision-making and processes 20 Invest in warehouse automation technologies and robotics
Research and Development	12 Become an industry pioneer in blockchain implementation	32 Invest in the development of biofuels and hydrogen 33 Invest in energy harvesting for sensors 34 Invest in the development of sustainable propulsion alternatives for the maritime sector
Fleet and Facility Management	13 Create streamlined reverse logistics processes	26 Increase share of electric long-haul fleet 27 Acquire own means of transport to ensure full flexibility 28 Adopt multimodal redundancies in freight lanes 29 Invest in drone infrastructure and fleet 30 Invest in urban consolidation centers 31 Shorten supply chains by nearshoring business operations
Business Development	14 Develop disaster response and contingency plans 15 Partner with e-mobility companies for the creation of a charging infrastructure 16 Establish network of early catastrophe warnings	21 Acquire start-ups in the field of alternative energy solutions 22 Expand the companies' current APAC branches horizontally and vertically 23 Develop emergency logistics and become provider to nations
Customer Service		24 Implement more sophisticated track and trace capabilities 25 Optimize delivery routes to offer quicker delivery

A strategic focus on skills development contributes to employee attraction and retention and helps combat labor shortages

Time Horizon 
Short-term: 3 to 4 years

Division	Option	Explanation	Time horizon justification	Scenarios*				
Human Resources	1 Offer continuous skills development for employees across levels and departments (up-skilling)	Employees increasingly expect continuous development opportunities at their jobs. If they no longer learn anything new, many switch to a competitor. Offering weekly or monthly training and development opportunities for employees at all levels boosts employee retention and leads to better company results. Examples are programming, SQL, data analytics and blockchain lessons that employees can receive certificates for.	Shortage of qualified labor is a critical concern for logistics providers. To avoid further downsides, actions should be implemented as soon as possible in the short-term to attract and retain highly qualified talent in the long run against competitors.	<table><tr><td>1</td><td>2</td></tr><tr><td>4</td><td>3</td></tr></table>	1	2	4	3
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	2 Reinforce sustainable accountability among employees	The increasing awareness of climate change became a global concern and needs to be considered an economic factor. CSR trainings should be done to align all processes with the 3PL's CSR goals and KPIs should be formulated. Further, employees should be trained in reverse logistic processes which increase sustainability efforts.	The increasing awareness of climate change became a global concern and needs to be considered an economic factor. The implementation of reverse logistic training needs to be done in correspondence with the implementation of the reverse logistics processes, thus a short-term implementation is needed.	<table><tr><td>1</td><td>2</td></tr><tr><td>4</td><td>3</td></tr></table>	1	2	4	3
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3 Put in place truck drivers' retirement schemes	Motor skills like agility, endurance and concentration together with vision and awareness are necessary for safe and timely driving but deteriorate after the age of 50. 3PLs should account for this by making their subcontractors comply with a preformulated retirement scheme. This scheme should allow for early retirement so that the reliability of logistics is not impacted by a high retirement age. Thereby, not only older drivers benefit, but younger drivers might be attracted and retained.	This is to be realized in the short-term to address the pressing truck driver shortage.	<table><tr><td>1</td><td>2</td></tr><tr><td>4</td><td>3</td></tr></table>	1	2	4	3	
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4 Realign training methods for operational staff to virtual reality training	Employers can give employees tailored tutoring during virtual reality training to help them improve their understanding on how operations are carried out while simulating real-life working conditions. This new learning methodology offers more flexible learning opportunities that are accessible across time and space and is specifically geared towards warehouse personnel and employees overseeing automated work processes.	Although this option implies high expenditures in training gear, new training methodologies should be implemented in the short-term to reach more employees.	<table><tr><td>1</td><td>2</td></tr><tr><td>4</td><td>3</td></tr></table>	1	2	4	3	
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Investments in technology infrastructure and development will decide over the future competitive advantage of 3PLs

Time Horizon 
Short-term: 3 to 4 years

Division	Option	Explanation	Time horizon justification	Scenarios*				
IT and Operations	9 Invest in Next-Generation ICT Infrastructure	As stated in the Readiness for Frontier Technologies Index, the development of ICT infrastructure (hardware, software, firmware, networks, company websites and more) is required for collecting and communicating high-quality data. As more digital devices are incorporated into supply chain operations, the capacity, speed, and stability limitations of ICT infrastructure are being reached. A next-generation connected European ICT infrastructure can enable seamless cross-border data exchange.	A multitude of advanced technologies can only be registered in the Internet of Things once the ICT infrastructure is highly developed in terms of capacity, speed and stability. Financial investments for this are not huge and need to be immediate in the short-term to not fall behind competitors.	<table><tr><td>1</td><td>2</td></tr><tr><td>4</td><td>3</td></tr></table>	1	2	4	3
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10 Integrate a cloud logistics platform into IT data infrastructure	With the emergence of platform business models in the logistics industry, incumbents are expected to significantly lose market share in the future if they don't adapt to this trend. An integrated platform enables companies to receive real-time data that not only leads to a high level of data transparency but also improves performance management.	Creating a platform is a short-term process which needs to happen in the next 3-4 years, otherwise incumbents will lose relevance and market share. The necessary IT infrastructure needs to be provided (e.g., additional servers, cloud solutions etc.) and corresponding API interfaces between different market players need to be established.	<table><tr><td>1</td><td>2</td></tr><tr><td>4</td><td>3</td></tr></table>	1	2	4	3	
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11 Install RFID tags and scanners to establish a dense sensor network	RFID technology enables the intelligent tracking and management of products and assets in the supply chain. RFID tags and scanners can improve product and materials handling inside and outside the warehouse, as the technology enables real-time information visibility. Systems, machines, vehicles, packages and containers can be equipped with sensors and registered in the Internet of Things. By connecting the RFID tags to the Internet, readers can identify, track and monitor the objects attached with tags automatically, globally, and in real-time.	Equipping a large quantity of things with smart sensors requires significant financial investments and is a time-consuming process. Due to its high potential in improving supply chain transparency, it should be started immediately (short-term), but will be a long-term process. Considering that there is a boom in tech start-ups refining these complex technologies, 3PLs should cooperate with one that will oversee implementation and technical maintenance of sensors.	<table><tr><td>1</td><td>2</td></tr><tr><td>4</td><td>3</td></tr></table>	1	2	4	3	
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Research and Development	12 Become an industry pioneer in blockchain implementation	Blockchain is a highly complex technology, currently only understood and used by experts and in niche business environments. As the logistics industry combines many stakeholders and data points in a complex way, the potential of blockchain for the industry is promising. As of now, there is no industry blockchain standard, so the potential for a 3PL to provide a pioneering industry solution by investing in R&D is large.	Resources in the R&D of blockchain in logistics should be allocated immediately in stable geopolitical and economic environments which allow companies to focus on innovation. If competencies are available, research can be conducted in-house, otherwise this can be outsourced (potentially to a tech start-up).	<table><tr><td>1</td><td>2</td></tr><tr><td>4</td><td>3</td></tr></table>	1	2	4	3
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*The scenarios in which the option is most relevant and feasible are colored in blue. This does not exclude their application to other scenarios.

3PLs need to prepare for increasing extreme weather events and actively invest in a sustainable transition

Time Horizon 
Short-term: 3 to 4 years

Division	Option	Explanation	Time horizon justification	Scenarios*				
Fleet and Facility Management	13 Create streamlined reverse logistics processes	The European focus on recycling and reduction of waste demands 3PLs to reconsider their processes to reduce unnecessary waste. Reverse logistics can support the creation of high levels of recycling and reduces the usage of sources. Having a working reverse process in place is essential for 3PLs to address the European climate goals and react to their clients’ needs.	The creation of reverse logistics processes is time intensive and requires the creation of a completely new working process. Its implementation will be timely and needs to be adapted continuously. Starting this process in the short-term is needed to be able to compete in the long-run.	<table><tr><td>1</td><td>2</td></tr><tr><td>4</td><td>3</td></tr></table>	1	2	4	3
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Business Development	14 Develop disaster response and contingency plans	Extreme weather events threaten to interrupt trade routes and can cause power outages. 3PLs need to have a network of back-up routes in case of natural disasters or geo-political conflict. Thereby, 3PLs can quickly switch to different routes in case of emergency and prevent supply chain backlogs. The plans should evaluate all current weather and geo-political risks and provide responses regarding transportation and fleet communication.	The creation should be done by an internally dedicated team. Steps for the realization of this option include the creation of an expert team and the development of a data base, which is continuously updated and available to all employees. Both steps can and should be done in the short-term , as the implementation is crucial to the operations of 3PLs, and disruptions are costly.	<table><tr><td>1</td><td>2</td></tr><tr><td>4</td><td>3</td></tr></table>	1	2	4	3
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15 Partner with e-mobility companies for the creation of a charging infrastructure	E-mobility companies are responsible for the creation of a charging infrastructure. However, this is still missing for middle-mile and long-haul transportation. Through a cooperation with established e-mobility companies, 3PLs can directly communicate their needs regarding the infrastructure and cooperate to create a customized solution.	The creation of infrastructure will be a long-term commitment; however, the start of its development needs to be done in the short-term . Through the development of a long-haul infrastructure, a shift to long-haul electric vehicles will be supported.	<table><tr><td>1</td><td>2</td></tr><tr><td>4</td><td>3</td></tr></table>	1	2	4	3	
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	16 Establish network of early catastrophe warnings	Cooperation with weather stations and weather forecasting startups allows 3PLs to proactively adapt their transportation routes before being affected by extreme weather events. Knowledge about safe routes is essential to ensure on-time delivery. Furthermore, collaboration with Enterprise Risk Management companies enable real time detection of political and economical threats.	Data shows that extreme weather events are already increasing and heavily affecting logistics. Therefore, action needs to be taken directly. Partnerships can be realized in the short-term , as weather stations and start-ups in this sector are already developed. 3PLs usually already have a department dedicated to partner management and an extra work stream for partnerships with weather forecasting experts can easily be added.	<table><tr><td>1</td><td>2</td></tr><tr><td>4</td><td>3</td></tr></table>	1	2	4	3
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*The scenarios in which the option is most relevant and feasible are colored in blue. This does not exclude their application to other scenarios.

Long-term investments into automation technologies together with incentives for migrant workers will mitigate talent shortage

Time Horizon 
Medium- to Long-term: 4 to 10 years

Division	Option	Explanation	Time horizon justification	Scenarios*				
Human Resources	17 Provide visa sponsoring for migrant workers	Immigration can be one of the keys to tackle labor shortages, especially in low-skilled labor areas such as warehousing and transportation. Sponsoring the visa process for migrant workers in countries with labor shortages can help attract more workers to those regions and positions.	This recommendation should be implemented in the medium-to-long term . The process to be a visa sponsor requires a lot of bureaucracy and it also implies a high cost for the company.	<table><tr><td>1</td><td>2</td></tr><tr><td>4</td><td>3</td></tr></table>	1	2	4	3
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Legal/Finance	18 Apply for government subsidies and funding to fuel innovation	In a stable geopolitical and economic environment, governments can allocate significant funds to innovation and digitalization. Firms should take advantage of this by applying for subsidies and funding for projects that are in the interest of governments, such as infrastructure development and digitalization.	The allocation of government funds is time-consuming and thus it will be a long-term endeavor for firms.	<table><tr><td>1</td><td>2</td></tr><tr><td>4</td><td>3</td></tr></table>	1	2	4	3
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IT and Operations	19 Implement big data analytics to optimize decision-making and processes	The analysis of large quantities of data can reveal patterns of the past, highlight real-time changes and create forecasts. Data points can be collected from a wide sensor network registered in the IoT which enables end-to-end inventory visibility. AI tools already have the potential to analyze and predict inventory holdings and stock-outs but they require more advanced data processing tools. Data analytics should be used along the supply chain in four ways: descriptive, diagnostic, predictive and prescriptive.	Utilizing data analytics and artificial intelligence tools to their fullest potential is a long-term process since a huge amount of data points must be collected and this can only occur with advances and wide implementation of sensor technologies.	<table><tr><td>1</td><td>2</td></tr><tr><td>4</td><td>3</td></tr></table>	1	2	4	3
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	20 Invest in warehouse automation technologies and robotics	3PLs can automate processes within the warehouse and in transportation to optimize inventory management, order management and shipping. Cost savings and improved efficiency are possible with robotically operated warehouses. Further supply chain automations also make it possible to allocate human labor and resources more effectively. Robots can assist or remove human workers from repetitive or dangerous tasks.	Since these technologies are already accessible but not fully sophisticated yet, 3PLs must wait for advances in R&D to be able to automate their operations in the long-term . Companies face large upfront investments when automating their processes that will pay off in the long-run due to lower operating costs.	<table><tr><td>1</td><td>2</td></tr><tr><td>4</td><td>3</td></tr></table>	1	2	4	3
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Vertical diversification of service offerings and further expansion to APAC are necessary to be well-positioned for growing global competition

Time Horizon 
Medium- to Long-term: 4 to 10 years

Division	Option	Explanation	Time horizon justification	Scenarios*				
Business Development	21 Acquire start-ups in the field of alternative energy solutions / digitalization for pilot projects	Fossil fuels are seen critically in the face of scarce resources and climate change. Thus, alternative solutions are required to ensure future competitiveness. Through acquisitions, 3PLs can gain knowledge and speed-up the development of sustainable alternatives, as well as digitalization. In-house knowledge regarding energy solutions can be a distinguishing factor from other 3PLs.	Acquisition of start-ups and other companies in the alternative energy sector is connected to long due diligence processes and should only been done, once a 3PL has identified the energy sources that are most useful for their specific needs. This processes is time and money intense and will be realized in the medium- to long-term .	<table><tr><td>1</td><td>2</td></tr><tr><td>4</td><td>3</td></tr></table>	1	2	4	3
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22 Expand the companies' current APAC branches horizontally and vertically	As the impact of APAC is increasing, China aims to become the international pioneer of global high-tech manufacturing. This should be a European 3PL's incentive to intensify their business abroad, possibly benefiting from technological innovation. Market research needs to be conducted first to understand local needs and service demands for a successful expansion of a 3PL's presence in the APAC region.	Escalating attempts to establish market activities abroad, reliable company representatives, understand the local market and local competition as well as undertaking buyouts, the expansion approach can be realized in a medium-to-long-term .	<table><tr><td>1</td><td>2</td></tr><tr><td>4</td><td>3</td></tr></table>	1	2	4	3	
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23 Develop emergency logistics and become provider to nations	With the increase of natural disaster and political conflict, nations will need immediate help in unstable regions. 3PLs can establish themselves as reliant supporters of nations at risk by offering comprehensive disaster response services. This entails the delivery of relief equipment, evacuation of people at risk, cleaning damaged areas, and re-establishment of energy and water supply.	Emergency logistics are a new business stream for 3PLs and need to be deeply investigated before being realized, as they also put the 3PL employees in dangerous situations. This process should not be rushed and is a long-term strategy for 3PLs to diversify their portfolio depending on the development of the environment.	<table><tr><td>1</td><td>2</td></tr><tr><td>4</td><td>3</td></tr></table>	1	2	4	3	
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3PLs must focus on fast and transparent deliveries with their own (electric) fleet to minimize risk of supply chain disruptions

Time Horizon 
Medium- to Long-term: 4 to 10 years

Division	Option	Explanation	Time horizon justification	Scenarios*				
Customer Service	24 Implement more sophisticated track and trace capabilities	There are several start-ups on the market working on long-haul shipment tracking that 3PL companies can partner with (e.g., what3words, Hive Logistics, Flexport, Forto). First, 3PLs need to wait for technological advances in sensors and data analytics, then they need to implement these sensors to finally process more accurate real-time data on shipments. This data can be utilized to provide more sophisticated track and trace services. B2B clients should be able to indicate preferred shipment times and be alerted about shipment delays and lost shipments to optimize their own stock anticipation.	The industry has to wait for significant technological advances to occur in terms of sensorization and data analytics before crucial improvements in track and trace can be made. Therefore, this is a long-term strategy.	<table><tr><td>1</td><td>2</td></tr><tr><td>4</td><td>3</td></tr></table>	1	2	4	3
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25 Optimize delivery routes to offer quicker delivery	As purchasing habits are changing, mainly due to e-commerce, consumers become more demanding regarding delivery time. Logistics providers must keep up with the rapidly changing expectations of their customers by offering faster shipping or they risk on losing business. Advanced AI tools can help optimize delivery routes and maximize carrier capacity for all routes, thus contributing to quicker deliveries.	Faster delivery can only be realized with more sophisticated technologies such as AI and automation to speed up and optimize processes. The industry has to wait for advances in technological development, thus this option can only be fulfilled in the medium-to-long-term .	<table><tr><td>1</td><td>2</td></tr><tr><td>4</td><td>3</td></tr></table>	1	2	4	3	
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Fleet and Facility Management	26 Increase share of electric long-haul fleet	Electric vehicles are already successfully used in the last-mile delivery. 3PLs should also implement this technology in the long-haul transportation after the implementation of a charging infrastructure. Road transport is one of the main modes of transport in the EU and its transition towards sustainability will have great impact on the overall sustainability of 3PLs.	The creation of a charging infrastructure for long-haul is time consuming and will only allow for bigger electric fleets to run on batteries in the long-run .	<table><tr><td>1</td><td>2</td></tr><tr><td>4</td><td>3</td></tr></table>	1	2	4	3
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27 Acquire own means of transport to ensure full flexibility	In order to minimize the consequences of future supply chain disruption, companies should consider to fully adopt own fleets, adding full flexibility and transparency to its transportations processes.	Due to the high investment needed, the acquisition of the company assets can only be realized over the long-term , rather than a single short-term financing	<table><tr><td>1</td><td>2</td></tr><tr><td>4</td><td>3</td></tr></table>	1	2	4	3	
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Investments into physical infrastructure and facilities are required to prepare for increased urbanization

Time Horizon 
Medium- to Long-term: 4 to 10 years

Division	Option	Explanation	Time horizon justification	Scenarios*				
Fleet and Facility Management	28 Adopt multimodal redundancies in freight lanes	This recommendation aims to diversify the strategy of companies and spread the external risk of supply chain breakdowns. The concept aims to use at least two modes of transport that make deliveries in parallel within a freight lane. E.g. a shipment via a freight train and a shipment via ocean freight.	The realization of redundant freight lanes can be achieved in the medium-to-long term as high investments and strong coordination among carriers is necessary.	<table><tr><td>1</td><td>2</td></tr><tr><td>4</td><td>3</td></tr></table>	1	2	4	3
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	29 Invest in drone infrastructure and fleet	Drone infrastructure requires pads for loading, take-off and landing as well as charging stations. If drone deliveries are increasingly established to minimize road traffic and enable critical deliveries to remote areas, relevant drone infrastructure needs to be developed. Also, a suitable drone service provider for subcontracting needs to be identified.	Since drone technology is not yet widely implemented as a delivery method, this option is for the long-term , and technology developments need to be closely monitored.	<table><tr><td>1</td><td>2</td></tr><tr><td>4</td><td>3</td></tr></table>	1	2	4	3
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30 Invest in urban consolidation centers	This option refers to the creation of urban centers in major European cities where inbound shipments are consolidated. Creating hubs in strategic places where the population is denser, is a smart response to the increasing urbanization trend. 3PLs need to understand how shifting demographics will impact their organizations' footprint. Knowing the specifics about where their customers live, and work is critical to success and critical to reducing carbon emissions.	This recommendation should be implemented in the medium-to-long-term because it requires significant investment and implies the redesign of the company's expansion strategy. It is also something that is difficult to revert.	<table><tr><td>1</td><td>2</td></tr><tr><td>4</td><td>3</td></tr></table>	1	2	4	3	
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31 Shorten supply chains by nearshoring business operations	Nearshoring describes the process of moving business operations geographically closer to the company's home country, enabling faster transportation from warehouses to the final consumer. The approach can support the mitigation of geopolitical and environmental risks which are disrupting long supply chains. Nearshoring also reduces the environmental footprint by shortening supply chains.	Shifting nodes of a company's supply chain requires a high invest in time and money. Tangible and intangible assets have to be relocated; thus, nearshoring can only be realized in the long-term .	<table><tr><td>1</td><td>2</td></tr><tr><td>4</td><td>3</td></tr></table>	1	2	4	3	
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Companies must invest into R&D of alternative energy solutions for each mode of transport to meet EU sustainability regulations

Time Horizon 
Medium- to Long-term: 4 to 10 years

Division	Option	Explanation	Time horizon justification	Scenarios*
Research and Development	32 Invest in the development of biofuels and hydrogen	Road transportation is expected to remain one of the main modes of transportation in the EU. The two most promising sustainable energy solutions for aviation are SAF and hydrogen fuel. With further investments in the development of biofuels and hydrogen, 3PLs create a strong and resilient base for future sustainable transportation.	Depending on the outcome of the detailed research of alternative propulsion options, 3PLs can realize their investments. The alternative energies are still in their early stages and not yet available for mass utilization. Thus, investing in sustainable propulsion solutions should be done in the long-run after having done the corresponding research, as well as in correspondence with external developments.	1 2 4 3
	33 Invest in energy harvesting for sensors	A major problem for sensors, who are essential for tracking and monitoring of the environmental impact on packages, is battery life. Scalable solutions are still limited and need further development and investment.	Depending on the outcome of the detailed research of alternative propulsion options, 3PLs can realize their investments. The alternative energies are still in their early stages and not yet available for mass utilization. Thus, investing in sustainable propulsion solutions should be done in the long-run after having done the corresponding research, as well as in correspondence with external developments.	1 2 4 3
	34 Invest in the development of sustainable propulsion alternatives for the maritime sector	Ocean freight is one of the main environmental polluters and sustainability discussions have become central to shipping companies. As maritime transport might experience one of the most rapid growth due to climate change, the adoption of sustainable propulsion possibilities is central to achieve the European sustainability goals by 2050. Investments in projects that develop solutions based on wind energy and biofuels will prepare 3PLs to become more sustainable.	Depending on the outcome of the detailed research of alternative propulsion options, 3PLs can realize their investments. The alternative energies are still in their early stages and not yet available for mass utilization. Thus, investing in sustainable propulsion solutions should be done in the long-run after having done the corresponding research, as well as in correspondence with external developments.	1 2 4 3

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06

Monitoring System

Early Indicators
Corporate KPIs
Monitoring Process



Tracking of 12 early indicators and 6 corporate KPIs is needed to scan the environment and measure company progress towards defined objectives

Early Indicators

1 Speed of development in frontier technologies	2 Industry application of frontier technologies	3 Number and level of data privacy regulations
4 Market fragmentation of the European 3PLs	5 Number and characteristics of new entrants into the logistics market	6 Vertical integration of logistics incumbents
7 Regulations and subsidies to support companies' sustainability efforts	8 Shortage of qualified labor	9 Nearshoring activities
10 Political stability within the EU	11 Euro Area Interest rate	12 HICP index and inflation level

Corporate Key Performance Indicators (KPIs)

Corporate KPIs are derived to **measure the progress towards company objectives**. The KPIs must be integrated with all aspects of the performance management process and linked throughout organizational levels.

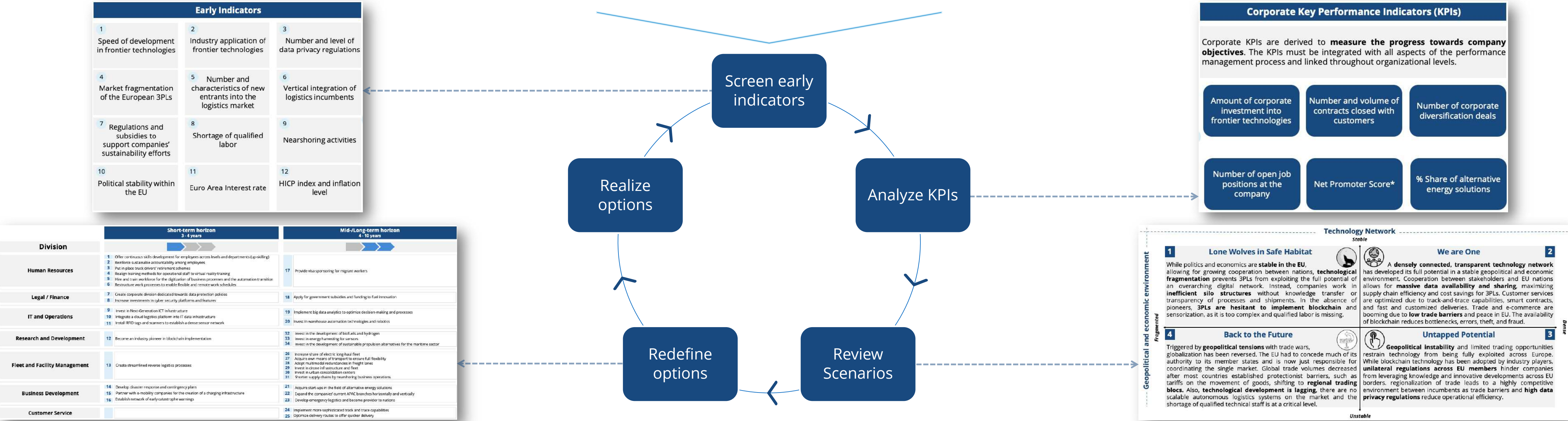
Amount of corporate investment into frontier technologies	Number and volume of contracts closed with customers	Number of corporate diversification deals
Number of open job positions at the company	Net Promoter Score*	% Share of alternative energy solutions

* Net Promoter Score measures customer loyalty

A regular monitoring system is needed to review the scenarios and assess if the company is well-prepared to face the unfolding scenario

Monitoring process

A **monitoring process**, which should be conducted **at least every three years**, needs to be put in place to observe and analyze the development of the early indicators, and assess the progress towards defined corporate KPIs. Based on that, organizations can verify the validity of the two axes and the formulated scenarios. Finally, strategic options should be reassessed and realized.



07

Conclusion and Limitations



In conclusion, this report presents four alternative, plausible scenarios for the future of the logistics industry that can unfold until 2032...

Conclusion

- The decision to conduct research on the development of the logistics industry was driven by **macro trends and disruptive events heavily affecting supply chains** over recent years.
- In 2022 and beyond, the logistics industry is challenged by a talent gap, customer expectations for transparent and fast deliveries as well as digitalization and innovation pressures. Moreover, rising transportation and energy costs, increasing extreme weather events and geopolitical tensions are disrupting supply chains. Countless new disruptive industry entrants and vertical integration of incumbents will challenge the industry in the future.
- The research findings enabled the authors to derive four plausible scenarios for the future of the logistics industry in the EU until 2032, based on the two most critical uncertainties 1) the stability of the **geopolitical and economic environment**, and 2) the density of the **technology network**
- **Strategic implications** and **options** for the scenarios include:
 1. 3PLs must diversify their service offerings, use **multiple modes of transport** and **digitize their processes** when trade barriers (e.g., customs regulations) or extreme weather events impact their supply chain stability. This way, companies can improve their supply chain resilience.
 2. 3PLs should focus on **training and developing the workforce** to use, adopt and adapt increasingly automated processes. Training the workforce is a strategic option recommended across scenarios, merely the type of training focus differs.
 3. 3PLs need to adapt to the speed in **technological innovations**, by investing into both the technologies and the corresponding ICT infrastructure.
 4. 3PLs that operate under a **stable government** are enabled to establish strategic long-term relations with international suppliers. Thus, multiple sourcing opportunities emerge, decreasing dependency risk on certain suppliers and countries.
 5. 3PLs should engage in **research and investment of sustainable propulsion solutions** to reduce carbon dioxide emissions and comply with sustainability policies.
- Regardless of which scenario will unfold, becoming **a lean, digitized, customer-centric, and resilient 3PL** is relevant to face competitive industry pressures.

...however, some limitations need to be accounted for.

Limitations	
1	The subjective opinion of experts and assumptions based on news, which can be limited in scope due to political ideals in certain countries and biased media channels, limit the qualitative significance of data .
2	Non-numerical data do not entail statistical relevance ; therefore, findings cannot be generalized.
3	Scenarios and recommendations were developed based on recent data and news , these can change over the time of the research, leading to outdated recommendations.
4	The report solely focuses on 3PL providers , disregarding other party logistics providers, as well as implications and options for them.
5	The scenario development was based on two key uncertainties which the researcher identified as the most impactful and most uncertain. The selection of other key uncertainties would lead to four completely different scenarios.
6	The geographical focus has been set on the EU , however due to the internationalization of supply chains, it is difficult to draw borders and see the EU in a vacuum. Thus, global players and activities are inevitable involved in the scenarios.

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241.Zukunftsinstitut GmbH. 2022. "Der Megatrend Neo-Ökologie." Zukunftsinstitut GmbH. 2022. <https://www.zukunftsinstitut.de/dossier/megatrend-neo-oekologie/>.

List of Abbreviations



List of Abbreviations

Abbreviation	Definition
AFC	Airborne Fulfillment Center
EU	European Union
ICT	Information and Communications Technology
IT	Information Technology
LSP	Logistics Service Provider
PL	Party Logistics
RFID	Radio-Frequency Identification
SDG	Sustainable Development Goals
UAV	Unmanned Aerial Vehicles
WEF	World Economic Forum

Appendix A

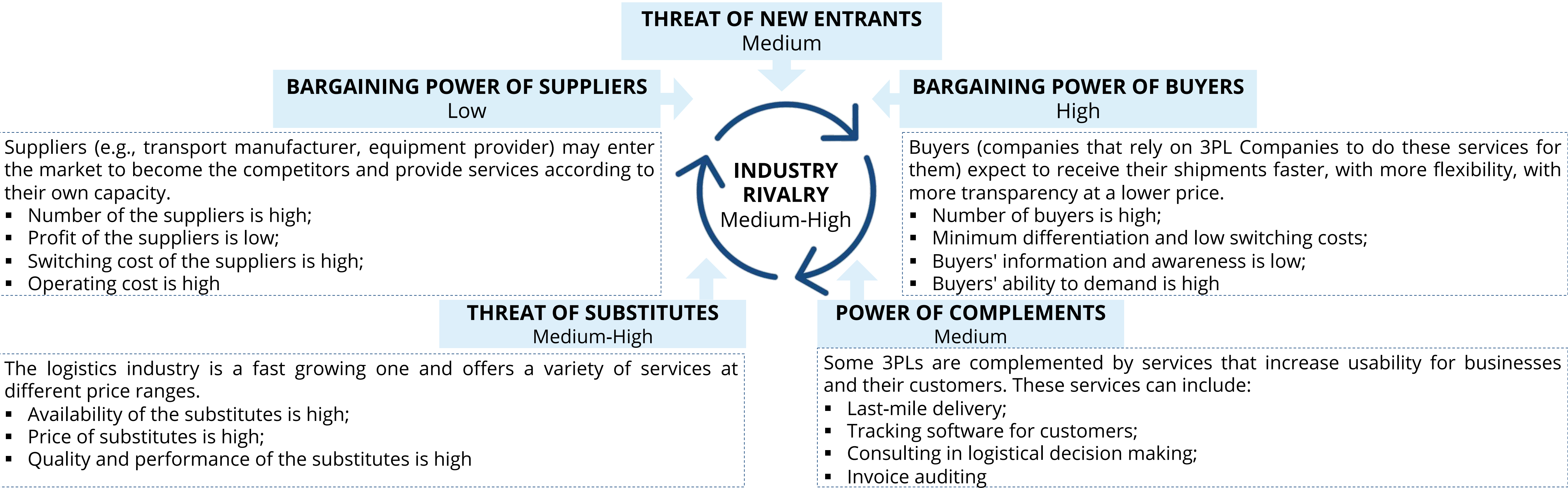
Porter’s Five Forces + Complements



The industry landscape is shifting as incumbents are threatened by new entrants and business models. Competition is based on price, speed and quality of service

The entry barriers are medium, and the rise of digital technologies has provided a platform for new business models with lower capital requirements.

- Traditionally high capital requirements, but increasingly asset-light start-ups;
- incumbents (mostly shipping companies) engage in vertical integration activities (e.g. CMA CGM entering air freight and parcel service), thereby expanding industry influence;
- Some of the sector's own customers (e-commerce businesses) are insourcing their logistics services (e.g., Amazon, Alibaba);
- Passenger transportation companies diversify to contract logistics by leveraging digital infrastructure, technical expertise, and "sharing" business models (e.g., Uber Freight)



Appendix B

Drivers of Change Analysis



Socio-Demographic Trends



Logistics industry is suffering from an ageing workforce which is less qualified to face industrialization 4.0, creating a void that immigrant workers could fill

Change in the Workforce – Ageing & Immigration

- Through the next years, the number of working people with more than 55 years old will rise significantly, mainly in southern Europe countries (Greece, Italy, Portugal, Spain).
- Even though employers expect that workers in and advanced age keep pace with the younger ones, there are some jobs that increase the chance of a riskier travel security and ineffective work as a consequence of deterioration of health conditions.
- There has been a trend of increasing the state pension age across European countries, aiming to minimize the rise in the total financial load of state pensions and retain older individuals in the labor force for longer.
- In the six subsectors of transportation (truck transportation, transit and ground passenger transportation, air transportation, building and maintenance of highways, rail transportation, and maritime transportation), 53% of the present workforce has 45 years or is older.
- People who are competent and properly trained in new, technologically sophisticated fields will be needed in the future.
- Immigration results in political and economic problems for the EU in all areas. Immigrants can work and develop their skills in the transportation industry.

Relevant Macrotrend Data

- In 2016, the employment rate for workers with ages between 55 and 64 in the EU was 55.3%, compared with 66.6% for those with ages between 15 and 64.
- Nearly 30% of workers in the transportation industry are over 50 years and will retire in the next 10 to 15 years.
- Immigrants accounted for 47% of the increase in the workforce in Europe during the previous ten years.

Relevant Sources

- (Aiyar, Ebeke, and Shao 2016)
- (Eurofound 2022)
- (Eurostat 2022c)
- (Eurostat 2022f)
- (Maselli 2016)
- (Pomoni et al. 2020)



Logistic providers have the need to adapt of consumer trends due to rapid urbanization

Growing Population & Urbanization

- How and where the population is growing and changing directly affects the type and distribution of logistics demand.
- The promise of jobs and prosperity, among other factors makes urban areas more attractive. Urbanization affects many aspects of human life and is expected to continue to increase.
- Urbanization is important for distribution logistics because it requires supplying rapidly expanding metropolitan zones where consumer demand is spatially concentrated.
- Major logistics companies use location information to proactively adapt their supply chains in response to these patterns in customer migration. Businesses employ location information enabled by GIS to identify shifting customer locations and modify their presence across markets.
- Where the business locates facilities is impacted by such changes on the supply side.
- They aid facility operators and planners in comprehending and accommodating the labor force.

Relevant Macrotrend Data

- Projections by the UN show a continued increase in global population (but a steady decline in the population growth rate) from its current 7 billion to a population that is expected to reach between 7.5 and 10.5 billion by 2050.
- In 2021, the population of Europe shrank by almost 0.18 percent, reaching a total of about 743.5 million people.
- Europe's population hasn't increased by more than 1% year since 1961.
- 75% of the EU population live in urban areas.

Relevant Sources

- (Baxter 2022)
- (Kazemi 2019)
- (Kellner 2021)
- (Rose, Ralston, and Autry 2020)
- (Statista 2022b)
- (Supply Chain Brain 2012)
- (The World Bank 2022)



The shift from retail stores to e-commerce with fast and low-cost deliveries has increased complexity levels and competitive pressures for logistics companies

Changing Purchasing Habits

- The rise in strong competition pushes customer expectations for fast deliveries with free or low-cost shipping.
- Many retailers are outsourcing their logistics operations to outside service providers like third-party logistics firms. This is because 3PLS handle every facet of the supply chain from fulfillment to deliver and retailers need to meet customer demands for quick and affordable deliveries
- For the 3PLs whose top priority is reducing shipping costs, this presents some difficulties.
- Existing logistics providers are being stretched thin by the sector's greater scale and other complexity factors, such as higher order amounts, changing pricing and shorter delivery windows.
- Companies should rely on implementing IoT, big data, and fully integrated supply chain systems in order to met the increased consumer expectations.

Relevant Macrotrend Data

- The global B2B e-commerce market values US\$14.9 trillion in 2020.
- 20% of all business revenue in the European Union in 2021 came from e-commerce.
- European businesses relied on e-commerce sales to a certain extent for revenue in 2021. With 38%, Ireland remained the nation with the highest e-commerce revenue in 2021.
- 60% of all online purchases in 2015 included free shipping.

Relevant Sources

- (Hanhaa News 2021)
- (Statista 2022a)
- (Statista 2022c)



In a post-pandemic world, logistics must be embedded with transparency, resilience and sustainability

Change in Consumer Values & Increase in Ethical Concerns

- The pandemic’s effects on consumer behavior have not been temporary but have changed the use of logistics services in the long-term.
- To satisfy consumer needs, retailers are increasingly offering same-day delivery. The attempt to provide on-demand convenience is a challenge for companies, as it requires more agile supply chains & operations.
- Customers have the need know that their purchases were both produced and shipped in a way that was both morally and ecologically responsible in addition to being economically viable.
- However, the demand for fast delivery among customers has a concealed environmental cost. Speed optimization results in fewer products being delivered each mile, more vehicles on the road, more GHG (Greenhouse Gas) emissions, as well as more packaging waste.
- Air freight create more than eight times as much CO2 per kilometer of transportation as trucks, which is sometimes required for urgent deliveries.
- Additionally, consumers have been purchasing products made in China under Western labels for decades, and the outdated notion that Chinese brands produce cheap, inferior goods has been changing.

Relevant Macrotrend Data

- Studies have shown that both GenZ and Millennials are willing to pay upwards of 30% extra to have a product or service expedited.
- According to Boston Consulting Group, transportation activities account for 17% of global greenhouse gas emissions.
- 56% of consumers say environmental concerns influenced their purchasing decisions.
- 67% of consumers claim to have purchased environmentally friendly products, even if such items were more expensive.

Relevant Sources

- (Covert 2019)
- (European Commission 2021a)
- (Goldman 2020)
- (Moody 2021)
- (Wang 2015)



After the past years' disruptions, it's clear that logistics must adapt. A changing workforce, particularly one that is embracing remote work, contributes to that

Shift to Remote Work

- Companies faced difficulties they had never faced before when the Covid-19 arrived, disrupting supply chain across the world and temporarily halting most manufacturing.
- The quick development of productivity and collaboration software opens doors and paves the way for people to collaborate in new ways. Working from home was one of them.
- As supply chains develop into digital ecosystems, a lot of personnel does not need to be physically there to perform their tasks, since data is accessed remotely.
- One part of logistics has gone digital and back-office technology is enabling logistics service providers of all types to serve their clients and keep supply chains flowing even while staff are working from home.
- However, there are some challenges with this shift:
 - the response time (e.g., when there's a shipping issue or a surprise factory shut-down) at home doesn't beat the one at the office.
 - there are still many front-line supply chain jobs that have to be done in-person.

Relevant Macrotrend Data

- 89% of companies report better retention rates because of their flexible work options.
- 40% of people feel that a flexible schedule is the greatest benefit of remote work.
- According to 61% of supply chain leaders, even at the front lines, a hybrid work paradigm will become the norm owing to the pandemic's acceleration of remote labor.

Relevant Sources

- (Berger 2021)
- (Boyarsky 2021)
- (Blonski 2022)
- (Dehoney 2020)
- (Lori 2020)



Major expansion of logistics training and skills development initiatives are necessary to acquire the competences needed for the sector's ongoing evolution

Shortage of Qualified Labor

- The future of the logistics workforce is impacted by the developing skilled labor shortage.
- The majority of employment in the transportation industry have always been viewed as undesirable:
 - Work patterns are frequently incompatible with family life due to extended working hours, absences from home, unexpected shifts, and overtime.
 - The historically low remuneration for non-management logistics positions also deters applicants from available positions.
- Major logistics companies currently employ about one-third of workers who are close to retirement age, which is felt strongly in the trucking industry.
- This older-than-average workforce feeds into the issue of a digital skills gap, making the biggest barrier to digital adoption the lack of digital culture and training.
- Additionally, there is a deficit of vocational school training for jobs in logistics. Innovations in logistics, particularly in IT, call for new skills that the workforce at present does not have.
- The young are disproportionately affected by this type of market failure since they often represent an untapped pool of apprentices in some professions (e.g., trucking).

Relevant Macrotrend Data

- 47% of third-party logistics companies finding, training and retaining qualified labor as a top challenge.
- 68% of COOs say hiring and retaining talent will be very important for their company's growth in 2022.
- By 2024, 54% of logistics companies anticipate a scarcity of drivers, warehouse workers, and back-office employees.

Relevant Sources

- (Berger 2021)
- (Blonski 2022)
- (Commission and Transport 2015)
- (Corporate Vision 2022)
- (Eurostat 2022c)
- (Fountain n.d.)

- (Mckinnon et al. 2017)
- (OECD.org 2004)
- (PwC 2022b)
- (st. George et al. 2021)



As the logistics industry undergo rapid digitalization, automation and data protection has emerged as a key challenge for the sector

Development of Data Security & Privacy Concerns

- A standard 3PL warehouse or transport company's software is a target for a cyberattack due to the massive volume of data it contains.
- Numerous companies today go through digital transformation and automation. The majority of sensitive customer data, including delivery addresses, purchase history, and other personal information, is kept on internal or external cloud-based systems
- Additionally, with the existence of many stakeholders and third-party vendors in the logistics chain, this sector is particularly rendered vulnerable.
- The continuing cloud transitions, which include shifting data outside of an organization and depending on third-party service providers, are probably what are causing the significantly increased anxiety about tech and data rules.
- Customers' trust can be badly undermined by a data breach, which may lead them to turn to one the competitor. It also can be extremely expensive to figure out how the breach occurred and put safeguards in place to keep it from happening again.
- AP Moller-Maersk suffered a ransomware attack in June 2017 that cost its logistics division millions of euros.

Relevant Macrotrend Data

- 58% of supply chain attacks are intended to gain access to data.
- The average frequency of data breaches and cyberattacks rose by 15.1% in 2021 compared to the previous year.
- 38% of logistics companies have significant unresolved question surrounding data privacy and security.
- 86% of the general public express an increasing worry about data privacy.

Relevant Sources

- (Brooks 2022)
- (CartonCloud 2021)
- (Cheung, Bell, and Bhattacharjya 2021)
- (Council of the European Union 2022)
- (DHL Logistics of Things 2022)
- (Infosys 2020)
- (KPMG 2021)
- (PwC 2022)



Technological Trends



Data analytics and artificial intelligence help to anticipate demand, streamline factory functions, and optimize routing

Advance in Data Analytics & Artificial Intelligence (AI)

- Data analytics lead to improvements in customer experience and operational efficiency and can also strengthen marketing and retail strategies.
- Cloud technologies provide remote-hosted data and processes with flexible real-time access across time and location which enhances flexibility, scalability & efficiency. Can also harmonize & standardize processes across an organization.
- Logistics companies can benefit from significantly improved forecasting to scale capacity up or down and plan dynamic and efficient routes: AI-led automation is used as predictive tool in warehousing to identify demand fluctuations and prevent shortages / overstocking.
- Increased access to data and digitally integrated value chains provide opportunities to improve performance and better serve customers.
- Greater inventory visibility and transparency allows improved 'predictive maintenance' and management.
- Lack of digital culture and training is the biggest challenge facing transportation and logistics companies, often due to unresolved questions around data security and data privacy and high financial investment requirements.

Relevant Macrotrend Data

- Industry experts in Transportation & Logistics ascribe a high importance to data & analytics in the next five years (90% compared to an average of 83%).
- 98% of 3PLs and 93% of shippers believe data-driven decision-making to be essential for supply chain activities.
- Transport & Logistics were planning to invest 5% of their revenues per annum from 2016 until 2020 in digitization.

Relevant Sources

- (Global Trade Magazine 2016)
- (Tipping and Kauschke 2016)
- (Unipart Logistics Group 2022)



Application of robotics & automation results in increased efficiency and reduced costs in logistics management

Advance in Robotics & Automation

- Increased application of intelligent robotics & automation in logistics management (e.g. semi-autonomous warehouse machinery and vehicles) result in the reduction of human workforce.
- Mobile and stationary robots assist workers with warehousing, transportation and last-mile deliveries to cut costs, boost output and meet growing customer demand.
- Operations are no longer fully dependent on the working hours of human employees and can occur around the clock, which results in increased efficiency in warehousing and delivery processes, and lower costs.
- Drones (Unmanned Aerial Vehicles: UAVs) are used within warehouses and for delivery, particularly in overpopulated and remote areas, and for short distances. The wider usage of drones is increasing.
- Application Areas:
 - Storage, Warehousing & Materials Handling
 - Packaging & Unitization
 - Inventory Management
 - Transportation

Relevant Macrotrend Data

- Global warehouse automation market is steadily growing (15 billion USD in 2019, forecasted to reach 30 billion USD by 2026).
- Autonomous mobile robots (AMRs) can improve productivity by up to 50% with point-to-point (P2P) transport, up to 150% for assisted order picking.
- Stationary robots (robotic arms) proliferate and return on investment can take less than 4 years.
- Proliferation of automated micro-fulfillment hubs in urban areas for instant delivery.

Relevant Sources

- (DHL Global 2022b)
- (Die Wirtschaftsmacher 2022)
- (Lagorio et al. 2020)
- (Statista 2020)
- (Tipping and Kauschke 2016)
- (Unipart Logistics Group 2022)



Internet of Things (IoT) and sensorization improve supply chain transparency and optimize carrier capacity through a shared logistics network

Implementation of IoT and Sensorization

- Physical Internet (PI): global logistics network that is connected physically, like the digital internet. For it to enable the movement, handling, storing and transportation of logistics products in an efficient manner; standardized shipment sizes, labelling and systems need to be introduced. Thus, the PI is geared to shrink inefficiencies in global supply chains.
- The PI requires a high level of physical interconnectivity (e.g., smart containers with sensors) which would be supported by the Internet of Things (IoT): Data transmission and exchange in electronic format due to smart sensors. Thereby, the IoT can provide end-to-end visibility of the PI objects.
- Sensorization is the increased use of smart sensors in systems and machines to achieve interconnectivity and enable the interaction between machine and human, and machine-to-machine. A prominent example are RFID (Radio Frequency Identification) tags.
- Sensors make global supply chains more self-monitoring and self-maintaining.
- Standardized modular containers increase trailer load sizes and reduce miles traveled by empty trailer loads, increasing overall efficiency and sustainability in transportation.
- It remains open whether European legislative bodies and international organizations will push for a shared logistics network (physical internet).

Relevant Macrotrend Data

- As of now, most of 535.000 distribution centers in the US are standalone operations owned by different companies.
- Research in 2013: If 25% of US supply chain operated with Physical Internet, profits for participating firms would increase by 100 billion USD and CO2 emissions from road-based freight would decrease by at least 33%.
- At 19,1% CAGR (2022-2028), the global smart sensor market size is expected to reach 145,30 Billion USD by 2028

Relevant Sources

- (DHL Global 2022a)
- (Montreuil and Louchez 2015)
- (Sawant 2022)
- (Tipping and Kauschke 2016)
- (Unipart Logistics Group 2022)



Blockchain third party certification increases security and reduces bottlenecks in the highly fragmented and competitive logistics industry

Implementation of Blockchain Technology

- Blockchain is a distributed ledger technology which records transactions between parties securely and permanently. It enables the transition from a centralized to a decentralized and distributed database accessible for all relevant stakeholders, offering intrinsic security mechanisms ("mutualization of data"). Private blockchains are restricted and limited to business networks.
- The information flow in international trade is complex, requires the collaboration of many stakeholders and is documentation-heavy. It is so far characterized by low transparency and unstandardized processes due to the fragmented and competitive nature of the logistics industry.
- Blockchain can realize substantial gains in logistics process efficiency by improving transparency and traceability in supply chains, introducing standardized processes, and automating commercial processes with smart contracts that decrease fraud (smart contracts pursue 'if-then' statements). It can achieve cost savings by promoting leaner, more automated, error-free processes and reduced paperwork in global trade.
- Maersk and IBM have established a global blockchain-based system for digitizing trade workflows and end-to-end shipment tracking in ocean freight: solution is expected to track tens of millions of shipping containers annually and lead to billions in savings due to fraud & delay reductions.
- There is a wide lack of trust and understanding of the technology and its application. As of now, there is no industry standard available.

Relevant Macrotrend Data

- Overall market for blockchain is expected to boom, growth estimation of blockchain technology from USD 411,5 million in 2017 to USD 7,68 billion in 2022
- WEF estimates that the reduction of supply chain barriers to trade could increase global GDP by nearly 5% and global trade by 15%
- Industry estimation that 10% of all freight invoices contain inaccurate data. In oil & energy industry alone, at least 5% in annual freight spend could be reduced with improved invoice accuracy.
- Blockfreight, a blockchain solution for global freight, was founded in 2017.

Relevant Sources

- (Blockfreight 2022)
- (Geimer et al. 2020)
- (Heutger and Kückelhaus 2018)
- (Tipping and Kauschke 2016)



3D printing technology enables production independent of time and place and challenges the logistics industry

Advance in 3D Printing Technology

- 3D printing is the process of making a physical object from a three-dimensional digital model. Thus, 3D printing is a production process; The needed product can be produced at any time at any place.
- 3D printing enables production & manufacturing closer to the consumer and lowers inventory as well as demand for the transportation of goods.
- 3D printing would have significant impact on global supply chains, decreasing complexities, saving on production costs, enhancing lead times and improving time-to-market.
- As the technology is still developing, it lacks application.
- 3D printing is a disruptive technology, since if 3D printing is further established, logistics companies will transport less. This offers opportunity for new business models: developing 3D printing hubs, printing capabilities at customer sites.

Relevant Macrotrend Data

- Global 3D Printing products and services market size was at 12,6 billion USD in 2020, forecasted to grow to 37,2 billion USD in 2026.
- In 2021, 12% of respondents indicated that one of their leading priorities in relation to 3D printing would be production flexibility.

Relevant Sources

- (Bayraktar 2021)
- (Sculpteo 2021, 13)
- (Simon and Gurley 2022)
- (Tipping and Kauschke 2016)



Economic Trends



Despite losses from restricted trade in goods, logistics was mainly positively impacted as consumers shifted from services to materials

Threat of Recession

- A decline in economic activity is referred to as a recession. A legitimate recession is one in which the gross domestic product (GDP) declines for two consecutive quarters.
- The logistics market has largely benefited from the last recession triggered by COVID-19, as consumers switched from purchasing services to purchasing materials.
- Despite the recession, through socioeconomic leveling and a growing middle class, customers' financial situations are still solid, offering some buffer.
- 2021 reflected a significant improvement in commerce, with merchandise trade values exceeding those of 2019.
- If businesses can take advantage of the demand opportunities presented by expanding populations and rising affluence, the results will be profound.
- The International Monetary Fund has revised down its growth projections for each of the top four economies in the eurozone, Germany, France, Italy, and Spain, for 2023 due to the conflict and rising interest rates.
- In 2020, more than half of Germany's gas and about a third of its oil came from Russia. The Kremlin has restricted supply since the start of the conflict, attributing a decrease in volume through the vital Nord Stream 1 pipeline

Relevant Macrotrend Data

- Two-thirds of the GDP is spent by American consumers, who have excess savings of over \$22 trillion, and the country's savings rate has recovered to pre-pandemic levels. So, consumption ought to continue.
- COVID-19 induced economic disruptions led to a 10% decrease in global trade in goods and services.
- The global commerce in products and services was down 10% as a result of the COVID-19-related economic disruptions.

Relevant Sources

- (SitusAMC 2022)
- (St. Golan, Lernegan and Linkov 2020)
- (Statista 2022d)
- (United Nations Conference on Trade and Development 2022b)
- (Partington & Elliot 2022)
- (Anderson & Eichler 2022)



Inflation should remain under control, with the gap between CPI and PPI expected to narrow

Rising Inflation

- Inflation reflects price increases and results in the gradual loss of purchasing power. Inflation rates of 1% to 2% annually are typically regarded as acceptable, while those of 3% to 4% can indicate an overheating economy.
- Logistics experts state that their business has suffered as a result of inflation. Capacity limitations, rate and price hikes, supply chain instability, delayed orders and ongoing shipping container problems are a few of these effects.
- The greatest upward contribution to yearly inflation rates was made by rising food prices. Furthermore, the conflict in Ukraine between Russia and the Ukraine continues to drive up energy prices in European nations.
- Russia's war on Ukraine has severely disrupted international markets, exposing weaknesses in the security of the raw material supply that is essential for industrial production and the green transition.
- There is opportunity to diversify sourcing for nations with weak supply chains through increased production and access to recognized essential raw material sources, positively influencing product pricing in the long term.
- The discrepancy between supply and demand is anticipated to narrow as pandemic containment advances and raw material supplies continue to increase. As a result, in 2022, producer pricing pressure is expected to stabilize.

Relevant Macrotrend Data

- Inflation was 10.1 percent in the European Union and 9.1 percent in the Euro Area as of August 2022.
- The Baltic nations are still the hardest hit; in particular, Estonia is seeing the highest rates of inflation in the eurozone, rising year over year from 6.4% in September 2021 to 24.2% in September 2022.

Relevant Sources

- (Euronews 2022)
- (Eurostat 2022e)
- (Kang & Ng 2021)
- (SitusAMC 2022)



Due to political instabilities and Covid-19 restrictions, sensitive export traders had to halt their supply chains

Disrupting Supply Chain Backlogs

- China's Zero Covid Policy, significantly disrupted the international economy and aggravated global distribution problems.
- In April 2020, strict regulations introduced to lower the spread of COVID-19 tripled the total of vessels waiting offshore from Shanghai, the largest cargo port in the world,
- Supply shortages were made worse by logistics industry disruptions triggered by container vessel activity, port congestion, and severe lockdown measures in important Asian countries, providing intermediate commodities.
- In 2022, the conflict in Ukraine amplifies supply problems by impeding exports of agricultural products including sunflower meal, oil, and seeds.
- The worldwide energy trade is heavily disrupted as nations switch from Russian supplies to alternative sources already constrained.
- A majority of the globe no longer has access to Russia's significant exports of mined products. Therefore, inflation appears as the price of particular items rises due to their shortage.
- Among others, backlogs in the supply chain are caused by a lack of drivers, capacity constraints with logistics providers and unforeseen spikes in demand..

Relevant Macrotrend Data

- Strict Covid testing methods have caused the air cargo facilities at Shanghai Pudong Airport to become congested. In the second quarter of 2020, more than 120 container ships were stalled in China's main commercial hub Shanghai-Ningbo.
- Trucking expenses have increased by 300% in Shenzhen, a significant manufacturing hub in the country's south, as a result of an order backlog and a driver shortage brought on by the implementation of comparable Covid restrictions..

Relevant Sources

- (Attinasi et al 2022)
- (Fechner, Luman & Konings 2022)
- (Knight 2022)
- (KPMG Singapore 2022)
- (LaRocco 2022)
- (Santacreu and LaBalle 2022)
- (SitusAMC 2022)



China’s economic transformation is enhanced by increased manufacturing investments enabling an expansion of national production capacity

Increased Manufacturing Investment in China

- Chinese industrial profits increased by 42.2% year over year at the end of October 2021, well exceeding pre-pandemic levels. The high level of industrial capacity utilization in China, prompted businesses to increase their production capacity.
- China's economic change will continue to be driven by manufacturing, accelerating international trade.
- China has prioritized upgrading this industry, as seen by the 14th Five-Year Plan's goal to retain manufacturing's GDP share while pursuing greener, more advanced, and higher-end production.
- "Made in China 2025," a state-led industrial initiative, introduced by the Chinese government, aims to make China the leader in global high-tech manufacturing, Chinese authorities were influenced by Germany's Industry 4.0 development strategy.

Relevant Macrotrend Data

- Compared to just 17% in 2017, China's value-based percentage of worldwide manufactured exports soared to a record high of 21% in 2021. The nation is currently a more significant global provider than Germany, the United States, and Japan put together.
- For the first eight months of 2022, fixed asset investment increased by 5.8%, exceeding the 5.5% increase predicted by Reuters. The largest increase in investment was in manufacturing, up 10% from the same time last year.

Relevant Sources

- (Cheng 2022)
- (Kang & Ng 2021)
- (McBride & Chatzky 2019)
- (Strachan 2022)



Triggered by resource nationalism and an improved consumer market, the global demand realized a drastic shift towards Asia

Peak Globalization and Rise of Asia

- Half of the world's middle class will reside in Asia, which will increase competition and cause trade tension.
- A renewed emphasis on resource nationalism and national self-sufficiency in Asian nations.
- Continual expansion of the labor market, a decreasing urban unemployment rate and a steady increase in personal income are offering optimistic expectations for a comeback in spending in 2022.
- The rise of "emerging Chinese Brands": In China, the quality and scale of the consumer market are rising, the country's cultural confidence and allure are increasing, Gen Z's share of the market is expanding quickly, and technology advancements are giving rise to new consumption scenarios.
- Chinese consumers seeking local brands is three times higher than domestic consumer interested in foreign brands.
- China is having an increasing influence on international affairs. Over the past ten years, China's foreign investment has increased ten-fold, and it now ranks as the third largest source of international investment, particularly in developing nations.

Relevant Macrotrend Data

- Indian exporters had a successful financial year in 2022 as the nation recorded its highest-ever exports in merchandise (US\$ 418 billion), up 43% from the prior year and 33% from the year prior (FY20).
- China was the top partner for EU imports (22.4%) and third-largest partner for EU exports (10.2%) in 2021.
- In 2021, Germany was the greatest exporter of commodities to China while the Netherlands have been the greatest buyer of goods from China.

Relevant Sources

- (Cheng 2022)
- (Eurostat 2022a)
- (Hill-Landholt, Nelson and Machin 2020)
- (International Institute for Sustainable Development 2016)
- (Kang and Ng 2021)
- (Mukewar 2022)



Environmental Trends



Companies and governments in the EU experience increased pressure to engage in sustainable climate action

Sustainability and Neo-ecology

- During the Covid-19 crisis, people got even more concerned about the urgency of climate change and the connected need for sustainability.
- The greater awareness among the population led to an increasing willingness to change behaviors, as human activity threatens the environment.
- The climate crisis became central to global concerns, which made room for the development of neo-ecology.
- Within neo-ecology, the individual environmental awareness becomes a social movement, which shifts sustainability from only a consumption trend to an economic factor: Sustainability becomes central to entrepreneurial action and the entire economic system, disrupting existing business models.
- The future demand for natural resources is expected to grow until 2030, which increases the urgency for sustainable consumption of scarce resources.
- While profit maximation will remain central in the economy, a focus needs to be put on sustainability, long-term growth and the common good.
- Logistics companies recognize the importance of sustainable practices, but face barriers in becoming more environmentally friendly.
- Green logistics evolved which aims to reduce packaging, air and noise emissions, as well as the environmental impact of the mode selection.

Relevant Macrotrend Data

- 87% of BCG survey respondents expect companies to integrate environmental concerns in their operations to a greater extent.
- EU agreed to reduce GHG at least 40% below 1990 levels by 2030.
- CO2 emissions from road freight transport have risen by more than 20% since 1995
- Pollution caused by logistics industry is about 25% in the EU

Relevant Sources

- | | |
|---------------------------|--|
| ▪ (BCG 2020) | ▪ (Rosenbauer 2019) |
| ▪ (Docks The Future 2018) | ▪ (Reuter M, Buchwitz M, Hilker M et al. 2017) |
| ▪ (Haag D 2022) | ▪ (Thuo S 2022) |
| ▪ (Haus von Eden 2022) | ▪ (Zukunftsinstitut GmbH 2022) |
| ▪ (Macrotrends LLC 2022a) | |
| ▪ (Macrotrends LLC 2022b) | |



Climate change and natural disasters due to greenhouse gas emissions require appropriate actions

Increase of Extreme Weather Events and Conditions

- A worldwide ecosystem decline can be observed, which encompasses the loss of biodiversity, stratospheric zone depletion, and climate change.
- Climate change leads among others to oceans becoming more acid, as well as an increase in frequency and intensity of extreme weather conditions.
- These events cause sporadic disruptions in global supply chains, aggravating shortages and delaying deliveries which consequently leads to increasing prices for consumers.
- The likelihood of conflicts in regions that are disproportionally affected by climate change is expected to increase.
- Heatwaves, drought, and heavy rainfalls have a knock-on effect on the transport industry.
- Extreme weather events increase mortality, reduce productivity, and damage the infrastructure.

Relevant Macrotrend Data

- The worldwide mean surface temperature has increased by $0,74 \pm 0,18^{\circ}\text{C}$ over the past 100 years, the sea level has risen by 1,8mm, and the Arctic sea ice is retreating by $2,7 \pm 0,6\%$ per decade.
- Droughts contribute to around 9 billion € annual economic losses in the EU and the UK and will happen twice as often, if the global average temperature increases by 3°C , leading to an increase in economic loss
- Weather accounts for 23% of all roadway delays in Commercial Vehicle Operation

Relevant Sources

- (European Centre for Disease Prevention and Control 2022)
- (European Commission 2022c)
- (Ivanova D, Vita G, Steen-Olsen K et al. 2022)
- (Otonomo 2022)



The reduction of waste and recycling are central to the EU’s efforts to reduce its effect on the environment

Increase of Waste Reduction

- The EU commission aims to manage waste in an environmentally sound manner by making the use of secondary materials a key element of the EU’s environmental policies.
- The EU demands companies in the logistics industry to use wasteless technologies where possible.
- Logistics companies are urged to use low toxic materials and high recycling goods.
- As a result of the increasing legislative pressure to reduce waste, the logistics industry is pushed to engage more in reverse logistics.
- Reverse logistics describes the process of moving goods from the consumer to the producer within the channel of distribution.
- Reverse logistics put an emphasis on source reduction and substitution over reuse and recycling, which aims to reduce total waste in the system. It includes product and marketing returns.

Relevant Macrotrend Data

- The average European produces about 5 tons of waste each year.
- In the EU, only 38% of waste is recycled.
- The global reverse logistics market is expected to grow from \$635,6 billion in 2020 to \$958,3 billion by 2028

Relevant Sources

- (European Commission 2022i)
- (Keleş A, Güngör G 2021)
- (Rogers D, Tibben-Lembke R 2001)
- (Statista 2020a)



Renewable energy is expected to surpass fossil fuels in the logistics industry and central to address climate change

Adoption of Alternative Energy Solutions

- Alternative energy solutions include a variety of technologies and their infrastructure, which use the energy sourced from natural, renewable resources that replenish faster than they are consumed.
- The transition from fossil fuels, which are responsible for a great share of emissions accounting for over 75% of global greenhouse gas emissions, to alternative energy solutions is central to address the current climate crisis.
- Historically, renewable energy used to be much more expensive than fossil fuels, but costs have declined by about 70% over the last 10 years. Nonetheless, existing solutions remain more costly than fossil fuels and are not yet available in the quantity needed. Large investments in R&D and the necessary infrastructure are required to increase the share of alternative energy solutions.
- In the European Union, the growth of the renewable energy sector is supported by the member states’ policies to meet their target of a 32% share of renewable energy in energy consumption by 2030. Currently, renewable energy presents only about 20% of the total consumption.
- All modes of transport in the logistics industry are affected by alternative energy solutions. Middle-mile and long-haul transportation experiences electrification but is restricted by insufficient charging stations. For air freight transportation sustainable aviation fuels are developed, while biofuel is produced for maritime transportation. However, both solutions remain costly and are not yet widely available, even though progress is made, as investments in R&D and infrastructure are still needed.

Relevant Macrotrend Data

- In 2015, the production and consumption of energy based on fossil energy presented 78% of greenhouse gas emissions (GHG).
- The UN roadmap states that fossil fuels should only present 30% of the global energy mix by 2030.
- Additions of wind and hydropower account for almost 90% of the increase in global total power capacity in 2020.
- Globally installed wind and solar PV capacity is expected to surpass natural gas in 2023 and coal in 2024.

Relevant Sources

- (DHL Global 2022a)
- (International Energy Agency 2020)
- (International Renewable Energy Agency, 2022)
- (Motyka M, Quasney E, Fitzgerald J et al. 2016)
- (United Nations 2022a)
- (United Nations 2022b)
- (Watchwire 2021)



Political Trends



The EU has formulated policies to address environmental concerns, but is urged to engage in more effective climate action by the population

Tightening Environmental Policies

- As a result of the increasing awareness among the population of climate change, governments experience greater pressure to engage in effective climate action.
- The EU has formulated a variety of policies and initiatives to address environmental issues, including, but not limited to the Zero Pollution Action Plan, the Single European Sky initiative and the revision of measures to address pollution from large industrial installations.
- The initiatives foster the shift to more sustainable modes of transport, such as rail and inland waterways. Logistics players already reacted with energy efficient fleets (e.g., hydrogen / electro cars, cargo-bikes for city center, sustainable aviation fuels etc.) to meet the set goals.
- However, only with equivalent infrastructure development, these climate goals can be achieved (e.g., charging infrastructure for electro vehicles). Correspondingly, EU subsidies are required to make the transition towards more sustainable methods attractive for companies.
- Traffic restrictions and charges in cities including vehicle access restrictions or tolling present currently and in future, significant barriers for logistics companies.

Relevant Macrotrend Data

- The European Green Deal seeks to reduce 90% of emissions by 2050.
- The EU has 330 to 940 billion euros of annual health and economic costs of air pollution due to lost workdays, healthcare, crop yield loss, and damage to buildings.
- The EU recommendation Alternative Fuel Infrastructure Directive (AFID) and Regulation (AFIR) set out recommendations in terms of the number of electric vehicles per public charger and the minimum public charger coverage on highways.

Relevant Sources

- (European Commission 2021b)
- (European Union 2022a)
- (IEA 2022)
- (McKinsey & Company 2022)



Trade wars and Asia’s economic rise lead to growing uncertainty about trade policies

Shift in Trade Policy Development

- Trade wars between nations raise uncertainty about trade policies, particularly China-US economic conflict (the top two manufacturing companies in the world).
- The Regional Comprehensive Economic Partnership (RCEP) presents a newly signed free trade agreement between 15 East Asian and Pacific Nations. It is now the largest trading bloc in the world.
- While members of the RCEP benefit from lower tariffs, the European Union is expected to have the largest export losses in terms of value from this new trading bloc.
- The Belt and Road Initiative (BRI) will accelerate the development of crucial infrastructure for the logistics industry (roads, railways), connecting more than 60 countries and 6 economic corridors.
- According to the Heritage Foundation’s trade freedom indicator, the trend of increased openness to trade began to decrease in 2019.
- Logistics companies face an uncertain development in trade policies, being directly affected by the continuous rise in Asia’s economic power (in terms of the RCEP and BRI).

Relevant Macrotrend Data

- The WTO joint initiative consists of 86 members, representing 90% of global trade, with the aim to establish joint market access and digital trade.
- The worldwide Trade Policy Uncertainty Index reached a peak in 2019, when new tariff threats on Mexico arose.
- The RCEP members represent roughly 30% of world GDP. The partnership eliminates 90% of tariffs within this trading bloc.

Relevant Sources

- (DHL 2022, 18–30)
- (OECD 2018)
- (Trade Policy Uncertainty Index 2019)
- (United Nations Conference on Trade and Development 2021a, 5–10)
- (World Trade Organization 2022)



Major shifts in geopolitical and economic power towards the East will diminish Europe’s current position in the global market

Shift of Geopolitical Power to the East

- Emerging markets are becoming more powerful with an overall shift of geopolitical and economic power towards the east.
- Asia might surpass North America and Europe combined in terms of global power by 2030.
- India and China are expected to become the two largest economies by 2050.
- Development towards a multipolar international order with multi-dimensional competition and strong interdependencies.
- International institutions such as the WTO are impacted by the political power shift in their effectiveness.
- Growing influence of China through the Road and Silk initiative.
- EU infrastructure and resource-supply dependencies on China or US present a significant threat to the EU’s open strategic autonomy approach.

Relevant Macrotrend Data

- The E7 (China, India, Indonesia, Brazil, Russia, Mexico and Turkey) will have an economic power double the size of the G7 (USA, UK, France, Germany, Japan, Canada, and Italy) by 2040.
- By 2050, EU’s share of global GDP might decrease to 9%.

Relevant Sources

- (European Commission 2022d)
- (WZB Berlin Social Science Center 2022)



Increasing geopolitical tension between market forces could lead to further protectionism

Geopolitical Instability

- Rise of nationalism could lead to protectionist behavior with regionalized supply chains.
- Growing EU vulnerability due to the EU’s one-sided dependency on the supply of resources (e.g. energy dependency on Russia).
- Global rivalry and fragility (e.g., the US-China trade war, Russia-Ukraine war, China-Taiwan tensions) lead to barriers and security concerns.
- This results in possible supply chain delays or even termination of business in countries of political unrest.
- Higher import duties due to protectionism could increase trade costs and impact price and quantity of traded goods.

Relevant Macrotrend Data

- According to the Global Trade Alert database, more than 80% of traded goods worldwide were subject to harmful trade measures.
- With 44%, China is EU’s largest global supplier of critical raw materials (CRM). The nation represents 52% of the total value of EU imports.
- In 2021, the EU imported a total of 62% of its energy consumption from Russia.
- In PwC’s 25th Annual Global CEO Survey, 71% (of 678 US participants) said, geopolitical conflict could inhibit their ability to sell products or services.

Relevant Sources

- (Cagnin et al. 2021, 1–4)
- (European Commission 2022k)
- (Global Trade Alert 2022)
- (Kettering Global 2018)
- (PwC 2022b)



Trend towards European digital sovereignty might hinder development of transparent supply chains

Development of Data Security Regulations

- Growing concern about data security due to cyber risks leads to further data security regulations and data sovereignty goals.
- Companies need to make sure to comply with all regulations or otherwise they face penalties/fines and loss of customer trust.
- Growing restrictions of transparent data structures hinder cross-border data transfers.
- Different data protection models between political powers (especially Europe, US and China), influence the nations’ ability to collect data and dominate the digital landscape.
- Technological developments such as IoT or Blockchain are slowed down due to the General Data Protection Regulation (GDPR).
- The OECD assessed the relationship between cross-border data flows , privacy policies and economic outcomes and concluded, that many agreements had a positive and highly significant effect on trade in services.

Relevant Macrotrend Data

- 71% of all countries worldwide have data protection laws and privacy legislation in place.
- Organizations face higher costs but the average return on privacy investments is 3 times the input amount.
- Deletion and transfer of data is ranked the most difficult among EU and U.S. firms in 2019.

Relevant Sources

- (Cisco Systems 2020, 7)
- (DHL 2019)
- (IAPP, EY 2021, 69)
- (Spiezia, Tscheke 2020, 7)
- (United Nations Conference on Trade and Development 2022a)



Industry Trends



Automation technologies have a lot of potential to help operations become more efficient, more accurate, and more productive

Logistics Moving Hybrid
▪ The advance in robotics and automation allied with the shift to remote work boosted by the pandemic is one of the next steps in the changing future of logistics employment. ▪ The remote work culture has long suffered in logistics organizations. Carriers used to require their staff to be physically present at the facilities. ▪ In order to collaborate, plan, and share knowledge, 3PLs, freight forwarders, and brokers typically needed to be in a central place. ▪ Historically, it was impossible to convert these jobs to the work-from-home paradigm. However, solutions are provided by Industry 4.0 technologies like 5G and the Internet of Things (IoT). ▪ With the use of sensor technologies like RFID, supervisors can access information while operating and supervising forklifts remotely. ▪ Even if they are not physically present, supply chain and operations managers can nevertheless gather information and insights about a warehouse, frequently in real time. ▪ Some ground operations in the warehouse or at the loading dock might be able to operate remotely as a result of developing technology.

Relevant Macrotrend Data
▪ More than 80% of the warehouses in 2021 had no automation whatsoever. ▪ Pick-to-Light, RFID, and Pick-to-Voice technologies reduce picking error rates by 67% compared to manual paper-and-pen methods. ▪ Automated Storage and Retrieval Systems (AS/RS) have the potential to increase order accuracy levels to above 99.99%.
Relevant Sources
▪ (A. Miller 2021) ▪ (Business Wire 2021) ▪ (Dehoney 2020) ▪ (Romaine 2021) ▪ (Wu et al. 2016) ▪ (Zuckerman 2020)



Incumbents face competition from startups that are digitizing logistics and specializing on distinct services

Boom of Logistics Startups with Focus on Digital Solutions

- New companies focus on providing only a very specific type of service, which contrasts with the rather integrated business models of incumbents.
- The startups tend to be in “asset—light” or “asset—less” parts of the logistics value chain.
- On-demand last-mile delivery platforms and road freight marketplaces were the top 2 business models receiving funding in the past ten years.
- The German startup TradeLink offers a supply chain management platform & enables logistics companies to digitize daily operations with real-time data.
- The Swedish startup Fast Trek facilitates sustainable logistics through predictive pattern analysis of driver performance and traffic among others.
- Europe is far behind the US and China in terms of new startups due to rare Venture Capital funding and incumbents hesitating to cooperate with startups.
- Numerous recent startup acquisitions by large players indicate a general market consolidation, however, also M&As amongst startups increased significantly from 2019 to 2021.

Relevant Macrotrend Data

- Funding in logistics startups almost doubled from 2020 to 2021, reaching \$24.6bn funding last year.
- Supply-chain technology start-ups received \$24.3 billion in venture capital globally in the first three quarters of 2021.
- 47 megadeals (value over \$1bn) happened in 2021 in the T&L industry compared to 20 deals in 2020.
- Median size of a funding round has grown by 95% with the general funding amount almost tripling in 2021.

Relevant Sources

- (Bauer et al. 2022)
- (Hausmann et al. 2022)
- (StartUs Insights 2022)
- (Tipping and Kauschke 2016, 9)



Players try to tackle their lack of digital capabilities by acquiring new technology entrants, leading to a more consolidated market.

Rising Diversification and Restructuring Efforts

- M&A activities in the sector are driven by companies wanting to expand their service offerings and aiming to have more control over their supply chains.
- Geopolitical tensions dampen the current outlook, with overall M&A activities expected to stagnate in 2022.
- The market is increasingly consolidating, with large players trying to increase their market share or buying crucial digital capabilities from new entrants.
- E-commerce companies transitioning from clients to competitors by insourcing logistics such as *Amazon* with its own cargo airline *Amazon Air* and its own delivery service.
- In 2018, the technology company *Uber* launched a new business unit called *Uber Freight*. By leveraging Uber’s capabilities, the platform aims to digitize the whole supply-chain infrastructure.
- Container Shipping companies drive vertical integration (*Maersk*, *CMA CGM*, *MSC*) since container shipping is subject to volatility of freight rates, it is a commodity, and huge profits of recent years need to be invested. *MSC* developed an air cargo solution as a complementary service offering, *CMA CGM* entered air freight and parcel service with acquisition of *Colis Privé*, and *Maersk* entered global supply chain solutions with acquisitions of *Pilot Freight Services* (US based) and *LF logistics* (Hong-Kong based contract logistics) .

Relevant Macrotrend Data

- With a total of 160 M&As in 2021, Asia remains the region with the highest number of deals. Europe follows on rank 2, with a total of 107 deals and a YoY increase of 30.5%.
- 40% of buyers came from abroad in 2021, signifying the importance of cross-boarder logistics deals.
- Despite a low growth development in M&A deals in Asia, 30 transactions in freight forwarding and logistics related only to targets in China and Hong Kong.

Relevant Sources

- (Bauer 2022a,b)
- (Chapman and Stickler 2022)
- (Deloitte 2022)
- (Goh 2019)
- (Krishnan 2022)
- (MSC 2022)
- (Schoolov 2021)
- (Interviewee 8, November 30 2022)



The trend of nearshoring requires logistics players to diversify their business as future cross-border transport is expected to decrease.

Growing number of companies with nearshoring plans

- Nearshoring describes the trend of outsourcing business processes to companies in nearby countries to save freight costs and duties.
- The trend of nearshoring is nothing recent, however the pandemic and geopolitical tensions have shifted the focus again towards reducing the dependency overseas.
- Decarbonization requirements throughout various industries also impact the setup of supply-chains.
- Lower manufacturing cost regions, such as China, have experienced a significant wage increase in recent years while consumer preferences evolved towards local production.
- These developments influence the companies' current plans of reshoring their production.
- While nearshoring would signify a boost in new jobs, logistics players will be faced with decreasing cross-border transport.

Relevant Macrotrend Data

- Within-border deals value comprises 76% of total deal value in the past year vs. 57% in FY 2021.
- In PwC's latest Pulse Survey, 60% of COOs indicated changes in their footprint by nearshoring (27%), reshoring (25%) or offshoring (18%).

Relevant Sources

- (Andersson et al. 2018)
- (Burke et al. 2021)
- (Chapman and Stickler 2022)
- (Comte and Caglar 2022)
- (DHL International GmbH 2022)
- (Romero 2022)
- (PwC 2022a)



Appendix C

Option Benefits and Risks



Justifications on Benefits and Risks for each Strategic Options 1/5

Option	Benefits	Risks
1. Offer continuous skills development for employees across levels and departments (up-skilling)	An investment in the skills development of one’s human capital is expected to pay off in terms of better operational and financial results, and in terms of employee satisfaction which improves employee attraction and retention rates.	There is a relatively low risk involved with this option since training is expected to directly improve employee performance. However, implementing frequent training programs across departments and levels requires significant resources and planning. There is also a risk that employees might take part in the trainings and then leave the company to apply their gained knowledge somewhere else.
2. Reinforce sustainable accountability among employees	Increasing awareness regarding sustainability among employees allows for the implementation and advancement of sustainability efforts within 3PLs. Further, it will help to achieve the European goal of zero-emissions by 2050.	This option is a low-risk option, as sustainability is a central topic in the economy and society and will remain or even increase in importance. However, 3PLs risk to be accused of green washing, if operational transparency is missing.
3. Put in place truck drivers' retirement schemes	This option provides an additional layer of trust for truck drivers, creating a healthier work environment. It will also make the industry and company more attractive when recruiting and retaining younger truck drivers.	Developing and managing a solid retirement plan for the trucking team will take time and require investment. However, the cost of not doing it could be more expensive in the end.
4. Realign training methods for operational staff to virtual reality training	With VR, employees effectively receive individualized on-the-job training while experiencing what it's like to be in real-world scenarios. As a result, there is less need for long training sessions that include reading through manuals, halting production, walk-arounds, and/or role-playing.	These technologies are still being developed and tested for training and require high investments, with no data proving the return on investment.
5. Hire and train workforce (re-skilling) for the digitization of business processes and the automation transition	Employees need to be equipped to use, adopt and adapt automation and other frontier technologies. Thus, a focus on hiring and training IT professionals benefits the company in the long-run, should automation be increasingly implemented.	This option needs to go hand-in-hand with the automation process to avoid 1) having a fully trained staff when the automation is not realized yet, 2) having automated processes without a well-trained workforce.
6. Restructure work processes to enable flexible and remote work schedules	Employees with flexible schedules may not have to commute to the office every day, which can increase their productivity. It can also reduce absence rates and support employees' mental health and stress.	Having a flexible and remote work schedule bears the risk of lower efficiency and motivation if performance is not directly supervised. Missing direct interaction can also complicate communication.
7. Create corporate division dedicated towards data protection policies	Knowing that their logistics provider is functioning according to a data protection policy ensures a layer of trust for customers/suppliers, knowing that they have legal options to defend themselves against invasions of their privacy.	3PLs bare the risk of investments in compliance training, installment of new data management equipment, and potential additional staff to become and remain compliant with data protection and privacy legislation, incurring expenditures they did not have before.

Justifications on Benefits and Risks for each Strategic Options 2/5

Option	Benefits	Risks
8. Increase investments in cyber security platforms and features	Robust cybersecurity increases the confidence of customers and other stakeholders along the supply chain in the 3PL. It also decreases hacker threats, data leaks, and other cyberattacks, and enables the 3PL to respond faster to security breaches.	There is a low risk associated with this option, since it is geared to better control the risk of cyberattacks. Implementing cyber security across the supply chain and divisions is a costly endeavor though.
9. Invest in Next-Generation ICT Infrastructure	The development of ICT infrastructure is essential for companies when multiple digital devices need to be incorporated into supply chain operations. With investments in the infrastructure, capacity, speed and stability can be optimized, enabling seamless cross-border data exchange.	ICT infrastructure investments require high capital expenditure. The financial risk is however rather low, as investments in the infrastructure will lead to future cost savings due to improved process efficiencies.
10. Integrate a cloud logistics platform into IT data infrastructure	Integrating a digital freight platform into the IT infrastructure will enable transparent communication among different stakeholders while reducing the latency. A sophisticated platform will be of great competitive advantage as clients can access all relevant data with a few clicks.	As platforms have existed for many years, the development itself is not seen as a risk. However, experts see a risk in a potential shortage of scalable solutions as platforms tend to be highly customizable to attract traffic.
11. Install RFID tags and scanners to establish a dense sensor network	Sensorization enables the intelligent tracking and management of products and assets along the supply chain. By connecting the RFID tags to the Internet of Things, readers can identify, track and monitor objects globally in real-time.	Associated risks are high capital expenditures and high maintenance requirements for the RFID tags. The risk of short sensor battery life and technical malfunctions at the sensors and within the digital infrastructure are high, which would compromise the reliability of the sensor network.
12. Become an industry pioneer in blockchain implementation	Being a successful pioneer has the benefit of reaping early rewards and becoming a role model and example for the industry to follow. The blockchain system in logistics itself has the benefit of increased transparency and traceability of goods and stakeholders along the supply chain.	Considering that previous projects aimed at digitizing supply chains in a blockchain environment (Maersk & IBM) have failed, there is a high risk of failure due to the high level of complexity associated with this endeavor. In addition, high investments are required and there is no example to follow.
13. Create streamlined reverse logistic processes	Reverse logistics address the increased demand for sustainable operations within logistics and respond to the societal pressure to realize green logistic processes. Thereby, 3PLs can reduce the usage of materials and waste.	Reverse logistics entail complex return order flows, which require the implementation of a new operational system. Thus, 3PLs face high investment risks, as well as operational risk in case of inefficient data and time management.
14. Establish network of early catastrophe warnings	Through early warnings concerning extreme weather events or geopolitical conflicts, 3PLs are able to switch to alternative modes of transport or routes to avoid supply chain disruption. Thereby, demand will be met, and clients will consider the 3PL reliable.	The creation of a network of partners is time consuming and the quality of the former mentioned network depends heavily on the expertise of the partners. Thus, this option is costly and entails the risk of being useless, if the quality of partners is not assured.

Justifications on Benefits and Risks for each Strategic Options 3/5

Option	Benefits	Risks
15. Develop disaster response and contingency plans	The creation of resilient disaster response and contingency plans allows 3PLs to act quickly in case of unforeseen supply chain disruptions due to extreme weather events or geopolitical conflicts. Processes are predefined and workers are familiar with the actions that need to be done. Thereby, 3PLs can remain operational, which can create a competitive advantage over other 3PLs.	The risks related to this options are low, as no upfront investment is needed. However, 3PLs need employees with expertise to develop detailed, comprehensive plans, which can come with extra costs. Additionally, the plans need to be revised regularly, otherwise 3PLs risk to rely on outdated plans, which will not be useful in case of emergency.
16. Partner with e-mobility companies for the creation of a charging infrastructure	Partnering with e-mobility companies allows 3PLs to communicate their needs regarding the charging infrastructure directly to the manufacturers. Thereby, 3PLs can advance the implementation of long-haul electric transportations. Through the creation of partnerships, the investment risk is mitigated to e-mobility companies.	3PLs risk to be dependent on the charging technologies of their e-mobility partners, which can result in the lock-in of potentially inefficient technology. This could hamper the advancement of electric trucking and decrease competitiveness.
17. Provide visa sponsoring for migrant workers	Hiring international employees increases diversity, filling roles where there are shortages of skilled workers.	The process of sponsoring a visa is difficult and employers typically assume liability for the employee actions once in the country.
18. Apply for government subsidies and funding to fuel innovation	Using government subsidies and funds to promote innovation is a strategy that reduces the use of in-house financial resources and leads to the alignment of goals with the government in terms of innovation.	The risks of this option are rather low and are limited to the loss of financial resources and time in case the funding application is not successful.
19. Implement big data analytics to optimize decision-making and processes	Big data analytics is a tool to make smarter business decisions based on sophisticated data, and leads to more efficient operations, lower costs, and more satisfied customers.	A high degree of financial and operational effort is involved in the implementation of big data analytics. There is also a risk of data privacy breaches if data protection policies are not strictly followed.
20. Invest in warehouse automation technologies and robotics	Automation of the business will imply considerable cost reduction and increase efficiency of the global operations. It would also reduce the need for employees to do repetitive tasks.	The risk of this strategy arises from the fact that automating the supply chain demands significant investment, with considerable operational changes. It would be difficult to revert all this investment if the outcomes fall short of the expectations. Also, the risk of not having a well-trained staff to handle automation technologies, needs to be avoided.
21. Acquire start-ups in the field of alternative energy solutions / digitalization for pilot projects	Through the direct acquisition of start-ups, 3PLs can gain insight and advance the energy solution that fits their needs the best. In-house knowledge regarding energy solutions can be a distinguishing factor from other 3PLs and can create an advantage regarding their implementation and availability.	Acquisition costs and uncertainty are high, which leads to high financial risks for 3PLs. 3PLs also face the risk that the chosen energy solution does not deliver as promised and other solutions could outperform the chosen innovation.

Justifications on Benefits and Risks for each Strategic Options 4/5

Option	Benefits	Risks
22. Expand the companies' current APAC branches horizontally and vertically	With more than 4.5 billion inhabitants, Asia is the most populous continent in the world, home to around 2/3 of all people. With relatively stable economies and a steady GDP growth, it has seen a great technological surge in recent decades.	International businesses will encounter some challenges that may put in risk revenue, output, and potential in developing markets. Additionally, there are obstacles to entrance, particularly for new enterprises in East and Southeast Asia, like language, customs and culture, local patterns and religious convictions.
23. Develop emergency logistics and become provider to nations	This option allows for the development of a completely new business segment and can increase the indispensability of logistics companies for nations. This option is especially worthwhile in unstable environments where disasters happen more frequent, while a dedicated infrastructure to address the challenges in the former mentioned environment are missing. Thus, 3PLs could fill a gap through the provision of emergency logistics.	Emergency logistics are delicate in their realization, as they need to be executed under extreme circumstances and increased pressure. Thus, 3PL employees face a greater risk of getting insured and 3PLs need to ensure the safety of their workers. The implementation of emergency logistics further requires high upfront investment, which is an additional risk that 3PLs need to consider.
24. Implement more sophisticated track and trace capabilities	As the demand for fully transparent supply chain processes rises, 3PLs must implement accurate and fast real-time track and trace options for clients. This way, the risk of supply chain backlogs can be mitigated as all involved parties will be notified if e.g., documentation is missing, traffic occurs etc. High transparency together with high data quality will be a competitive advantage to logistics provider, optimizing their warehouse and transport processes.	With more transparency comes a great data security risk. Moreover, the implementation of the underlying technology (such as sensorization), requires high capital expenditures and experts who set up the ecosystem where all shipments are traceable by customers.
25. Optimize delivery routes to offer quicker delivery	The benefit this provides is high since it would increase competitiveness as the delivery time is one of the most demanded options. This would be directly related to the improvement of the customer experience and to the increasing in efficiency of the supply chain.	The risk was considered medium due to the investment required to improve delivery capacity.
26. Increase share of electric long-haul fleet	By increasing the logistics providers' share of electric long-haul fleet, sustainability goals both on a state and company level can be achieved more easily. As customers also increasingly focus on sustainability measures of contracted parties, a greater share of electric vehicles could create a USP for logistics providers.	The implementation of this option requires a dense, uniform, European wide charging infrastructure. As companies cannot influence the cross-border infrastructure development, this option poses a high risk as it is unclear, whether sufficient charging infrastructure will be developed in the long-run.
27. Acquire own means of transport to ensure full flexibility	A promising strategy for enhancing the effectiveness and potential for performance of transportation services is flexible transport systems (FTS). FTS wants to give organizations the freedom to select the routes, timings, modes of transportation, service providers, and payment methods that work best for them.	The main risk arises through a low return on assets: Despite better gross margins, it is difficult to recoup high upfront expenses involved in purchasing the assets. In addition, the management staff must excel at using the resources efficiently to produce a strong return.

Justifications on Benefits and Risks for each Strategic Options 5/5

Option	Benefits	Risks
28. Adopt multimodal redundancies in freight lanes	A multimodal approach diversifies the sourcing of components and thus minimizes the risk of backlogs. This way, companies can increase the resilience of supply chains.	Risk of cost increase due to the diversified supply chain setups and thus risk of profitability decrease. While the overall risk of disruption and backlog can be reduced, the risk of partial disruption of each source of a component can increase.
29. Invest in drone infrastructure and fleet	Expected benefits of drone delivery are more speedy and convenient deliveries to remote and rural areas, specifically for high-value emergency goods.	The building of drone infrastructure is associated with high capital expenditures that would go to waste if the technology does not take off. Thus, risks need to be mitigated by closely monitoring technology advances and potential before making investments that are not reversible.
30. Invest in urban consolidation centers	Urban consolidation centers will decrease transportation costs and CO2 emissions, also allowing for faster processes from the warehouse to delivery points.	High investment is needed to establish the new warehouses and investigate the best locations.
31. Shorten supply chains by nearshoring business operations	A few advantages include greater efficiency levels, lower costs, and/or cost-cutting. Another is that increased efficiency and control will probably result in higher-quality products. Labor costs may be lower and hiring skilled staff is easy.	Potential hazards of geographic relocation include language hurdles, time disparities, political unpredictability, economic uncertainty, and crime.
32. Invest in the development of biofuels and hydrogen	Similar to maritime propulsion alternatives, the investment in biofuels and hydrogen can enable 3PLs to reduce their emissions, which in return allows 3PLs to become sustainable in their operations. As sustainability is increasingly important to companies, 3PLs can gain a competitive advantage through the use of alternative fuels.	The investment in biofuels and hydrogen requires high upfront payments, while their successful implementation cannot be assured. Biofuels and hydrogen are still being tested and do not yet have the same efficiency as fossil fuel, thus further research is needed, which requires additional funding.
33. Invest in energy harvesting for sensors	Traceability and monitoring of packages allow for greater transparency within the supply chain. Through the investment in energy harvesting, 3PLs can benefit from pilot projects and eventually eliminate the problem of sensors' battery life.	Energy harvesting is still being tested and not yet profitable, thus investment in this technology will require high upfront investments at a great risk.
34. Invest in the development of sustainable propulsion alternatives for the maritime sector	With ocean freight being one of the main polluters worldwide, the development of alternative sustainable propulsion solutions will allow 3PLs to reduce green house gas emissions and enable 3PLs to comply with sustainability policies like the European zero-emissions goal by 2050.	The great number of alternative energy solutions complicates the decisions making process in finding the most promising propulsion method. 3PLs need to gather detailed insights which require the allocation of resources. Thus, upfront investment costs are high, while uncertainty about the potential of alternative energy solutions remains.

Appendix D

Expert Interview Summaries



Interview #1: Controlling Manager, DSV

Trends & uncertainties	▪ Increase agility by pursuing acquiring acquisitions. Additionally, remaining asset light increases flexibility Therefore, maintain good relationships with external providers, built on trust ▪ Digitalization and sustainability are the major forces that shape the industry ▪ Truck driver shortage results in drivers having high bargaining power on DSV ▪ 3PLs must offer ecologic and environmentally friendly solutions
Technology	▪ Development of smart and automated solutions for warehouse handling, supporting lower energy consumptions and lower emissions of co2 ▪ Investments needed in IT infrastructures, automation and robotization to demonstrate clients how efficient, innovative and sustainable they are ▪ Technology must be enhanced, to optimize shipment routes by better analysis and coordination of incoming orders, meeting docking times and predicting traffic conditions
Geopolitical situation / trade	▪ In 2020, DSV realized a negative effect on its income statement, triggered by heavy increases in prices of gas and oil. Another effect of the Ukraine-Russia war, is detected by DSV's withdrawal of all its operation from Russia and Belarus ▪ In general, more complex governmental regulations are emerging. Geopolitical situations like the Brexit demand process adaptions, underlined by increased time in processes and bureaucratic regulations.
Strategic outlook for 3PLs	▪ Strengthening position in Middle Eastern Asia and gain market share in continents that are less dominated ▪ Gain capabilities in technology by M&A activities. Dedicated teams are needed t screen the market and work on projects intended to improve processes ▪ Next to technology, invest in human capital. The workforce can not fully be substituted by machines.

Interview #2: Pathways Operations Manager, Amazon

Trends & uncertainties	- A strong sustainability trend can be detected. To be specific, amazon only plans and constructs buildings with solar energy and e-parking spaces - Amazon plans to reduce its building investment by 400%. For example, instead of four buildings, only one will be built in Germany next year. - The biggest uncertainty within the sustainability trend, is whether many companies can afford green logistics
Technology	- Increased digitalization in order to reduce human errors - The EU currently lacks 30-40% of the labor force to maintain, operate and build these new technologies
Geopolitical situation / trade	- China and India will certainly be the last to enter the market, hindering amazon to operate in these trading booming nations - Amazon is currently launching buildings in Australia, New Zealand and Saudi Arabia. The rest will possibly be foreseeable by 2035 or similar
Strategic outlook for 3PLs	Amazon sets an example for a sustainable competitive positioning, indicating a strategic outlook for other logistic service providers. By owning its own supply chain and having its own fleet, Amazon operates completely independent. Therefore, protection against high costs and at the same time, an increased delivery speed to end customer can be guaranteed

Interview #3: Supply Chain Manager, Global 3PL

Trends & uncertainties	▪ Recent years are marked by volatility in global overall developments and as a result also in logistics ▪ Due to the high degree of current uncertainties in the economy and society, proactive and reactive measures need to planned and implemented to stay operational ▪ Sustainability is a major concern to consider on a societal and economic level in the long-run ▪ Market consolidation in the logistics industry, thus among 2PLs, 3PLs, 4PLs, and 5PLs, is not significant at the moment
Technology	▪ 3PLs started to reallocate their resources after the identification of the necessity for technological solutions to efficiently handle the growing demand ▪ Technologies are needed to be able to act proactive. This includes forecasting techniques, artificial intelligence, automation technologies, and machine learning ▪ Emergence of start-ups that focus on making new technologies available and useful for 3PLs ▪ However, a certain degree of aversion towards automation processes (like autonomous vehicles and robots) can be observed among 3PLs and among customers ▪ The technological capabilities differentiate between large and niche 3PLs. Large 3PL can offer customized IT solutions to customers
Geopolitical situation / trade	▪ B2C trade volume went up during Covid-19, because customers were in lock-down and increasingly engaged in e-commerce ▪ Highly unstable geopolitical environment because of the ongoing war in the Ukraine and the impending recession related to the current instability (e.g., trade agreements have been cancelled) ▪ Sanctions imposed on Russia from the EU and US have led to trade embargoes especially for cross-border trade with the Ukraine ▪ Zero-covid policy in China hampers global trade, as trade volume goes down and demand can no longer be fulfilled, because of missing supply of resources
Strategic outlook for 3PLs	▪ Future action of 3PLs need to be proactive and reactive to be able to handle market developments ▪ The distinction between global and regional 3PLs will become more pronounced ▪ Road transport might suffer from increasing boarder controls in an unstable geopolitical environment ▪ Ocean freight will increase, if the global trade volume increases

Interview #4: Operations Manager, Kuehne+Nagel

Trends & uncertainties	▪ Smaller startups have the technological know-how and personnel to scale up their operations and leverage technology to its fullest. ▪ Digital transformation is rather slow in big corporations as they oftentimes still work with outdated IT programs.
Technology	▪ Cyber attacks become an increasing problem for 3PLs. It doesn't necessarily have to be a cyber attack against the logistics company itself, but if one service provider of Kuehne is attacked, Kuehne and its trade flows are immediately affected as well. ▪ Large scale blockchain implementation is still way ahead in the future as large corporations like Kuehne have such complex IT systems, that they either don't want to touch it at all to avoid any problems, or they require a business case to show the financial outcome of an IT infrastructure change.
Geopolitical situation / trade	▪ Closed borders and disrupted supply chains lead to full warehouses for 3PLs like Kuehne, since the end product which needs to be shipped from the warehouse to the customer is being consolidated at Kuehne. If one single piece is held back in the supply chain, all other products can't be shipped out thus a huge stock develops ▪ Trade wars create a massive amount of extra work (in terms of customs and required documentation). If a specific contract sale is not fulfilled by a certain date, the goods cannot be shipped anymore.
Strategic outlook for 3PLs	▪ Technology implementation and qualified (tech) labor will be the main obstacles in the future ▪ Only those who manage to completely digitally transform can stay competitive as they have the master data they can harvest and the ability to keep up with the speed of changing customer demands

Interview #5: Team Lead Operations Development, Logistics Start-up

Trends & uncertainties	▪ The logistics industry is currently fragmented and any movements towards market consolidation are smaller than in other sectors ▪ A main challenge for the logistics industry is currently the shortage of drivers, which was worsened due to the war in the Ukraine. This is expected to lead to a capacity shortage which might be solved through the future implementation of autonomous trucking ▪ Customers increasingly asks logistics companies to account for their emissions. Either through emission reports or other transparency measures ▪ Increasing fuel prices and the economic downturn especially challenge small 3PLs and freight forwarders ▪ Tender business is going down because of the high prices, while spot business in increasing
Technology	▪ Start-ups that base their business on a platform model are becoming more frequent and aim to make the logistics industry more digital ▪ Two main advantages of technology in logistics are transparency and visibility. Technology helps to track vehicles and measure emissions of transportation ▪ Blockchain and sensors are not yet implemented on a broader scale in logistics ▪ Autonomous trucking has high potential to become central to road transport to be able to meet the growing demand
Geopolitical situation / trade	▪ Logistics are heavily impacted by political and economic developments in the short-term ▪ Trade volume within the EU went down during the Covid-19 pandemic, especially regarding cross-border trade ▪ High uncertainty for the trade volume in 2023 because of the overall market environment (rising interest rates, inflation, lower demand by end consumers)
Strategic outlook for 3PLs	▪ Platform business models in the logistics industry aim to cut out middlemen in transaction processes ▪ Platform business models aim to drive the logistics industry towards the digital age ▪ Future business models will incorporate sustainability solutions in their services and products ▪ Autonomous trucking will become central to road freight. However, the timeframe for this is unsure

Interview #6: Vice-Chairman, The Global Research Network Belt and Road Initiative (GRN-BRI)

Trends & uncertainties	- Increased shift from road to sea, considering a more environmentally friendly mode of transport - Rising prices of transportation, triggered by increasing costs in energy, labor and transport - Biggest current uncertainty is how long the Ukraine-Russia war will last. Ukraine is the main granary, supplying grain to the rest of the world.
Technology	- Development of software, that aims to automatize the speed of the vessel. Reducing the speed of the vessels reduce the carbon emissions into the atmosphere - In addition, the software should work towards just in time operations, acceleration environmentally friendly activities
Geopolitical situation / trade	- One of the impacts that the war of Ukraine had on transport was the stopping of trains coming from Asia to Poland and to Germany. Maersk started during the COVID pandemic, some cargo trains directly from China - Especially in case of maritime shipping, key objectives of the trans-European transport networks policy works towards the reinforcement of territorial, economic and social cohesion of the European Union
Strategic outlook for 3PLs	According to Ana Casaca, Logistics Service Providers must change their mentality in a sense that, vessel owners must be compensated for rising fuel prices. In the long run, transportation and hence the final products will become more expensive, adapting to increasing prices of raw materials and its finishing at manufacturers

Interview #7: Consultant, DHL Consulting

Trends & uncertainties	- For 2025, DHL Consulting formulated four core topics desired to be enhanced.: Future of work, future operations, data analytics, and sustainability - One of the major goals for 2030 is standardizing system across all DHL warehouses and across clients, to enable smooth system linkages - Especially during peak times (Christmas and Black Week) labor shortages become vivid - The acceleration and reliance of sustainability efforts is underlined with great uncertainty, as alternative fuels or electric vehicles might not be efficient enough to operate effectively
Technology	- Future operations present a major topics dedicated towards DHL development. DHL has innovation centers, dedication research towards process optimization - Software for automated warehouse management systems are being developed - DHL currently tests electric planes. For next year, 15 planes are already ordered, highlighting technological process in the logistics industry
Geopolitical situation / trade	Industry sector exposed to external events. The most recent event of Russia invading Ukraine, resulted in high prices of gas and oil. However, financial consequences can only be slightly realized, as the high costs are passed to the end-consumer
Strategic outlook for 3PLs	3PLs must hold up with technological innovations, especially to enable technological connectivity with clients - Building few large networks with multiple dedicated accounts, rather than many networks with few accounts. Network connectivity enhances organization efficiency

Interview #8: Director of Transport, Logistics & Mobility, PwC (two interviews)

Trends & uncertainties	- There are four major forces shaping logistics: 1) Climate Change: emissions are going up and PwC believes that battery electric trucks will prevail in the future→ the right technologies and alternative fuels need to be scaled, 2) The Talent Gap: truck drivers (particularly from Ukraine/Russia due to war) and IT specialists. The logistics industry has a reputation issue and is not really attractive. Autonomous trucks might be part of the solution, 3) Digitalization, 4) Geopolitical Developments whereas this is more of an uncertainty - Three types of new entrants: 1) Start-ups have been around for many years but only small number have gained significant market share, 2) Players from other industries: from clients to competitors (e.g., Amazon), 3) Container shipping companies driving vertical integration to enter into higher margin businesses than freight (a) Maersk expanding into supply chain solutions: acquired US based and Hong Kong-based supply chain providers, b) CMA CGM acquired Colis Privé: air freight)
Technology	- Supply chain transparency and delivery surveillance becomes increasingly crucial. End-to-end monitoring requires equipping containers etc. with sensors and connecting them to IoT. - Digitization needs to occur in cooperation with customs authorities (to speed up customs processes). Many important documents e.g., the bill of lading are still handled on paper. - Automation and digitalization process is still too slow. As of now, there is not much disruptive technology in the industry. Some that are increasing efficiency like autonomous vehicles. - Research over the past 5+ years into blockchain, but there is still no breakthrough, so most medium-sized logistics companies do not deal with it. Maersk has recently stopped blockchain project with IBM. Many disruptive technologies will still need 10+ years to be implemented in the logistics industry. - Many small, older companies will not manage to digitize out of their own strengths and will be acquired by bigger companies.
Geopolitical situation / trade	- The transport industry is where their clients are, so despite potential trade wars with China, logistics companies are increasing their services in APAC since many clients are moving production/procurement to Asian countries - Russia-Ukraine war: Most logistics companies are not too badly affected, since Russian logistics market is a fraction of the European (Russia: \$20 billion, European: \$1000 billion), biggest impact is the rising energy prices "Re-globalization": A change of globalization patterns is ahead: moves from one country to another, but supply chains will remain global, many global free trade agreements - Global geopolitical situation is a large uncertainty; very difficult to make predictions regarding geopolitical stability
Strategic outlook for 3PLs	- Fraunhofer Top 100 in Logistics: incumbents like DHL, FedEx, UPS, Kuehne + Nagel remain in the top ranks. Digital logistics service providers are still relatively small in scale (e.g., Flexport, Sennder, Forto). They are not big in terms of transport volumes since the logistics business is hard to scale up (Talent is needed: digitals recruit ex-managers from logistics incumbents to get that expertise, relationships are needed, asset-heavy industry: warehouses and infrastructure is needed) - Market consolidation process has been going on for many years. Start-ups are stronger and more creative in terms of digitalization, so many incumbents work with start-ups or found their own start-ups and take them out of their organization, some start-ups are acquired. However, as interest rates are going up, investments into start-ups are levelling off - Incumbents do not collaborate but focus to optimize their own supply chains. Incumbents are "too big to fail" but also "too big to disrupt themselves" as there is so much complexity.

Interview #9: Tender Manager, DHL

Trends & uncertainties	- Startups are of no threat to legacy player as they do not have enough people that can be trained - Startups are viewed as future potential partners instead of as a threat with various acquisitions are taking place - Difficulties to train worldwide employees on technologies - Strategic goal to be carbon neutral in Germany by 2030 and globally by 2050
Technology	- Developments towards blockchain technology for decentralized IT systems - Difficulties to globally digitize a whole company - Some countries might have embargoes on specific software applications - By 2030, most European warehouses will be automated with robots working within the warehouses
Geopolitical situation / trade	- Collaboration between players only takes place when its for the common good (e.g., during Covid) - Global events like Covid or trade wars create discrepancies between signed volumes and needed volumes. Dropping volumes lead to decreasing revenues. - Recent events have led to the company goal of reducing assets (e.g., fleet) as much as possible with the aim to engage more and more with 4PLs to reduce fixed costs. - Regulation is a topic the company can tackle due to skilled staff
Strategic outlook for 3PLs	Any potential geopolitical disruptions pose an immense threat on 3PLs

Appendix E

Expert Interview Transcripts



Interview Controlling Manager – DSV

Annabel Stöhr

Which area of your business are you planning to strengthen at DSV? And maybe also starting from there, what is the core business of DSV and how do you plan to enlarge that?

Interviewee

It's a Danish multinational, that operates in transporter logistics with up to 7000 employees and present in 90 countries in the world. So it's a pretty big company, the third largest freight forwarder in the world. And right now, let's say that the areas where we focus the most on value creation, via mergers and acquisition, and a continued focus to remain an asset light organization, meaning that DSV doesn't own planes, trucks or anything, so it remains asset light. And this allows the company to adapt very fast to the market and its needs. The assets that we use as they are, are not our own, but we use it or just rent it out. However, one of the latest focus points that we want to pursue for the coming years is an organic growth and this organic growth is based on five pillars. The first one is leveraging our global network. The company is present in more than 90 countries all over the world and this means that we can satisfy the majority of our clients' needs because we can bring things or provide services everywhere in the world. For us, this is a major strength, satisfying your customers is always point number one on the list. The second point is deepening our vertical expertise, which basically means utilizing the competencies that we have to support specific customer needs, meaning that we are always able to provide ad hoc services, whatever the request or the need might be. Third, we try accelerating our operational excellence and digitalization. This is one of the biggest focal points for which the company is actually developing or staffing, resources and creating teams in order to enhance digital solutions to improve customer experience, retaining existing customers and winning new ones. Forth, greater collaboration between our divisions is planned. So DSV is generally composed of three divisions, air& sea, road, and finally solutions. We want to be perceived as one company. So we really want to deliver these services as one company,

even if in the end, they are different legal entities. Lastly, we want to refine the sustainability agenda. As you know, sustainability is a hot topic on almost every company's agenda. And we redefined our organizational structure in order to bring sustainability closer to the business and actually elevate our sustainability ambition, both from the internal and external perspective.

Annabel Stöhr

You are a very asset light company. I think it's super interesting, because I would assume that being asset light is actually more like a disadvantage, because you're very reliable on external providers.

Interviewee

True, however we tend to have very good relationships with our external providers, and long term relationship built on trust and in return we are bringing them business. So if it's not one, it's the other I think companies want to work with DSV, because it's a company that ensures certainty. It's true that you are dependent on external providers. However, there are several external providers that can provide services.

Annabel Stöhr

Just one background question, because I didn't quite understand what you meant with the solution part besides sea and air and road.

Interviewee

Solutions is a division that offers logistics solution to a company, for example warehousing, packaging and transportation. So we really do value added logistics. We can stock stuff on behalf of the client, but we also pick up things from their factory, bring them in our own warehouse, and handle orders for them. We pack the stuff, load them on a truck and we send it to the companies' clients. So it's really an integrated value added, the solution business provided by us.

Annabel Stöhr

Do you know if the service you named is 3PL or 4PL?

Interviewee

Yes, these are types of logistics that you can offer to your clients. DSV is able to offer all PLs.

Annabel Stöhr

How's the Ukraine Russia war impacting you? Do you realize any other external instabilities impacting your business?

Interviewee

What we have noticed the most since the beginning of the war is the increase in prices of several commodities, especially the oil and gas business. Also supply chain disruptions that increased freight charges or created container shortages or lowered warehousing space. Port congestions were also caused by the war and this created basically a sort of pullback of orders by clients. So, lots of lots of uncertainty. The increase in the oil and gas prices also had a negative effect on the income statement of our company, because we had to absorb the increase in energy prices, which, especially in the warehousing business, and I'm talking about very, very large warehouses in this case has really doubled costs for electricity, which were not foreseen and it really impacted negatively the business. Also, DSV has withdrew all operations from Russia and Belarus. DSV maintains only humanitarian shipments like medicines, and some foods and beverages. So to sum up: Price increases, port congestion, lack of warehousing spaces impacted us. And that created a lot of uncertainty.

Annabel Stöhr

I think I saw that last year, you had a major increase in revenue, I mean, it was exponential right.

Interviewee

Especially the MNC business this is because the prices to rent containers went really up. So, the company could benefit actually from the pandemic because the prices went up and we could sell to our clients this base very high. So DSV has grown a lot in the last year, actually every time the company publishes quarterly results. It has to adapt upwards the forecast for the end of the year. So and that together with the acquisitions that they were pursuing in 2019, completing the Panalpina Welttransport acquisition in 2021, thereby acquiring agility. It's really a very dynamic company and hectic environment.

Annabel Stöhr

And with agility, it's more like wanting to strengthen your position in the Asian market?

Interviewee

Yes, in the Middle Eastern Asia. In general, all acquisition suit DSV, in a sense to gain market share in continents that were less dominated. And the result is now that we are the third biggest freight forwarder in the world. If we talk specifically about the company DHL for example is headquartered in Kuwait, with presence in the Middle East and Asia. So it was for that and to be honest, finance wise, these are very interesting activities, to work projects to work on. Because it doesn't happen every day that your company acquires another company and that you play an important role in. I advise and I wish for you that one day, you can try this experience if you go in finance, because it's very interesting.

Annabel Stöhr

One of the most general and for us also the most interesting question as we dare an outlook to the industry, what do you think which major forces will shape the industry in the next 10 years?

Interviewee

So, for me the major forces that shape the industry are for sure the digitalization and sustainability of the business now, it seems that everyone is going crazy with the

sustainability topic, which is very good, because at some point the world has to realize that we are harming the planet. However, I think that slowly, we will be able to reduce the impact that we create on the environment and that eventually one day, we will use, you know, smart warehouses with lower energy consumptions and lower emissions of co2 in general. So, that's for sustainability. Why the digitalization, it's very important for DSV to invest in IT infrastructures, and automation, robotization, because, nowadays, you know, when we are screened by our clients to be their freight forwarder provider, you know, we are basically asked to sort of demonstrate how efficient, how innovative and how sustainable we are. The challenges that we're facing in the industry are basically it's not easy to cut on transportation costs in the sense that there is not a big margin between the revenue or what we are able to invoice to our client and the price we pay to transport basically the goods or provide the services to our clients. So, what we have to work on is basically the optimization of shipment routes through that analysis and better coordination of incoming orders, meeting docking times and predicting traffic conditions in order to cut these costs. Then, a very big challenge, rising fuel prices, this is of course, a macroeconomic factor that is impacting our society but as we are transporting goods on planes, ships or trucks, we basically have to pay higher price for fuel which is included in the invoice we received from our suppliers then we've also had during the pandemic and still now facing driver shortages. So it's not easy to find drivers to ship our goods all over the world. Our drivers actually have a bigger bargaining power on us. We need to pay on time because now we are dependent. If these people leave us, then we are in trouble. So this is one of the challenges that we're facing.

Annabel Stöhr

So power dynamics changed.

Interviewee

Yes, correct. Then, also we face more complex governmental regulations, because of the pandemic but also because of geopolitical situations like Brexit. So, this has had a very important impact on the transportation and logistics industry. So, it was a strong effort for

us to adapt to the situation where we have seen increased time in processes and bureaucratic regulations. And I think the way to elaborate on this is technology. It is the only way how we can optimize lead times and so on. And also another point is the growing need for sustainable logistic operations. Everyone is asking for ecologic and environmentally friendly solutions nowadays. As I said, nothing wrong with that. But companies need to invest in infrastructures and also in human capital in the end, if they want to adapt to this.

Annabel Stöhr

I would have one question concerning technology again. So what ways does DSV try to gain capabilities in technology? Is it rather through M&A or like internal?

Interviewee

For technologies I would say: Investment. So creating dedicated teams, which screen the market and work on projects that really study and think about how to improve processes, you know for example using apps. Now, one of the latest one is for drivers. They can use apps to manage the transportation documents, instead of working with papers, they can do everything online. So for Mergers and Acquisition, if you acquire a company that is more innovative in certain aspects you can surely leverage from the technology that they're using and bring it in your business, I would say that the DSV we are doing it more through the creation of dedicated teams that really focus on this part of the business. I believe that a lot of the importance is dedicated to human capital in the end. We cannot be fully substituted by robots or machine because human brain it still think it's the best creations in the world to work on projects to develop new technologies.

Annabel Stöhr

So talking about the development of technologies, you just mentioned for example, an app, which I would say is suitable for the time right now. But if you think a bit further towards like robotics, automation, and in general artificial intelligence or blockchain, how do you think will this develop over the next ten years?

Interviewee

Sure. DSV is already quite advanced in the use of robotics and automation in their warehouses. In Europe, let's say in Italy, for our clients in the automotive industry, we offer smart and really automated solutions for warehouse handling of cars. Also, in the Netherlands DSV opened up a jewel of a warehouse, where they manage the logistics for a sportswear company which is fully automated. So, the journey, this has already started and of course, being able to provide such services and prove to clients that you can do certain things is the best sponsor you can have to acquire new clients. So, nowadays, it is all about automation and robotization in the warehouse. Because of course, you need one person to control all these systems, but in a way you can make an investment at the beginning which will lead to a cut in costs in the following years. Earlier you needed 10 People now you need two robots and one person for example. A pity for the people that are impacted by this, however, they can also try to develop new skills and try to be the person that is controlling this.

Interview Pathways Operations Manager – Amazon

Interviewee answered interview questions in written format.

Company Status Quo

I generally believe that our network and infrastructure are what set us apart. Amazon invests a lot in its own supply chain. We have our own trailers, our own containers, our own trucks, etc.. So, no matter what happens we are completely independent and can protect ourselves against high costs and at the same time increase our speed to the customer. Delivery speed and consistency are certainly No.1 - for example Amazon has its own containers and also shares in shipping companies in order to be able to reliably maintain an inventory even with rising prices. At the same time, we lease airplanes for our own fleet and want to be completely decoupled from UPS and DHL in the next 10 years with regard to delivery service.

We use AI mainly to plan customer orders in advance and to plan and build inventory accordingly.

Outlook

I think the biggest challenge in the next few years will be to get a reasonable workforce. Of course, more autonomous robots will be created, tested and also installed, but in the next few years the human being will remain a big part of the success. I think we in the EU currently lack 30-40% of the workforce to maintain, operate and build these new technologies. I see digitalization as a tool to spread information faster and easier. It will be more and more the case that we want to make ourselves independent of the individual employee in order to reduce the error rate and increase customer satisfaction.

So Energy I think will be more and more sustainable, we also only build buildings with solar energy and e parking etc. but the question will be how many companies can afford to

invest so much in the next 5 years at current interest rates. Amazon plans to reduce the building investment by 400%. That is, instead of 4 buildings next year in DE listens to 1. Therefore, I think there will be in the next few years rather a small growth in the reference.

China and India will certainly be the last to enter the market. Currently we are launching buildings in Australia, New Zealand and also Saudi Arabia. The rest I think will be foreseeable by 2035 or similar but I don't think it's currently realistic until then.

Otherwise, I see few competitors in the competitive landscape, and I don't think that will change. The infrastructure that Amazon has, and the know-how will take decades to achieve. The biggest competitors will be logistics companies in niche markets, but not on the scale that Amazon operates. Especially with regard to e-trucks, networking of individual buildings, inventory, supply chain integration, etc., the logistics companies will not be able to compete on this scale.

Interview Supply Chain Manager – Global 3PL

Annabel Stöhr

As an introduction, could you tell us a bit about your role in the company?

Interviewee

My role is in sales. So I am an account manager for existing customers that are with us being the commercial liaison, or the first point of touch, for daily operations and any projects that come through. But then also I work with solution designing for new opportunities, new customers, bidding on tenders making proposals. If we win a customer, then it'd be an opportunity to implement the setup, proposal, stuff like that. That's my role. We serve. So the area that we serve for our customers are in EMEA. So it could be that an account exists in Asia Pacific or in the US as well. But then whatever orders, whatever shipments they have for EMEA would be served by us.

Annabel Stöhr

You already mentioned the international logistics company you are working for. So what would you say? What is the USP of that company? And well, what role does it play in the rapidly changing environment?

Interviewee

Sure. So I think here is where we need to make that clarification, right. Because when you talk about the part of the group I work for, which is part of that global company, we have all the resources of that global company at our disposal. But if you talk about your research it is more from a 3PL perspective, and in their my company plays the part of a logistics provider. So in that sense, it is a very crucial role, but it's not the entire picture, right? Of course, just like any global player, I mean, these are very volatile times. So last year, we saw or rather, end of 2020, we started seeing this immense growth in B2C orders. Worldwide, everybody was behind their computers at home stuck at home, ordering stuff

online. And, in my opinion, this is just my personal opinion, right? That all of the big global transport providers, logistics providers, they were facing similar challenges, their infrastructure just wasn't able to grow as much as the demand was growing. And so I think last year, and then earlier this year, as well. At least my company made a lot of changes to their networks, how they are allocating their resources, you know, how they're handling operations, they upgraded many of their stations, which I imagine many other suppliers and global players also did. Right. And yeah, I think that is how these companies are dealing with this change that is happening right now.

Annabel Stöhr

And do you think that to keep up with the increased demand, technological changes need to be made? How do you think was that implemented and how do you think it will work out in the future?

Interviewee

Yeah, for sure. For sure. I mean, again, this is my my opinion. I'm not talking about any of the companies or what they did, but we need to technologies to act proactive. So you need forecasting, forecasting techniques, artificial intelligence, machine learning, these are tools that can be used. There are a lot of startups right now that work in that arena. But yeah, it's still nice to come to the mainstream, I think. But that is on the proactive bit. And of course, was in the industry. It's not that easy to get actual forecasts about your customers that are real, you know, that you can rely on. But I think that would be the proactive part of things. But then on the reactive part of things, I think. And right now, in my opinion, reactive is as important as proactive, because we just don't know what's going to happen. I mean, there's a war, there's impending recession, you know, all the experts are saying it's going to be a recession like nothing that we've seen. So, you know, all of these uncertainties, you can plan for them, but you really don't know what's going to happen. So you need some reactive measures as well. That is where probably your automation in the floor in the warehouse, or, you know, self-driving delivery vehicles or drones, those kinds of things come in. Yeah,

so that's my personal opinion is we're going to see a bit more in the future than we're utilizing now.

Annabel Stöhr

I think this is also what's like a big part of our research that we actually estimated, or we think that within like the next 10 years, we will have much more artificial intelligence implemented in the logistics industry. So I think this is actually super interesting to have an insight on what might happen. I don't know, I mean, we already have growth, delivering packages and all that stuff. And I'm very curious how this will develop actually.

Interviewee

Yeah. I think there's a certain aversion for it right now within the companies, but then also probably the customers probably there have been afraid of, okay, how do we secure our goods? If it's a self driving board? If it's a drone? Those might be some hurdles that need to be overcome. But yeah, I think that's the future.

Annabel Stöhr

Definitely. And you just mentioned also, for example, the current war going on between Ukraine and Russia, which can limit your activities? Did you and your day to day business realize any disruptions or any hurdles? Triggered by the war?

Interviewee

I mean, it's a war that has two sides, both sides are putting sanctions on each other. There are trade agreements that are being cancelled, left, right, and center. So you obviously see volume fluctuation in that sense, but then many are rather most big players, big companies have suspended their services in that region. So it's, for example, I mean, if I talk about the medical industry, medical goods that do not fall under sanctions, or rather most sanctions, because you know, it's a humanitarian thing. But then you need to be able to prove that these goods really do not fall under the sanctions. If you can't prove that, then you can't ship that. So that is something that 3PLs are dealing with right now. What can you ship to those countries and what you can't? And how do you? How do you ensure your compliance

with these regulations? While at the same time making sure that the customer is not getting affected that much? Because in the end, it's your responsibility? Because you're the one who is taking those goods across the border.

Annabel Stöhr

So you would say that lack of political regulations affect your way of things?

Interviewee

Indeed, so the sanctions, the trade embargoes. That the US and EU say that you cannot take stuff over the border in Russia, or even that the financial accounts are seasonal, the bank accounts overseas, financial transactions are more difficult. These are problems almost every industry is facing right now. But 3PL, of course, has added complexity with the actual flow of goods as well. But I will assume I mean, I'm sitting in Netherlands, so I'm within the EU. So I'm looking at it from this perspective, but I can imagine people on that side of things will also have a similar issues, similar bottlenecks. So I think it's for the whole world right now.

Annabel Stöhr

Definitely. So I mean, you're just mentioned for example, you're in the Netherlands and your main customers are like within EMEA. Did you realize an economic shift towards booming trade nations like China and India? How do you realize that these countries actually are booming trade nations right now or are becoming booming trade nations?

Interviewee

So honestly, I can't talk too much about Emirates and India, because personally, my customers or the flows that I've seen, are not that much dealing with those countries. I have a few outbound flows towards those countries, which honestly have not been that effective. If I compare it to the last year, and this year, I'm not going to talk about 2020. Because 2020 was just, you know, outlier in that sense. But if I talk about, you know, how the economy is going in the world, but for China, and then again, because my outbound supply chain, so my downwards supply chain is all in EMEA, China, India, these come generally

in the Asia Pacific side of things, but what I would say is, we receive a lot of stuff from China, right. And we, of course, see that China right now has much influence over global trade. That if something happens in China, for example, there was a lockdown in Shanghai, right? In the special economic zone, and all of those things were affected. Earlier this year, that is, when you really saw a dip in volume, you saw customers saying that they were struggling to meet the demand because the supply couldn't be fulfilled from China. Nothing could be shipped out. We even saw there was a container shortage since last year, and then earlier this year, all these reports in LA and in the West Coast of the US were blocked, stuff like that. All of that volume affects or rather, all of those events affect how the volume is flowing from China. And that really, that was really noticeable on a global scale. And you see that everywhere. So indeed China is a big player right now.

Annabel Stöhr

You as a 3PL, you ship a lot of parcels, it's a lot of traffic going on, which also means some kind of unsustainability as I would assume. What do you do in order to meet certain sustainability standards? And also, are there any, like upcoming alternative energy sources you're using, especially now as we have a gas shortage from Russia? So how do you deal with this? And also how do you realize actually, that you need to adapt your energy sources?

Interviewee

I think we all noticed that on a personal level, but also from a company level. And I'm not speaking for the company here itself. But I think we all see everybody realizing the need to be more sustainable. For the future. It's more than what I see the change in the mindset is that previously, it used to be the notion that if you want more sustainability, you're will have to pay extra. But now companies are figuring out the actual cost, the end to end costs of things. And I think in the in the long-run and in the broader picture, it makes more sense to be sustainable. Alternative fuels. I know 3PL companies are always experimenting with new fuels. Like hydrogen fuel. I think there was even a solar car that was being tested. Honestly, I think that's still a long way to go. I mean, electric cars are already there, right?

So I'm not even considering that as an alternative fuel, because electric cars are here. But yeah, fuel cells, solar cells, wind powered. In my personal opinion, there's still some ways to go to make that commercially feasible. But yeah, and in terms of the gas price hike for Google, the war and stuff. I think most companies are doing the same thing. It's a good thing that people are working hybrid now. So just in general, half of your costs are probably going down. Don't quote me on the half. But you know, I notice something very interesting. Offices have these automatic lighting, right. So when you walk into a room, the lights turn on. The timer for that has been reduced in many offices. So suddenly you're in the dark. I don't know how effective that is. But those are the measures that people are taking companies. You climb the stairs more often than taking the lift. I think that's a common thing.

Annabel Stöhr

So talking about like players in general, I think they're like a few big ones in the market. Do you think that like over the past the market became more consolidated, and only like a few players actually sustain in the market and are able to compete? And how does your company keep competing successfully against other 3PL companies?

Interviewee

Honestly, I don't see consolidation happening. It's happening in a few industries. I've a background in maritime and in that industry, it really see more consolidation. I mean, all the small players were eaten up by these larger ones. And in the past five to six years. I haven't seen that kind of consolidation in the 3PL industry. My personal opinion is that that is mainly because you have different USP ideas, different capabilities within the industry we have larger global players and the local players. The global players generally are more standardized. So they offer you a solution that would largely fit their existing operations, maybe here and there, they can make a few tweaks. But their USP is that they're global, so they can offer you avenues into new markets into developing markets, while you have the benefit of the stability that you have with them. So you don't need to go looking for other providers in those other markets, you can stay with the same one is a single point of contact.

But if you look at the local players, the smaller players, they're generally more customizable, they are willing to accommodate more of your needs. So if you don't have standard products, if you don't have standard processes, they are willing to accommodate more and give you a solution around those needs. But again, if it's a local player that you're dealing with in the Netherlands, they might not have a branch or they might not serve other areas outside Europe, then you need to go looking for something else within global supply chains and global players. And the supply chain of the global company I am working for is kind of unique in that sense. And I've worked with other 3PLs I mean, as an employee, but also, when competing for accounts. Our supply chain is unique in that way that they are part of this bigger group. So they have those resources at their disposal, but they're small enough to be adaptable and give you customizable solutions. And that is what I say really benefits me when I'm making a sales pitch to my customers. Because I can offer you all of these things. Another difference might be IT capabilities. Because if you're a customer, you have your own IT processes, systems, etc. If it's a local player, they are more likely to be using an off-the-shelf software, which might or might not be able to be integrated with your IT systems. But with these bigger players they generally have their own system and IT capabilities. The bigger players generally have an in-house IT team. They have customized solutions. So they are better equipped to handle those integrations.

Annabel Stöhr

A short question: when you say customized solutions, what would be a common example just for us to understand a bit more clearly.

Interviewee

An example. Indeed, I think I think the basic activities remain largely the same, right? You receive goods. And now I'm talking about the 3PLs with warehousing plus fulfilment, you receive goods, you store goods, then when the customer presents you with an order that needs to be shipped out, you take those goods, pack them in whatever way, whatever way they want, and then ship them out. That is the standard flow of things. It could be that your goods come in in small boxes, but they also come in on pallets, but they also come in on

these larger pellets, which are just difficult to handle. To give you an example. I don't know if you can quote me on that, but there is a cinema provider. You know, a cinema hall has these big screens, the same company has these screens, but the same company also has these speakers, the same company also has the server parts. If that company is your customer, then it's challenge for you to be able to accommodate all of those parts, not just to handle, but also to store how you store them, you need special facilities for that. So those are the kinds of things that in my opinion, on the physical side of things, a local player handles better than a bigger player. Because these are, again, if I'm taking the same example of a cinema, company manufacture, it's not high volumes that you're dealing with. So it's not going to be a very lucrative business for you. Unless there's more into it, then it's a foot in the door. So I think that is why smaller players are more involved with that. But this is the physical side of things. It could also be that you need customized solutions, on a systems side of things, where you say, okay, I am dealing with your company and you say your order process is based on this old 1980s software. And you are not willing to change given the costs involved for transitions and everything. So you need to be able to receive orders via an interface with your 90s software. So an off-the-shelf software might not be able to do it. But then in this case, a big player might be able to integrate that. So here the customer needs the big player to come in.

Annabel Stöhr

Okay, last question. Your company is incorporating, I would say all kinds of modes of transportation. From aviation to shipment and roads. How did the modes of transportation change during Corona, could you observe a trend?

Interviewee

That's a fair question. I think the road transport initially suffered because of the internal amount of newly back EU from the road transport. I think initially, it suffered because of all of the different restrictions in different countries where you could go where you couldn't go. But ocean trade really increased, I think just because the global trade volumes increased. But at a certain point, you can see that containers are not available or you know,

you don't have slots in ports etc. So to supplement that demand, companies had to make use of air shipments, express shipments where they would send smaller shipments just to meet the just in time demand.

Annabel Stöhr

During Corona regulations were stricter, do you think that trade regulations will be tightened even more in the future? Or that this was kind of like a sign that those regulations were too tight?

Interviewee

If they tighten all the regulations, it's a big thing for 4PL and 3PL especially for the major powers in the major countries with high trade volumes. I just don't know if I'm an expert in that. But my personal opinion is that trade regulations will become more loose as globalization is the phenomena that is really happening. As long as we have trade, it's going to be more or less the more countries can do business with each other. So I think this was really Corona and the war are really events that have restricted trade. In the long-run I think it'll be more loose. That's my personal opinion. Would be good for all of us.

Interview Operations Manager – Kuehne + Nagel

Annabel Stöhr

We already had a look at your LinkedIn profile to see what your current job and your current position is. Maybe you can just briefly explain what is your current role at Kühne & Nagel as an operation manager.

Interviewee

As an operation manager, I'm responsible for a warehouse and its whole operations in that case. So, I know that there are different kind of descriptions of this role. For example, support for a small area of the shop floor, but in my case, and including Kühne & Nagel's case, an operations manager is responsible for a warehouse, a so-called dedicated warehouse. So, we are having only one customer and one warehouse. It is a global healthcare industry company. And my responsibility in this warehouse is, on one hand, the responsibility to take over the responsibility for a smooth operation. That depends on inbound, outbound, and also the internal picking packing processes. Additionally, in our case, I am also the person who is responsible if the site lead is not on site. So I'm therefore also responsible for the administration side, we are in our warehouse performing exports to all kinds of countries in every area of the world. So we are shipping to USA, Africa, Australia, China, so globally. And then to get the whole picture also the communication with the customer. The weekly calls with customers regarding action trackers, or current statuses of projects, the weekly call regarding KPIs and the preparation of these KPIs with the team or with the teams, and therefore, internal processes in the operation administration. Additionally, the field of quality and inventory management are also parts which are directly linked to me. So it's kind of Secretary of the warehouse.

Annabel Stöhr

You just mentioned that you're responsible for shipments all over the world. How does like trade regulations or political regulations affect your day-to-day business? Because I can imagine that in China are the trade regulations different from the US. So how do you realize regulations limiting trading in each country?

Interviewee

The good thing is that we are working as a direct hand of our customer, so to say, we are using customer systems in the warehouse, and also when we are shipping shipments all over the world, we represent the customer in the systems and the customer is in this case in German a so called A E O (Authorized Economic Operator), a known exporter. Therefore, the shipments all over the world are a little bit more easy to carry out. Additionally, we are shipping healthcare products. So healthcare products are often not that limited in exports, which is also making it easier. But still, for example, with the Russian regulation, that exist at the moment, all the sanctions from the EU to Russia and the other way around, this is something which is heavily affecting shipments into that direction. And therefore, it is more complicated till impossible to ship something into these countries. Political special situation, which are heavily affecting logistic streams in any way.

Annabel Stöhr

Super interesting. Interesting to see how the Ukraine Russia war is actually impacting everything. Not just the logistics, but in general, economical activities between the countries. You mentioned that you realize that the war affects your operations. In which sense? Is it just not possible to ship there or is it like very highly regulated or extremely expensive.

Interviewee

I strongly guess it is expensive. We are not buying the transportation, this is done by the customer, but it is way more complex or not possible depending on what you're shipping of course. But just when you are looking at the paperwork and the extra attention customs,

or the customs bureau give to this shipment, then you are realizing that the amount of work which needs to be done for these shipments is constantly rising to at least double or three times the needed attention work volume, additional documentation, paper work which is needed to hand over to the transportation company; customs which demand to see for example contracts which give info when a specific sale would have been carried out. And now the shipping is following up on that sale. Shipments are sometimes regulated, if the contract or sale hasn't been done until this and that date, afterwards this can't be shipped anymore. So this is not also speaking from my perspective from our house, but in general feedback which I got from other colleagues and people off the logistics state how low or how this political situations are affecting their logistics operations as well.

Annabel Stöhr

One last question regarding the political aspect? Because I mean, right now, I asked about the Ukraine Russia war. Do you think also having experienced the pandemic and associated trade regulations between that, like cross border trade tightening. Do you think this will develop over the time? So, do you think it will be more complicated or tougher to actually keep up the international trade? Or do you think that trade regulations will be loosened in order to make it easier to enhance international trade?

Interviewee

It strongly depends on the political relationship of countries or regions, for example as this also affects the trade regulations. Because what I would also guess is that it's sometimes a very welcome cause to have for a country to say, why we would like to import from you or we would like to export to you, but the current health situation just doesn't give us the chance to do so. So this is always a possible argument to use in the political relationship. To give a general answer here is quite hard. Since this, is something so strongly dependent on the current political situation. When you would have asked someone a year ago regarding shipping regulations to Russia, for example, they would have said, yeah, it's quite tricky. But still, there's a good political relationship and few months later, there's heavy war and sanctions ongoing. And therefore, this is quite tricky to answer.

Anna Mettler

So kind of linked to the whole trade barriers and what you also said earlier, having a lot of documentation that you need to fill out right now also with Ukraine and Russia war. How does blockchain and like technology play a role in that? Is Kühne & Nagel already into blockchain? What you say like what is the role for that for?

Interviewee

So I know that blockchain is a topic which is currently researched on, I don't know how big the efforts of Kühne are. But what I definitely can tell is that the whole topic of information technology, smart systems, and data quality is becoming more and more needed and useful. And also will be, at least from my perspective, at some point, be something which will differentiate between someone who is able to deliver and who is not able to deliver. So as I'm looking at our system right now, with, we are working with, that is not very advanced, doesn't provide master data of items or the possibility to foresee how big a shipment might become, or how to pack a truck. So that it is correct with all the regulations and that you're planning ahead if you're packing the truck. And if you don't have all this data, but want to or need to keep up with current speed and with the demands of the customer itself, then that gets more and more into the focus. If you're not able to keep up the speed, then at some point, you will reach a border or a line where you won't be able to extend or to get beyond and to fulfill needs which might come up but we just have to say we are just not capable to do so or to fulfill your needs, because we just don't know, because our own data on systems are not able to tell.

Anna Mettler

Where do you see the biggest barrier for that? Do you see it in the implementation of the technology or rather the development of it?

Interviewee

In the implementation of the technology because you need the experts which are not available. But something which is more critical, for example, if you want a dashboard to

steer your warehouse, or you need a dashboard to steer your warehouse, and if you don't have such thing, then you would ask to program it. But in modern companies or huge stock market companies, you will always get the question from IT, but what is the business case? And is it paying off? We would need to take a developer and he will have to develop the dashboard that might need for let's say 40 days, one day 1000 euros or dollar 40,000 euros invest? Are you able to present the business case which is showing that this is a useful investment? And I think that you will have many things which you are not able to present the business case in the first place. Everything in the future is able to advance and to develop further and to become more professional, faster, efficient, and therefore something that you are having which your competitors don't have. So for example, if you don't get master data or a lot of data that you can harvest, then you will never get to the point to experience what it will actually bring to you. For example, I have a friend from my studies, and he's working in a very fast developing up, which is scaling up its operations.

The delivery service Flaschenpost in Münster. When he is telling me about the possibilities that they have, because they are strongly data driven, because they have developers, which are able to quickly develop and advance the technology that they're using, then you kind of get angry, because you see what is possible, when there's attention paid to it. And when you then see a big corporation struggling with it, then you know that this data problem will become bigger at some point or too big at some point to handle. Because, of course, these huge companies don't want to touch their IT infrastructure, because it's so complex at this moment, that if you change something, which is too big to change, or then of course also too big to fail, you might end up in a huge problem. And then on the other hand, as I said before, you have this problem of arguing, which is now to be done first because of course, since this system is so big, you have so many points where you could optimize and perfectionist things which in the end is not able to be done all at once. And then you have to prioritize.

Anna Mettler

I feel like that's a problem a lot of large corporations struggle with, like keeping up with the startups that are now coming into the market and actually just have their business model focused on digitization.

Interviewee

I mean, the thing is that there are startups which are only based on the digital platform or so. But there are of course, also startups, which are actually moving physical goods. But they are still paying a lot of attention to their Digital Development and they know that this is the key factor for the future. And yeah, Blockchain might be something, but this is so complex, and so futuristic. And not a standard, that this is something which I don't think will develop so quickly in the future on a large and wide scale. Because the companies are not even running without Excel 2001 yet.

Anna Mettler

I just wanted to link this again in terms of the digitization, do you see like any threat coming from China, from Asia in that terms, in terms of technology?

Interviewee

I mean, when you were talking about the threat, then you are very quickly at this point of hacker attacks and cyberattacks. I mean, I don't know if it's specifically China. was carrying them out or the bits at the moment, for example, by the Russian influence which is going forward here, but in the last month, I heard more of, of experiences from colleagues or also from my family. My father's colleagues, who is also working in logistics that they are actually either know someone or actively are getting under cyber attacks. And also our current operation is on my job is, at the moment heavily affected by such a cyber attack, not at our warehouse, but at a service provider that we are using, which is not an operational since I think, for a month. And which is also causing us to have longer processes and more efforts to, to help provide certain documents to our customer. Which is simply possible because the service provider found a way around, but isn't a positive or he's not capable to

provide a solution for his current status. And also probably won't be in the near future. And this is a service provider, or service from the federal state of the government. So it's not a private service provider, but a public one. So yeah, from cyber attacks, there is a threat. But if it's that specifically from China, or from Russia, or from whoever it is, it's hard to tell, of course, when you think of who might be able or capable with less resources, then you're kind of quickly at these players. Okay, but there's nothing I can say for sure.

Annabel Stöhr

As we just talked about China. Do you realize increasing trade activities by like the east, so talking about like China or India or Emirates? Do you realize in your day to day business, that these nations are actually booming in trade and that, for example, Chinese brands gained more acceptance?

Interviewee

Since the products shipping from our warehouse are also produced in China and therefore not be so smart to ship it forth and back, I can hardly tell because if there are increasing sales in the Eastern Europe or the East Asian markets, then this isn't something that we would recognize so much. I can't tell from my own experience, but when you are looking at sources, like professional media or economic media, it is often recognized that trade increases with China and is also often criticized. For example, the automotive industry has I think, 40% just Volkswagen of sales volume in China. Therefore, this is something which is in general recognized, but it's not personally recognized by me.

Annabel Stöhr

One last question before going to your main expertise - the operations. Having experienced the pandemic, I think it's clear to say that most companies had a huge inventory backlog. What could you learn from that in order to prevent that for a possible next pandemic? How did you handle the situation? Any lessons learned?

Interviewee

Since we are a healthcare warehouse, we weren't affected in a negative way by the pandemic. As healthcare products were strongly demanded, the work volume in this specific warehouse went through the roof. So we were not even putting away products into the racks anymore, we just received goods and basically just sent them out right away to the customer in need.

Annabel Stöhr

So you didn't have any, struggles receiving goods, because that's what I would have imagined that warehouses were super full with inventory, you couldn't ship them out. You couldn't get any new products due to shipment

Interviewee

True, that is something that we still have until today because we still have the, the aftermath of all this harbor closing and opening all over the world. So for example, in our warehouse, we are shipping out huge systems for hospitals. And these systems are not only manufactured at one place, but they are manufactured all the world. And additional technology comes from other countries in the world where they are manufactured. And at some point, all of these items will be at our warehouse and then our warehouse job is basically to consolidate and then to ship out the whole system to the customer (to a hospital). And then you recognize that when these global supply chains are totally off because there's a lot of volume in the supply chain here but smaller volumes there, so container volumes get shifted, then there are ships waiting in front of harbors and are not getting let in so the containers can't be loaded off or airports are closed therefore the flight can't depart from China to Europe. When all this happens then you recognize that for example one item is missing for a whole installation at a hospital and then this whole stock which is waiting for one item is sitting at the warehouse. Also, and it's not moving out, and therefore your stock increases. But this is something that you don't have any control of because you're just waiting for something to arrive. So, this is something that we experienced quite a lot. And that is something which the warehouse is most often not

prepared for because the warehouse is calculated at some point for a certain volume. And if this volume strongly increases, then you have to make investments or extend to your warehouse at some point or somehow also and use additional equipment in the warehouse to be able to handle all this volume, which wasn't planned before.

Anna Mettler

Looking into the future, from the operations perspective, what needs to happen to stay competitive and prepare for things to come?

Interviewee

Main thing will be to get an idea how to find workers for your operations. We are experiencing how hard it is to find good colleagues and to actually hold them in your company. This is problem at the moment which become a huge problem in the future when you look at the driver market. Companies need to take action through technology (in terms of communication in different languages). Companies will have to put much more effort into leadership. The young generation is much more demanding than the older one. Technology will be something that will be a major competition driver and also something how you can differentiate between companies in markets and who will become top of the market and who won't be. So its technology and people.

People turning into technology is only possible if technology gets way smarter, or if processes become much more standardized which is in logistics often much harder to do. When I am looking at our warehouse and the inbounds we are receiving, the goods are stacked on different types of pallets depending on where they arrive from. If this process doesn't get standardized and also not protected that it somehow can't be interfered with, then technology can't handle the process.

Interview Teamlead Operations Development – Startup

Carlotta Rehrmann

To begin with, could you tell us a bit about your position and how your company is operating?

Interviewee

So I've been with my company for two years now, actually starting as an intern. I just recently changed roles to a chief of staff position. I'm reporting to the three founders of the company. I mostly handle projects and execute projects for the founding team in the operations and finance dimension.

Carlotta Rehrmann

Okay, and what are the tasks you do, just to get a better understanding?

Interviewee

It has two dimensions, first of all, preparation of slides for potential investors and internal communication, and then second of all executing projects.

Carlotta Rehrmann

Looking at how your company operates and what it puts the focus on, how you think it poses a threat to already really established 3PL companies like DHL or FedEx?

Interviewee

The company I am working for basically has two business units. First of all, the traditional freight forwarding business. It's trying to do that a more digitally. And then second of all transport management, which is close to what 4PL companies do. Generally, the logistic industry in the EU is quite fragmented. The top three players that you mentioned, have approximately 5% of the total market share and most of the transportation is driven by the

700,000 plus carriers in Europe with on average, I don't know, six, seven trucks. We are not going to drive DHL out of business, but of course we do want to increase our market share. And in general, I mean, we try to do our business by inquiry. First of all, cutting out middlemen. Second of all, driving the logistic business into the digital age, and third of all trying to also incorporate increasing awareness of sustainable solutions to logistics.

Carlotta Rehrmann

What aspects do you focus on regarding driving logistic companies into the digital age?

Interviewee

So first of all, I think, first of all, it's transparency and visibility. So I mean, as you know, a lot of stuff in logistics is still happening via telephone, Excel sheets, with the decentralized information. So I think the first step to improve this would be creating visibility in terms of where's my truck at moment. If it delays, then what happens to other other transports at the warehouse? So it needs an increase in visibility for example by tracking and tracing automatically. The same is happening in the systemic sustainability dimension. First of all, it's about properly measuring how much specific transports create in emission and then we can take measures to improve this.

Carlotta Rehrmann

What specific technologies are you using to achieve this? Like automation software, blockchain, sensorization?

Interviewee

We don't use blockchain in any way. We don't usually really use sensors, as we don't own any assets. So we don't own the trucks, but we are using someone else's trucks. We do use GPS providers for tracking purposes. And we use internet algorithms, for example, to find suitable carriers. We use historical data and don't just write 1000 carriers if you have a load, but check whether there is any previous information in our system. We do have a carrier finding algorithm and we have a pricing algorithm for which we have a front end application in E-commerce. You need to provide some parameters and then you get the

price immediately. Whereas 10 years ago, it was industry standard to call someone and then two days later, you'll get a prize. So for this, we leverage technology. But I think blockchain for us is a bit too early.

Carlotta Rehrmann

During our research we also experienced that companies are reluctant to new technologies and the industry is missing pioneers. But what do you the competitive landscape will look like in about 10 years? Do you think the implementation will remain this low and the market will stay fragmented or more consolidated?

Interviewee

I think it will be more consolidated. I don't know by how much, but in the past there were already a couple of other digital freight forwarders coming up in Europe and only a handful of them survived. I also think with the traditional freight forwarders, there is a little bit of consolidation happening. So yes, I do think it will be more consolidated. But I don't think that it will be the same as in for example the search engine market.

Carlotta Rehrmann

If you look at how the market might develop, what changes will be the most relevant in the industry? Apart from digitalisation.

Interviewee

I mean, at some point, there's going to be autonomous trucking. So first of all, autonomous trucks on the highway, and then maybe at some point, also from the highway to the warehouse. I think it's quite speculative. I mean, I have no clue about when this is going to happen. But listening to people with more expertise, I do think they're going to come at some point. And this has, of course, high implications, because one of the challenges right now is also a shortage of drivers, which even got worsened by the Ukraine war, as there were quite a lot of drivers coming from Ukraine. I think it's going to be interesting, first of all, during the next 10 years, or until we have autonomous trucking, what's going to happen regarding capacity shortage. And then also, at some point, if we have autonomous trucks,

that's going to be a huge potential for the logistics industry in general. Ultimately, we need to anticipate what we want to do to address capacity shortage. We have a broad network of companies that we're working with trying to consolidate this capacity and to sell it to huge clients so that they don't have to work with 100 plus individual carrier companies.

Carlotta Rehrmann

And what do you think regarding other trends like energy sources or sustainability. How will they play a role in the next 10 years?

Interviewee

I think, it's quite difficult to estimate. But what we do see, for example, that large companies tell us that they're taking sustainability solutions into account. So for example, we also try to offer intermodal solutions, where you have some ratio of the transportation happening on the road, but also on the rail. We also have an increasing number of companies that are asking us for emissions reports. Right now it's still only starting and not very organised. Some companies ask for that and some companies ask for different info. So during the next 10 years, that's definitely going to be increasing and could be a competitive advantage of someone else.

Carlotta Rehrmann

What do you think is going to be the most challenging for the logistics industry in the next 10 years? Do you see any developments right now that will be tough to overcome?

Interviewee

As already mentioned driver shortages, for sure. And then increasing fuel prices. We also do see some sort of economic downturn happening. While we still have increased fuel prices. So this could be also one potential reason for further consolidation. Small companies might not be equipped to handle this. And then long term again, autonomous trucking and sustainability.

Carlotta Rehrmann

What do you think is most uncertain in the industry at the moment? This could be geopolitical, technological, sustainable. Do you expect any shocks in that sense?

Interviewee

In the short-term it might mostly be due to political and economic things that could highly impact transportation business. So I don't know if demand is rapidly going down. That's, of course, difficult to handle because then we don't have any revenues left. At the same time, we have increased costs by carriers because there is a couple of capacities shortage plus their cost in terms of fuel going to go up. And then, long term the main trends are going to be, as I said, sustainability and some sort of alternative autonomous trucking. I'm not sure whether we or other companies have understood what this means for our business model. What does it mean for trucking companies? How do they adapt and change? Do they want to engage more into logistic operations instead of simply providing the assets. And what does that mean for freight forwarders? What does it mean for small carrier companies? So I think autonomous trucks will change how business model are constructed, but I don't think that the industry has figured out it all out yet.

Carlotta Rehrmann

Do you actually do some kind of industry forecasting in your company? To anticipate what will happen do you orient yourself towards trends and trend radars?

Interviewee

I think it's not institutionalized at our company and we're still relatively young, we have a couple of key people with logistics expertise. We are at some conferences, we talk to experts, but we are not. We don't have a department called "The Future of logistics" where we have experts researching industry trends. I think we're just too small for that.

Carlotta Rehrmann

Do you then use trend radars created by bigger companies like DHL?

Interviewee

Probably, yes. I mean, we do our research in terms of talking to experts, reading papers from I don't know McKinsey and DHL, but we're not specifically looking into what a huge competitor of us is doing. So I think it's more broad research and less oriented towards the top three players in the logistics market.

Carlotta Rehrmann

You previously said demand is going down. We talked to some people who said that especially during Corona demand actually went up for logistics companies. Is demand generally going down for you or simply compared to the last years and Corona?

Interviewee

I think it's quite differentiated. So within Germany I was talking about Q3 and Q4 of 2022, compared to previous years. In Germany, it was quite stable regarding cross border business. So Germany, Italy, France, Spain, is way below the levels of last year and the year before. And now, with the overall economic development demand is going down. For sure, there'll be an increase during Christmas in Q4, but even this is going to be less than last year's. And then I think there's quite some uncertainty regarding Q1 in 2023. And I think this could even be below of the limits of right now.

Carlotta Rehrmann

What do you consider to be the main reasons for it?

Interviewee

I think this is just overall market environment. Rising interest rates, inflation, which means end consumers are going to consume less and that will also affect the transportation of goods.

Carlotta Rehrmann

And how do you think the current energy situation will influence that described development?

Interviewee

We implemented a diesel floater or fuel floater in Q1 of this year. And you see that this has quite an impact on the transport type, transportation price and puts an additional 10% or 20% on the transportation price. And just because the base price. So if rates are negotiated in 2020 and if you consider that fuel prices of a carrier, so a real truck, it's approximately 30%, then this has a high impact on the transportation price.

Carlotta Rehrmann

How does that work exactly with the diesel floater?

Interviewee

It is quite complex. And it's unfortunately, as often in logistics not very standardized. There are a lot of different fuel indices, on the market, and every company is using their own. But in general, it goes like this: You have a base period, let's say, January 2020, where we negotiated a transport price with everything included, including fuel, and let's say it's 1000 Euros. And then two and a half years later in June 2022, the full price increase by 50%. And if we say that the full costs of a carrier are approximately, 25% of overall carrier costs, then this means that we would include this price increase in the transportation price. This is not increasing profit of us, because at the same time the carrier's going to us as saying they have increased fuel prices. So eventually no one is benefiting from fuel floaters because the customer pays us a higher price and we pay the carrier the higher price and the carriers has higher costs. So it's a zero sum game in the end and it doesn't have any effect on the gross profit so in the end it's only additional complexity and administration

Carlotta Rehrmann

So fuel prices are also increasing due to the current war in Ukraine, as geopolitical instability actually impacts your current business. Are there any other geopolitical and geoeconomic events that impact your operations?

Interviewee

There was a mobility package in the EU in 2022, which had an effect. I think the number of loads that someone is allowed to do within a foreign country or in Germany. So this had an additional impact on the capacity. So I think they're since logistics is a cross border business, it's highly impacted by geopolitical decisions.

Carlotta Rehrmann

Are you exclusively operating in the EU

Interviewee

Yes, 99% of our operations are in the EU.

Carlotta Rehrmann

Did you choose the EU because of its trade regulations and stable political environment?

Interviewee

I think in contrast to say air freight or sea freight, road freight has natural borders, within continents. So if we would decide to expand to Asia, there would very limited synergies between our businesses. So because we are Berlin based startup, we started in Europe. And also I think there's huge potential, and economic ties are quite strong in the EU. That's the reason why we are not going to just expand very quickly to another market, because it would basically be like opening another new business.

Carlotta Rehrmann

Okay, you actually answered all our questions. Do you have anything else that you want to add that I didn't ask but you consider really important for the future of the logistics industry?

Interviewee

I don't think so. For me the most surprising thing working in logistics was the high degree of transparency. So I could assume that it's actually quite hard writing a master thesis about this, because it's really difficult. There's no centralized source of truth.

Carlotta Rehrmann

Yes it was quite tough to understand the difference between 3PL and 4PL contract logistics. Like how do they relate?

Interviewee

I can completely relate. I think it's quite tough. Also I actually want to add something regarding contract and spot business. You have two types of demand. You either have a tender, like for example Coca Cola asking for someone to drive 10 loads per week, for the next 18 months. Or you have spot ad hoc demand, when a customer needs one load in three days, and they ask for immediate capacity. Because of the rising prices, companies are less willing to do 18 month tenders because of the high level of pricing at the moment and they were hoping for the reduced price we had in the past. So we saw that our spot business or the share of the spot business has highly increased.

Carlotta Rehrmann

Is that an industry wide trend?

Interviewee

I would assume it would be in general because customer in general aren't willing to do tender business. We are expecting a lot of delayed tenders in Q2. But basically Q2 also

didn't have a lot of tenders because of the ongoing high prices. I think probably Q2 was the best spot quarter that we've had in terms of revenue and gross profit.

Carlotta Rehrmann

And is it beneficial for you to have more spot business?

Interviewee

Not generally. In Q2, yes, because also the gross profit was quite good. But in general spot means more bureaucracy. If we have a tender, we can have fixed carriers, which always arrive on a specific day and do a specific tour. If we have a spot business, that means that we have to find a new carrier on a more frequent basis. But in the end, it's a matter of the price. If the gross profit is high enough, it might also be worth finding a new carrier every single time. So overall I think it's just two different ways of doing business. I don't think that one is better than the other.

Carlotta Rehrmann

But you would need more transparency about your operations, like the availability of trucks, drivers and so on for spot business, because it is ad hoc demand and you need to react with flexibility.

Interviewee

Yes, that's true.

Carlotta Rehrmann

Do you think spot business will increase in the future?

Interviewee

I think in general, it's easier for everyone to do tenders, because it's more plentiful. At the same time, if no one is willing to pay the price that we have right now, then tenders are not going to be at the level of before.

Carlotta Rehrmann

Because if you do that option, like your clients are obligated to stay with a fixed price for like six months, right? So if the fuel price goes down, they are stuck with the high prices for six months.

Interviewee

Yes that is the situation right now.

Carlotta Rehrmann

Thank you, that was actually everything we wanted to ask you. Thanks for taking the time and giving us so many insights!

Interview Vice-Chairman – The Global Research Network Belt and Road Initiative

Annabel Stöhr

Hey Ana, thank you very much for taking the time. To start, can you give a short overview of what you're currently researching on and what you are mainly interested in, in the shipping industry?

Interviewee

My name is Ana Casaca. I have seven years of shipping industry experience. As I went through logistics, I did my PhD in sourcing shipping so that we could integrate the transport mode started shipping as part of transport chains because of the policy in force of the European Union, so we need the model shift because of the environmental issues and these dates from 1992. When they released the green communication, the impact of transport and the environment just before signing the Treaty of Maastricht. So, they had to agree on a common transport policy which was released in November. And there had to be a common ground so that they could promote environmental transport. So, they focus on this shift from roads to sea or more precise from roads to environmentally friendly modes of transport when we are considering sea, rail and inland waterways. So, that was the policy based on that. And because the issue of shipping was new, I decided to study shorter shipping. And then during my PhD, I released a number of papers on that issue. Then after that, I drifted a little bit, although I remained focused because I do evaluations for the European Commission for transport research proposals and transport infrastructure proposals started with Marco Polo, then transit networks and now is connecting European facility. So meaning that I contribute in the development of the transport corridors that bring countries together. I say transport level because the corridors, they involve energy and communications. That's the three levels. And then I moved away a little bit, started delivering some medication, some training on distribution channels, and traditional

logistics, which was good at the end. Because for you to understand the shipping industry, how it works, sometimes you need to go back to fundamentals and the fundamental starts with marketing and the first pillar of marketing which is the place, which has to do with distribution. So by going further upstream the industry, my focus is to bring all that knowledge into the concept of maritime logistics. Many people think that maritime Logistics is ports, but it is not. It's a broad area yet to be explored. It brings a lot of things into it and what I'm doing now, I'm finalizing a research report. I accompany the maritime education and training during COVID 19 pandemic and assessments. Currently, we are working on a survey. And, you know, sometimes the research doesn't come out within the timeframes that we want. We are finalizing the report so that we can maybe release on Friday. And also, I'm doing my corrections, so there is some bureaucracy, with it, because I'm registering the document with the SPN. And I'm preparing some training to deliver next year. Also, I engaged in consultant teaching for Metropolitan College in Greece, a lot of things going on.

Annabel Stöhr

From your introduction, I have two questions. At the very beginning, you mentioned the environmental issues within the EU on transportation and logistics. What were the major changes which had to be done in order to comply with those new policies?

Interviewee

The first thing is that shippers they need to change their mentality. The thing is that when it comes to transport, when you see logistics, you cannot see logistics individually as warehouse or transport mode or the chain of modes or whatever. You need to see the overall cost of the logistics chain. So, we need to bring in the inventory the cost of the warehousing, and when we bring it into transport, like ships or aircrafts, I mean, which we require the use of interfaces. So we're talking about a broken logistics chains because we need we need an interface capable of accommodating the cargo that is delivered from the ship and the ship at the end, the cargo that the ship is going to pick it up. It's like a buffer. And with road transport, although it exists through cross docking operations, it is not feasible because

you can pick up a cargo on a full cargo truck and deliver it to the end because there's the flexibility, right, although there are restrictions in terms of driving and so on and so forth. But it is one chain, which does not happen either with air rail and inland waterways and shipping. I mean, there is this issue of a broken chain. And one of the issues that I've realized throughout the years is that as the cargo, as quite often the owners of the cargo, they don't ship the cargo themselves, they use third parties. So it is a third party decision making. The third parties that make the decision-making process and tell the shipper whatever mode they're going to use.

Annabel Stöhr

So it's not the company itself choosing the mode of transportation?

Interviewee

No, unless the company says so specifically. If we're talking about small medium carrier and medium shippers, I mean, you just deliver the cargo to the intermediaries, freight forwarders, the third-party logistics, the fourth party, the big logistic operators, that then will deal with the companies. Unless you are a big company like Ikea or Walmart, those are the big shippers like those companies, then they will deal directly with the shipping companies, right and they will take care of the logistics. But if you are a small owner of a shoemaker, you probably will go to a freight forwarder to deal with the booking and all the logistics operation so in the end depending on the destination of the cargo and origin destination, the freight forwarder might suggest the mode of transport that the shipper will accept. So I mean, there is this mentality of shippers that must be changed. And the other issue is that over the years, increasing vessel size has allowed a decrease of transport costs. So they always want cheaper transport costs, which cannot be possible because we are coming to a point that the pressure on the shipping industry is so high that you are going to be forced to use alternative fuels, but the cost of alternative fuels, it's a nightmare. So the manufacturing industry prepared to pay the price because at the end of the day, we'll come to the end consumers. But the thing is that it has already been shown that the increase in the price of goods, which the manufacturing industry claims, that will be very high, it's

not representative, because if you think of a container ship with multiple containers, and then if you can think about the number of shoe boxes that goes into it, you know, it's a huge increase per container, increase in costs or increase in freight for shipping that container, it is a ridiculous amount of money. But the thing is that the shippers must change the mentality and be prepared to pay a higher price. And not claim so much saying that the cost of shipping is that expensive, because something must be done. And that is within the scope that is transport corridors, which has been on the back of the EU for some time now. Because if you compare the policy at the European level, we are well advanced than other regions of the world. The issue of green corridors as they are trying to implement from Far East Asia to Europe, I don't know if there is another one to the United States, but it has to promote a shift in mentality. The shipping industry often is the bad guy, but in fact it is a shipper certainly to change the mentality and be prepared to pay more.

Annabel Stöhr

Would you say that there was a trend detected over the last years that shipping got more expensive?

Interviewee

Shipping is a very particular industry because it depends on the market. You basically have two markets to have the Tramp market which deals with the bulk cargoes, and you have a liner market which deals with containers to put it simply. Then we have another number of markets and the tramp market where you carry the commodities like iron or grain they simply work on function of demand and supply. It's a very competitive market. Very pure competitive market in the sense that it's the law of demand and supply if there is too much demand, freight rates increase if there is low demand freight rates will decrease because if the capacity does not change, then there's the power of negotiation goes from the side of the shippers to the side cargos.

Interviewee

The bulk carrier market was affected, but in the bulk carrying market, you could see that the shippers could get some benefit from the trade of iron and coal to China because of port

congestion. If you have a stable demand, and the stable supply, but if you have a factor coming in like the one of Port congestion that we've witnessed in China because of the zero COVID-19 policy, what happens is that you have a tight capacity which is not being used. So capacity in the market decreases as the capacity decreases, then if the demand stays the same, the factories are going crazy, so this is a playing field where there are all these factors coming into it. And while versus the bulk market has benefited from it. The tanker market decreased, because everybody was staying at home, there was no need to spend money on gas and diesel. So I mean, there was weekly demand levels very limited. So no employment for the tankers. So I mean, that are the principles of the tramp market. Now, if you come to liner market where you've got containers, basically, what happens is that you need to have a structure built in, that is fixed to support the operations because it happens. Its like a bus, as bus goes from one stop to the other. So ships call one port after the other according to a rotation that they defined. And that has a cost. Now, what happened with the pandemic, because of the sudden rise in demand, there was this sudden exponential increase in fare rates. And because this was caused by the United States consumers, what happened is that there was this big US imports, because they were not able to accommodate the increase in demand. And they have some logistics problems with infrastructures, meaning that a lot of container capacity was tight, while in port congestion, and the rate went on increasing. Plus, there was another issue which was at the beginning of the pandemic, no one knew what's going to happen. With containers there is this cycle of container life, the container lifecycle. And then suddenly, there were a lot of empty containers, located in Europe, in the wrong place so that when the demand started from the United States, Asia was lacking empty containers. And then in the middle of it, I don't know if you recall, we had a blockage of the Suez Canal. So if you bring all these factors in obliging water some vessels reroute because we never know how long the vessel would be stuck there. And this even sort of maybe we have to take out some containers to relieve the vessel or if the vessel could break because of the weight.

Anna Mettler

Do you see any new players in the shipping market? Would you say there are some that are rather focused on the sustainability sector that you've been talking about or just focus on your business model on a rather like technological approach?

Interviewee

The market for shipping companies is well established. Competing with for example Maersk or CMS or Hapag Lloyd or Costco or whatever, if I'm not wrong, they cover more than 40%. So the market is an oligopoly. Then if we consider the biggest 10 companies or the 10 most used shipping companies, the most important in terms of capacity. I think that they cover up more than 60%. So I mean, for you to go into this market as it is now. I think it's very difficult. Probably someone crazy would come in and start buying the small players and then go into M&A. But to do that it requires a lot of money.

Anna Mettler

Do you see that happening from China's side? That they are going into that market?

Interviewee

They've already got their shipping company the Cosco, so no. And not as the market is now, because the market is coming down, the rates are coming down for containers, which is why it is now a good time to buy vessels, because we need to buy container ships when the vessel market is low. But I think that market conditions will be so deteriorating that no one is going into it. What the big companies are doing, like Maersk, they are getting involved in the landside operations and in air freight. Okay, and all of them they now have air cargo companies. The most reluctant in this strategy has been MSC. It has been the last one to get involved in logistics, now is getting involved also in cargo operations. But because they wanted to keep the core business as shipping, but it is the way to go. I mean, they will have to integrate all the transport modes.

Annabel Stöhr

Do you think that shipping by sea is the main transportation also the future? Or do you think that this will change?

Interviewee

There's no way to accommodate the volume of cargo being carried. We have 80% of the cargo being carried by sea. So, the remaining 20% of world cargo is carried by roads, rail and air. And now the amount of cargo being carried by air decreased, because what happened with the pandemic is that because no one could travel, all the fleets were on the ground and they refurbished some of the airplanes from passenger into cargo and because there was this demand for air cargo for medical material and then to form the movement of equipment from Asia to Europe or to the United States because of the port congestion issue. But these days as the port congestion is diminishing and is almost gone, there is no need for demand air freight which is more expensive.

Annabel Stöhr

You mentioned that transport corridors, which obviously connect multiple geographic locations, I was wondering, what do you think are the main external disruptions from a political side? So do you realize any political instability happening, for example, the Russia Ukraine war? How do you realize these political instabilities on the transport corridors are on trading in general?

Interviewee

One of the impacts that the war of Ukraine had on transport was the stopping of the trains coming from Asia to Poland and to Germany. Maersk started during the COVID pandemic, some cargo trains directly from China, I think that they take about 33 days if I'm not wrong, and this will be something developed under the Belt and Road Initiative. But with the war. And when I say it's with the sanctions that have been imposed on Russia. Of course, that's the transport by rail probably stopped. And they're not because they don't know what could

happen. In terms of transport, it effected in beginning the train cargo sector. As Ukraine is the granary of the world. And so slowly grain is coming out, we're talking about production of 50 million tons of grain. So, it was good that they could come to an agreement, because it is going to feed the world. And, of course, it is the demand for transport modes for the Tramp market. For the container market, they don't have much impact. But in one way or the other, the fact that it is a war and its close to Europe, and that we have to support because at the end of the day, we are supporting Ukraine with military equipment. It means that the money goes to other areas and with us having to look for other crude from other sources, meaning that we have to pay higher for the transport after sources and then we are witnessing any inflation, rising prices. Not only here, but overall because impact is less now in the United States than in Europe. But I don't think that this will go down until the war stops.

Annabel Stöhr

When looking at your maritime training, you mentioned that you also conduct technical translations. What is the current and main technology used in the maritime logistics and what do you think will be further developments in the technology in order to make the maritime logistics more efficient?

Interviewee

Okay, because the industry is facing the impact of climate, the industry is facing an external pressure in order to reduce the carbon emissions into the atmosphere. So, the immediate way to do it is either reduce the speed of the vessels or try to automatize the operations. In the sense there are a number of companies that have emerged developing software, so that they can automatize their speed, their function of the sensors that release the data, and they can automatize the speed of the vessel and the consumption and to put the vessels operating on a just in time basis, which was something that the industry was not used to. Sometimes, or not often, always, contractual arrangements, at least in the bulk market, they determine just that the vessels fulfill with a certain speed. Okay? Now, that concept is a little bit changing, because if, if the verse is being occupied, and if the vessels arrive earlier, there's

no need to increase the speed of the vessel. So there's this just in time concept being applied to the, to the industry, meaning that the shipping companies can address the vessel speed, so and reduce it, so that it doesn't have to anchor when it arrives. No need to stay there by reducing the speed and reduce the amount of carbon into the atmosphere. Now the other issue, you can add some equipment on board to wash the gases before releasing them into the atmosphere, we call that equipment scrubbers. And but then it costs about four, 4 million to have a scrubber install onboard. And that decision depends on the age in which the vessel is and the state of the market, because it means that you need to take out the vessel from operations and have it in in a shipyard to be dry-docked and to carry out that work. And it also depends on having the shipyard available to do that.

So I mean, things are not so straightforward as you can imagine. I was telling the other day to someone that ship is not a car and sea is not a highway. So the business it's not complicated, but the number of issues that we need to take into account we cannot just do it like this and then everything comes out immediately. Now, there is this issue of slow steaming some companies are developing software's to accommodate with that. Now the next issue is to find out an alternative fuel, although some analysts saying that it will be not only one alternative fuel, but it will be several. Because if you're going to need to be out biodiesel and things like that, it means that you are taking using, how can I say, using plants and things to produce biodiesel, which can be used to feed of people and then you have to knock down the forest. So I mean, there is an issue at the end of the day, probably if you get the old crude oil, it will be easier; at least they will have carbon storage units on board so that it can recover all that carbon, but then again, you will need assure units to discharge that carbon, that you're retaining on board into the into the shore side, and then you have to decide what to do with that carbon. So there are a number of logistics issues.

And the other issue is that the countries which produce green hydrogen or green ammonia are not the countries in which the demand for fuel exists. We're talking about Morocco, we're talking about South Africa, talking about Chile, meaning that you have to create supply chains to bring that fuel to the points of consumption. So, I mean, then you have to find out the engines to put the engine to work on the two, three city bases. Now they are

coming out, dual-fuels for methanol and LNG. But probably they need to bring another third fuel into the system, so that they can guarantee that vessels have supply of bunkers all over the green corridors.

Okay, so the things are not very easy. It needs a lot of investment from shipping companies. And our regulatory institution, which is International Maritime Organization, works very slowly. So I came to know that the ballast water convention took 40 years, for an agreement to be reached.

Annabel Stöhr

So they need some autonomous working?

Interviewee

We need some. There's this pressure, we need some more speedy regulatory approach because in the end, countries must stop thinking about a valley and must look into what is happening to the world because if they don't, no one will survive.

Annabel Stöhr

Maybe one last question. Do you think that in the future, the regulations implied by the governments will become stricter in order to make trade more difficult? Or do you think that trade will become easier because there are no restrictions on international shipping?

Interviewee

I mean, if you go back with putting restrictions, then we will go against the World Trade Organization efforts and guts and guts and water organization work that has been carried out all these years really if the tariffs and the quotas and everything because they are promoting free trade. Now the only thing that we need to do is we need to create the conditions and think about the future and implement the measures that we need. But the thing is that in the case of the shipping industry, we're talking about 80,000 ships. So changing 80,000 ships, a fleet of 80,000 ships, it's difficult. And then bringing in, if you think about that we have been using fossil fuels as bunkers. Then we have a network of

fossil fuels of bunkering systems all over the world, to supply those 80,000 ships. Now think about that, suddenly, you have to change all those sub-bunkering supplies to alternative fuels. We don't even know which one will work.

Annabel Stöhr

That's the question. How will this develop?

Interviewee

The million dollar question I would like to know. So the next few years on logistics, while streamlining operations and having supply chains more resilient or responsive to external factors, we need to sort out the technology issue and that it will take a little bit more time than we expect. And then, you know, for instance, European Union because of the lack of activity from the International Maritime Organization, has included shipping industry into the European trading scheme for carbon emissions. Now, we are the most advanced system in the world in that sense, and which will create a mess, no, because that will have an impact on the world fleet. And the thing is that it has been created because the IMO, which is the regulatory body has been very passive about it. And then there is the issue, which who will pay for all this research and development. So a fund that needs to be created. And several attempts have been made to do it. But at the end of the day, some countries are against because for instance, there's China and India are two of the countries against it saying that if you have the possibility of getting into a development stage, why can't we as well.

Interviewee

So the thing is, if there is this selfish attitude from certain states, which needs to be changed. Okay, so that's it. I mean, some countries need to address hinterland capacity, which is the case of the United States. At the end of the day, we need to change our behaviour. Yeah, maybe nearshoring, some reshoring.

Annabel Stöhr

Maybe one last question, because you just mentioned that you're going over like a paper about COVID.

Interviewee

Maritime training, maritime education and training during COVID.

Annabel Stöhr

What is the main, the main statement or like the main takeaway from that? Like, which influences COVID had on... I mean, there are some obvious reasons or obvious points, which influences COVID had on the logistics, but maybe one most surprising outcome.

Interviewee

I mean, the paper is dedicated to the way the training was carried out during COVID.

Annabel Stöhr

So it wasn't all research, it was like how the training was done?

Interviewee

No, it was how educators approach the seven shifts, because if you go to economics, or marketing or probably other education sectors, a lot is being done. electronically, processing, you have all these platforms like Moodle, and then you have all these courses online, which are non-credit, of course, but you have a lot of this information, and there are some changes taking place. But in the case of maritime, we need some practical work. It is not only theoretical, we need some workshops. And you need all these simulators for training manoeuvrability. And the thing is that suddenly, what happens is that because it is a very traditional approach face to face, suddenly all the lecturers had to move into a remote environment. And some of them have been doing everything delivering online classes for some time, others didn't. So what I'm sensing is how they felt and their use of the technologies like Kahoot, like Moodle, you know, like those learning platforms, the zoom, a Cisco WebEx and all these technologies, which were dormant, and we didn't have to think about them. I mean, even the students, one of the courses that I read is that you can be

technical, you are very digital. But when it comes to working with the technologies, you know, like the computers, there was some difficulty from your side.

Annabel Stöhr

Yeah, definitely. I mean, yes, it is a different learning experience, and it's definitely not the same and especially in fields where it's very urgent to have the physical contact, like maritime training. Yeah, it's just not the same.

Interviewee

So there are some issues that development of maritime education training policies, the need to put in place those policies, it is not just designing the case of human resources, and even the students acceptance from this type of training. That's our main conclusions. So in broad terms it is.

Annabel Stöhr

Thank you so much Ana for your insights. It was very interesting to hear from like a real person and not from any research paper. So thank you. And maybe if I have some questions for my individual part, I will text you again on LinkedIn if that's fine for you.

Interview Consultant - DHL Consulting

Elisa Nunes

As a first question, what do you think are the major forces shaping the logistics industry within the next 10 years?

Interviewee

Okay, so what I can tell you about is what we are focused more on HR consulting. We have for the for 2025, four core topics, which are future of work, future operations, data analytics, and sustainability. So future work, it's basically transforming the organization, not necessarily logistics focused, but to create processes which are more lean, more flexible, more diverse, so to also help recruit digital talent. A lot of projects, as well related with health and wellbeing. So these are some of the things that are affecting DHL the most, and that it's one of our main focus topics, then the other one is future operations. So I think this one is more self explanatory. This is everything that has to do with automation, robotics, how can we make our processes more efficient? How can we make them more automated? How can we incorporate data analytics? Yeah, so a lot of data usage in HR is focusing a lot on that. So we've hired a lot of data scientists recently for example. Then sustainability: I think this one is maybe the easiest one to understand. Anything sustainability related, and it can be directly, like fuel or electric vehicles, but it can also be creating networks to make the distribution more optimized.

Elisa Nunes

So these are the four major forces that at least DHL is trying to implement in the next 10 years. Do you think those are the four challenges too or do you think there is more on that, like a shortage a skilled workforce. Is DHL impacted by that right now?

Interviewee

Yeah, so especially right now, for example, for this season. We're missing about I don't know 5000 People, because it's especially from now beginning in October until December, which I guess you can imagine it's Black Friday and Christmas, everything its peak season. So for this period, DHL is like in desperate need of a lot of people. But even throughout the year, like labour shortages is something quite common, I would say unfortunately. So these are a little bit focused on the problems but also gives future outlooks. So for example, sustainability or future of work are currently the problems, but together with operations and data analytics, they're also strategic in looking forward.

Elisa Nunes

Would you say that the focus on digitalization and an adoption of your company to the industry dynamic are essential towards a good future? Like digitalization and automation. Do you think all of that is being adopted by a company and is it essential to the future?

Interviewee

Yeah, absolutely. So, as I've said, one of the topics is precisely that its future of operations. It's all that has to do with automation, AI, robotics, all of those things. It's one of the major focus topics. And DHL itself, they have like innovation centres, where not only they partner with a lot of companies to develop things, but also are driving it in developing themselves. So they have all this sort of cool things like robots that pick up boxes. Definitely one of the major things and I would say on both sides. So technology, yes. But also softwares for automation for warehouse management systems. All of this is a very, very big topic right now.

Elisa Nunes

And in this topic of technology, do you think blockchain will be implemented by DHL in the near future?

Interviewee

I know that DHL is doing something, but I'm not really sure what's the current status. So I know what it has to do with transparency. But I haven't worked directly on that topic yet. Okay. So I'm not sure.

Elisa Nunes

Moving on, what do you think, are the biggest uncertainties for the sector?

Interviewee

So I think the Sector is relatively exposed to external events. So I don't know, China, trade wars, Russia invading Ukraine, like, all those things have an impact. And it's, that's the biggest uncertainty, because it's 100% out of DHL's control. So that would be one, which has some impact, but also, usually it's manageable, the impact that it has, but it's it obviously affects everything. Also, another which I think a lot of our strategy relies on, especially for sustainability, is technology revolution. And if there's no more efficient fuels, if electric vehicles are not efficient enough, they cannot be used in our operations. Our business is moving stuff from point A to B, obviously, a lot more than this. But the business will have to continue, nonetheless. And for example, achieving our sustainability targets is depending a lot also on those factors.

Elisa Nunes

Do you know any new technologies DHL is implementing? For example, drones?

Interviewee

Yeah, I think all the very famous ones. Obviously, drones is something that's being developed. Our self-driving cars as well. Electric vehicles, a lot of E fuel and sustainable fuel, from biomass and all those things already being used. Also, something that is being done right now. But yeah, this goes a little bit to the point of technology development. DHL has one electric plane, starting to being tested right now. But there's already around 15, or something ordered for the next two years. But currently, it's not very efficient. So, it can

be used for short trips between hubs, for example, and it works. But it's something that's being developed. And it means that if we're having 15 in the next two years, maybe in the next 10 years, which is your timeframe, the number will be much higher. Yeah, so that's something.

Elisa Nunes

About the war that you mentioned before. How has the Ukraine Russian war impacted you so far? Do you have any perception of that?

Interviewee

Yes, so that's one of the hottest topics when we joined. We discussed it quite a little bit. Contrary to what should be intuitive, it hasn't affected that much. So obviously, fuel prices have gone up, that has an impact on the business, because DHL spends a lot of fuel. But the fact is that we can pass that price on to the customer, actually. So while it has increased our fuel costs, for let's say, 80% of the cases, that cost is passed on to the customer. So then in the end, the business itself is not affected, at least directly because of that. The affects on the customer result in less buying power, hindering them to order many things, then it will generate indirect effects on us. But directly, not so much. Not sure if you know the concept of open book and closed book. I will explain it shortly: If it's an open book account, then you list your costs, you put a margin on that, and the customer pays that price. So if your costs increase, your margin stays the same, like the money you're making stays the same, because then it's just more expensive to the customer.

Elisa Nunes

How are consumers reacting to that? Like, have you lost any major clients?

Interviewee

Not to my understanding? Because like in terms of Russia or Ukraine business, I don't think it was very relevant before the war anyway. So, there were no major losses. And in terms of the others, like the impact that it has, is that it gets more expensive for them, but they still need to ship things.

Elisa Nunes

What is the most used mode of transportation?

Interviewee

Trucks! So, we have everything, but trucks is the main one. It also depends a lot on which stage of the supply chain you are. So, if it's last mile, then it's mostly smaller trucks or even bicycles.

Elisa Nunes

Moving on more to a competitive landscape. Do you think that start-ups pose high threats to companies like DHL?

Interviewee

I think they have an impact. But from what I've seen so far, their impact is not necessarily that much on a competitive level that they're posing too big of a threat. But more pressing you to also develop new things. So, because start-ups from the ones that I've seen so far is mostly classified business. It means that they don't own the trucks, they don't own things. What they do is a lot of software, for example. So warehousing management systems are platforms that connect companies that have the trucks to people that need transportation services, which obviously impacts DHL because that's a business that we're also in. But that's it. That's the business we are also in we are also in a lot of different things that they don't have. I think if there's a start-up that now has an incredible warehousing management software, it may affect us a little bit, but it will push DHL to develop its own. And historically, DHL has been built on acquisitions, which also has its problems. But yeah, that's a whole other topic, but I expect that it will continue like this. So, one of our biggest projects right now is an M&A integration from a company that was bought earlier this year. I think it will probably continue to happen a lot.

Interviewee

I think in this business that also happens a lot even with all the other UPS or FedEx. So, we make money in mass, we transport a lot, and our advantage is that we have one of the biggest transport networks. A Start-up does one small part of that process, which is good. I don't think that it can compete on a very deep level with one of the big players.

Elisa Nunes

Do you think regarding major players, the market focuses on forming alliances, becoming more consolidated or is more like you will play really against each other. And there is no cooperation between the players?

Interviewee

I think there is some degree of cooperation. For example, one tool that we have now is called DG Hall. That's done in cooperation with another logistics company, I don't remember who it is right now. But that's an example of cooperation. Also, our supply chain in business in China, I think, two years ago, or something like that. It was also kind of merged incorporation with a Chinese company. So, I think it's not a very fragmented market. And companies don't tend to cooperate to compete on that aggressive way that they would in a fragmented.

Elisa Nunes

How important would you rate the availability of alternative energy sources for the industry?

Interviewee

I think very. We need to transport stuff, we need to put airplanes in the sky, we need to ship boats from one continent to the other. We need to use fuel, for example. And if there is sustainable fuel available, that's the main priority right now and DHL is really, really focused on sustainability. So that will be the main priority, but otherwise, it still needs to happen, right? So, if there's electric vehicles available, if they're sustainable fuel, anything

from scooters to trucks? Anything that can be used with alternative energy sources, DHL is trying to pursue it, if it's available.

Elisa Nunes

Are you partnering with any green energy companies? Do you finance there? Do you give them investments to pursue more alternative energy resources for you? Or do you just buy from the already existing market?

Interviewee

Yeah, I think there is some level of partnership, you can also search online. You can search for glow green, which is our sustainable and green side of the business.

Elisa Nunes

I have a question regarding technology. What do you think? How interconnected will the technology be in the future? So, meaning between different countries and also between different companies, technology facilitates that connectivity and transparency, right? How interconnected do you think will it be in the next 10 years.

Interviewee

Yeah, I think that's a big topic right now. It's something we're working on a lot. It is connecting our systems, with the clients, which can be quite some trouble as you can imagine. So, for example, because DHL does everything from Warehouse Management to transport, and clients have their own warehousing systems, and DHL has their own. And then when you try to optimize and make a network out of this, for example, it gets crazy. One of the major goals for 2030 is standardizing DHL business across itself and across the clients also across itself, because as I was saying before, DHL was built a lot with acquisitions. And sometimes when you look at it, it's almost like a Frankenstein, you know, like one piece of this one piece of this and so on. Having a standardized system across all warehouses, all countries, is something very important. That's a major thing that we're trying to pursue. So, within DHL and within clients. I think within DHL, we will for sure be able to do it in this timeframe. Absolutely. With the clients, I'm not sure because I think

that's always the case that if you're talking about a big client, like Tesco, they also have their own systems. And sometimes they're like, no, we want to keep our systems and you guys do the transport part of it, or we do the transport, and you do the warehousing. They know what they want. So, I think clients is trickier. But it's very good. Because so for example, one of the major efforts that we're doing in sustainability, it's not even electric vehicles or fuel, it's building networks. Because if you're doing, let's say 10,000 dedicated accounts, where you have these trucks for this customer, and they do those routes, it will be much, much less efficient if you have a few networks of a couple 100 clients. And then you can manage them in a network where you can optimize the routes, you can optimize inventory, you can optimize everything. But for this, we need that connectivity, and we need clients also to be on board with that.

Interview Director of Transport, Logistics & Mobility – PwC

Part 1

Marie Rasche

How are new entrants changing the competitive industry landscape?

Interviewee

So first of all new entrants. The question is, what is a new entrant? I've thought about it a bit and I'm seeing three main categories. One would be startups. Second would be players from other industries. And actually, it's primarily the retail industry. And it's primarily Amazon. So group two would be Amazon. And the third group would be container shipping companies. So start maybe let me start with startups. Logistics startups have been around for many years now. We've been talking about startups for at least 10 years. Today, I would say only a small number of startups have actually succeeded to gain significant market share in freight forwarding or other logistics services. So if you look at the list of top players by revenue in logistics, like I don't know if you know, the Fraunhofer Top 100 in logistics, which is an annual publication displaying in the various fields like freight forwarding, supply chain, and so on, displaying the biggest players. If you look at these lists in Germany, or in Europe, or even globally, I think you will always still find the incumbents in the top ranks. So you will see the usual suspects you will see DHL and FedEx UPS Kuehne + Nagel and so on. But when you think of digital freight forwarders, or other digital logistics service providers, these are usually still relatively small in scale. So three of the best known names are Flexport, Sender, or Forto, two of which are in Germany. These are among the most prominent digital freight forwarders. But they are actually not very big in terms of transport volumes. So obviously, this business is quite hard to scale up. So you, if you're a freight forwarder, be it a digital one or a traditional freight forwarder. You will need offices when you operate, you will need a lot of insights into how the freight

forwarding industry actually works. And you will need relationships to build business. So this is one of the reasons why those digital freight forwarders used to recruit managers from logistics incumbents to get that logistics expertise. And all this takes time. So the growth of these companies is not super fast. So if you asked me how have they changed the competitive environment, I would say slowly, they have certainly for even for many incumbents, they've opened their eyes towards digitization. But it looks like they still hold their big pieces of the market share. Second, maybe Amazon came in from a completely different angle. I think they acknowledged at some point of time that logistics should be their core competency to become more independent of DHL and the likes. But also, Amazon wanted to provide end to end services to end customers. So from the perspective of a traditional Express Company, Amazon has actually evolved from a client to competitor and thus it has changed the competitive landscape quite a bit at least in the Express business. Maybe looking at the third group, the shipping companies, you will probably have also followed the developments that in recent years, some of the major shipping companies have made some remarkable and maybe even surprising acquisitions. And three shipping companies stand out: it's Maersk, a Danish company. CMA CGM from France and MSC from Switzerland. So as an example, I mean Maersk this year acquired, amongst others, pilot freight services. That's a US based supply chain provider with cross border solutions into Canada and Mexico. Maersk also announced the completion of its acquisition of LF logistics which is Hong Kong based, it's a contract logistics company. And this already shows that Maersk is actually going global. And they're going beyond container shipping. So they're going into Supply Chain Solutions. So this is one example. And CMA CGM, for instance, has been particularly active with some transactions, which includes air freight. Also, parcel service. Colis Privé was one of their acquisitions, and also automotive logistics, they are quite vertical. So these shipping companies, they are driving a new wave of vertical integration in the transport and logistics industry. And why are they doing it? I would say for a couple of reasons. One is the container shipping business is very much subject to volatility of freight rates. You know, freight rates have been very low for many years. So it was a natural ambition for these companies to enter into a higher margin business. Second reason, the business of container shipping is like trucking or other freight

transportation a commodity, you could say, it's all the same, I mean, put stuff into boxes and ship it from A to B. So it's a commodity and there is little opportunity for value added service. And there is no direct contact to end customers, which today is of course, extremely important to any organization. So this is why container lines wanted and still want to evolve into end to end logistics service providers. And I would say the third reason is simply over the past two years, freight rates have been historically high, which is, amongst others caused by all these supply chain disruptions that we've seen during COVID and was caused by other events. So shipping lines have made huge profits and need to invest. So that's what I would say about new entrants, three groups with from different angles and different motives and objectives. So that is, so that's one. You've also asked about major forces shaping the industry within the next 10 years.

Elisa Nunes

Can I ask a follow-up question regarding what you just said. You said, one, one of the categories was players from other industries, and you gave the example of Amazon. But I mean, Amazon is pretty self explanatory. Why would that be? But do you have another example of another industry?

Interviewee

Not too many, to be honest. I mean, in the industry, the automotive industry or construction or whatsoever. There is always the question of would they outsource their logistics, or keep on doing their own logistics or even in source logistics? And I think over the past years, sometimes there seems to be a trend to outsource then there was a trend back, it's not very clear. And I would say I mean, logistics as such is a is an asset heavy business. So many companies, I would say will not have a big ambition to get into this. Because it requires lots of investment. It's difficult to scale. Wherever you go, you need trucks or ships or aircraft, whatever. You need a lot of infrastructure you need warehouses. It is really, really tough. And I remember during one of our discussions that we had with some colleagues, we said okay, one of the coolest startups 50 years ago or so, was FedEx putting little boxes with consumer goods into a plane which before that nobody would ever have done because

aviation was far too expensive. But that was new that was groundbreaking. And since then, they have, and like UPS and DHL, they have grown and beyond Express also developed logistics services; freight forwarding, and so on and so on. But we said today who would try and build a new FedEx today? Nobody would ever do that. It's far too asset heavy, too much investment. So this is why I would say, there are not so many examples of companies really entering logistics. All companies are more and more looking at their own supply chain management. That's a bit of a different story. So and it also answers one of the other questions. So it's good that we talked about it. You know, many companies are building up their, say their logistics control towers, because surveillance, supply chain transparency, surveillance of deliveries is getting more and more crucial. So they are active in logistics, probably anything that's related to digitization. That's, that's what companies are keen on. But the core logistics operations is not as attractive, I would say.

Marie Rasche

I also have a follow up question here. Which is interesting also for future conversations, I guess. So basically, you're referring to the digital freight forwarders and digital companies? Are those generally like in our research, we learned that they are not so asset heavy, or they try to be obviously asset light, because then it's easier to enter the industry by just offering digital services. So in that sphere, I guess there's more entries happening in the logistics industry, right, if it's just a digital business model, and just the digital service.

Interviewee

Sorry now my phone rang, which is why I was distracted for a second. So what you were what you were asking is, is it whether it's easier to enter the market when you have an asset light business model?

Marie Rasche

Yeah, that's I feel that was kind of self explanatory, I would assume. But so the digital freight forwarders that you were referring to such as Flexport and Sennder. Have they tried to do it in an asset light way? And maybe is that why they have been able to succeed in the market?

Interviewee

Well, yes, and no. I mean, yes, they are going asset light, and I mean many startups. Many logistics startups are not actually in the freight forwarding business. Many of them provide solutions for and sell these solutions to freight forwarders and offer the freight forwarder to use their platforms or their systems. The three that I mentioned, are actually in freight forwarding. And their experiences, yes it's a good idea to be asset light, but you still need to have a market entry. And I mean, the traditional freight forwarders are so strong, they have all the direct relationships. And when I say relationships, I'm talking about relationships between people. They have 1000s of people selling freight forwarding services to people at industrial companies. They know each other, they have relationships, and it's difficult to get in. So it's not only the technology that they have, it's not necessarily the assets that they need, but they need the insights and the relationships within this logistics or supply chain ecosystem. You need to know the people on the shipper side, you need to know the people in the ports in the customs authorities, you need to be in this system. And this is why also some of these companies, they actually hire logistics experts, in some cases, seasoned logistics experts who have relationships and they still need IT specialists who can help further develop their platforms, artificial intelligence experts, but they also need logistics experts to actually get into the business.

Marie Rasche

Okay, that makes sense. So we're also thinking about M&A. But that is something you would rather talk about later? Because I think these small companies they are often acquired, right? There are partnerships happening with new entrants?

Interviewee

That's true. I mean, we are as far as M&A is concerned, we are seeing a consolidation process going on for many years already. Because if you simply look at European road transport or European logistics providers generally, there are 1000s of small companies or 10000s of small companies. And they are simply too small to digitize, many of them will probably never succeed in really digitizing the business out of their own strengths. So many

of these will be acquired, and we will see, well, a tendency of bigger companies. So that's, that's one thing. When it comes to those startups who really have a technological edge. I mean, it depends many, many freight forwarders or logistics service providers on the side of the incumbents. They do work together with startups because they understand that they probably develop solutions that they cannot develop in house, because they simply don't have the right people. And the bigger the companies get you could say as a general rule, the less well creative they can be. So sometimes they work with startups or they found their own startups take them out of their organization to give those people a room where they can work without bothering about all the say reporting stuff and so on, which is required in a large organization. Some of the startups may be acquired. Again, for different reasons, maybe the founders always had the idea of, of selling their business for a couple of millions being a rich man or woman. Or I mean, some may be distracted and simply may don't may not work out, maybe investors don't have any more confidence. So they get acquired by a larger firm. That will be interesting going forward because what we are now seeing is that investors now also as interest rates are going up again, investors, it looks like the appetite of investors more generally, not only in logistics, but putting the money into startups is levelling off a little bit.

Marie Rasche

So, and we know that for example, DHL has a large innovation department so they are very concerned in doing and researching innovation in house. And but for example, if they would if they were to implement blockchain solutions or other more advanced AI tools, do you think it is rather likely that they will develop that in house or do that by acquisition from a startup or learn from another company? Just to understand this dynamic here.

Interviewee

I think for DHL, you are right. They are very strong in innovation. They are front runners with their innovation centers in Bonn and I think two or three other places. They also have a huge workforce looking into innovation management. They I think they also work with startups. So they do things. Well that organization is so big, it's very difficult to say they

will go this way or that way. It really depends. DHL is definitely big enough to do a lot themselves, but they also collaborate with startups.

Marie Rasche

Okay, then maybe let's move on in the list. Sorry for the distraction. Where would you like to dive back in?

Interviewee

Well, I mean, I could talk quickly about major forces and uncertainties. From when I thought about major forces, I thought about four things: climate change, the talent gap, digitization, and geopolitical developments. Geopolitical developments probably falls under uncertainties. So there were many questions about technology and digital. So maybe first, let's quickly talk about climate change, I think very clearly there is that pressing need to decarbonize any industrial activity, including logistics, you will also have read and be aware that the transport sector generally has not managed to bring down co2 emissions in three decades. The opposite is the case. Emissions are going up, of course, because of the growth, but nevertheless, growth is no longer an excuse. So it will be a huge challenge for the industry to bring down co2 emissions. And that's a question of the right technologies and alternative fuels. For trucks, we at PwC, we believe that battery electric trucks will prevail. We have a group of experts who have done some calculations, and they believe that by 2025, already, the total cost of ownership of an electric truck will be lower than for an ICE truck. For aircraft and ships, it's more a question of, of sustainable fuels. So probably some other people could talk about that for hours. But that's definitely that's definitely one big driver. The talent gap. That's, of course, it's an issue all over the place. The main focus here is probably on truck drivers. But not only in Europe, and also North America and elsewhere. There's a huge lack of truck drivers, the job isn't attractive at all. Companies need to pay higher salaries and award incentives to find people. Autonomous trucks might be a part of the solution. But that's still a couple of years down the road. Similar in shipping, here, it's actually the Ukraine war has added to this problem. Ukraine and Russia together, they provide, I don't have the exact numbers right in front of me, but

they provide something like I don't know 10, 12, 15% of the overall supply of officers, but also ratings for the Global Freight fleet. So the talent gap is big issue. And also, as I already mentioned, on top of that, IT specialists are definitely needed. And some other industries appear to be much more attractive to young people. So the industry also has a reputation issue. Some find it fascinating, but many would rather work in the consumer goods industry or in the automotive industry. Or in the pharmaceuticals industry, maybe. So that's the second Yeah. And I said the third geopolitical development that actually would take us to the topic of geopolitical. Which we could talk about, I still have a couple of minutes. We could either do that. Or talk about the one question which I also found interesting which of the four scenarios from our report "Shifting patterns" do I think is reality today. I thought this was a good question. Because normally when we create such scenarios, we always say, okay, hopefully nobody will ask us again whether we were right or wrong. The good thing about scenarios is, well, you create different scenarios, but you don't say which one you believe will happen. I had a look at it. And you may have the same thing in front of you now. It's page 12. In the shifting patterns report. Well, I had a look at that. We have these four scenarios: 1) Sharing the pie, 2) Startup shake up, 3) Complex competition and 4) Scale matters. I thought, there's probably a bit of truth in each of them. As of today, I think the third and the fourth, or I should say the fourth and the third are probably closest to the reality today. When I read what we, when I read our narrative "4) Scale matters: Incumbents increase efficiency by streamlining their operations and taking full advantage of new technology." That's actually what they are after, right now, still going on. Probably still too slow. But I think most of those big organizations are really trying to streamline operations, bringing down the costs, and there is definitely still a lot of room to do so. If you think of the 1000s and 1000s of freight forwarding agents, which are probably not needed, at least not all of them. So I think that's, that's one. "They fund promising new technologies with venture capital cash and attract new staff with critical skills and expertise in competition to create a dominant market position." This is actually what they are after. And it's not only venture capital cash. Now, as most logistics companies are making huge profits, they actually use a lot of that to invest in digitization. "Major players merge to extend their geographical scale and enhance their cross-modal coverage." This is this is

actually what happened. I mentioned the three shipping lines, who are driving vertical integration by acquisitions. And these are just examples. So there are many, many of these deals that take companies or are giving companies more global reach and in the broader service offering. So I think 4) Scale matters is quite close to what's going on right now. 3) Complex competition: "Big retail players expand their logistics offerings to fill their own needs and beyond, effectively moving from customers to competitors." That's exactly the Amazon story. "They purchase small logistic players to help cover major markets." I think this is also what we are seeing today. The first two scenarios were more collaborative in nature. And I would say I see a little of that. "Incumbents reducing their environmental impact by collaborating more."? Not sure. I think they're all focusing more on themselves and trying to optimize their own supply chains. Yeah, "developing new business models", maybe "sharing networks", not so much. We were also at that time when we did it. Everybody was talking about last mile delivery. And the question whether the big service providers, it's, I mean, you see them on the road in front of your door, and you see, it's either the yellow truck from DHL, or it's the brown truck from UPS or it's in Germany, it's DPD, or Hermes and so on. Would they collaborate? And it's not really happening. So it looks like that the two collaboration scenarios are not really developing very much.

Marie Rasche

Do you think in terms of, for example, Blockchain, because that would be a technology that everyone needs to collaborate on, because it's a decentralized network, right? So if that were to be implemented, there would need to be way more collaboration. At least that is what we assume. Do you agree with that?

Interviewee

Yeah, definitely. Yes. But we don't see very much in reality. I mean, we've also talked about blockchain for many years and the discussions about what are the use cases in logistics, and there are quite a few. These discussions are also 5,6,7 years old. We know that Maersk is looking into blockchain quite a lot. But not because they want to democratize their processes, but rather making use of it but still leading the whole thing. So I don't know

I'm not the biggest expert in blockchain technology, I really find it difficult to understand. But from looking at the market. I think we're still waiting for the breakthrough. And I think many of the medium sized logistics companies, they don't really deal much with it.

Elisa Nunes

One of your axes is clearly technology. What would be the other axis right now? For doing the scenarios.

Interviewee

For doing the scenarios? I mean, the two axes here are one is incumbents versus new entrants. And the other one is collaboration versus competition.

Elisa Nunes

Yes, but for us, it would, it would have to be like trends. So we know that technology you have a lot in your report. So what do you think would be the other axis besides technology?

Interviewee

Well, we said technology should not be an axis. We actually thought about it. It's a good question. We thought about it. And when we first started, as far as I remember, it's a couple of years ago, but we thought okay, technology is one axis. And it would go from no progress to big progress technology, technology-wise. Then during the discussion, we said, that doesn't make sense. Because no progress is not realistic at all. There will be progress in terms of the use of technology. It may be a bit faster, it may be a bit slower. But so we said: Technology is all around. So you'll see all those technologies on that circle. But the axes we chose different axes. It's important to talk about technology, but we said in terms of buildings scenarios, technology is not the leading criterion. We assume that technology is progressing. But other things are more open. Like will the incumbents prevail or the new entrants? Will companies collaborate or not? We found that these are the better dimensions for the scenarios.

Part 2

Marie Rasche

How are geopolitical tensions threatening the logistics industry?

Interviewee

Exactly, okay. So yeah, geopolitical developments. When I look at the questions that you brought up about the Ukraine - Russia war, and other geopolitical instabilities impacting logistics service providers. Well, let's start with Russia, Ukraine, maybe? I think most logistics companies are actually not too badly affected by the Ukraine war. I mean, some may be very specialized on the Eastern European market, and they may experience a big hit. But for most of the players, Russia, is or has not been the most important market, honestly. I think there are some numbers, the Russian logistics market is estimated at about 20 billion US dollar. The German logistics market is at around 280 billion US dollars. So the German market, even though the country is so much smaller, is more than 10 times as big as the Russian market. And Ukraine, I don't know. The European market, so if you take the EU and the UK and Switzerland, and so on, it's more than 1000 billion US dollars. So it's much much, much bigger, and Russia, is relatively small. So I think the industry can handle it. There are some indirect effects, of course, that war has added to some more disruption. So some capacities went away. I mean, and I think we already discussed that last time. Many seafarers, and also truck drivers come from Ukraine and also from Russia. So these are now not available to do their jobs at the moment. So that's a bit of an issue for the overall global European fleet. Then, the airspace above Russia is closed, so some flights between Europe and Asia need to take longer routes. So there are some disruptions. So freight rates go up, maybe capacities, go down a little bit. The biggest thing is, of course, fuel prices. That's an energy question. But I would say as long as we talk about Russia-Ukraine, the industry can handle it. Now the focus is, of course, much more on China. And we all don't know what's going to happen. It looks like there is sort of a trade war between China and the US or between the East and the West. But still, I would say the trade with

China is definitely still going on. Some industries may look at other Asian countries. So moving production or their procurement from China into Vietnam, Indonesia, Thailand, other of those upcoming Asian countries. And the transport industry will follow. That's for sure, the transport industry is where their clients are. If they don't have a footprint in Vietnam yet they will try to get a footprint in Vietnam when their clients go there. And I would say that there has been a lot of talk about de-globalization. But I don't think that will be de-globalization in a way that we will really turn back the wheel and go back to national or regional markets. But there will be something like re-globalization. And by re-globalization, what I mean is a change of globalization patterns. So moves from one country to another, I think those supply chains will still be global. And that means that globally, logistics service providers will continue to act on a global level. I mean, if something escalates, nobody knows what happens. And this is what we all don't hope. And it's very, very difficult to make any predictions here. Because it's the big political game. And that's not a topic of your master thesis. And also, I'm not into that. It's very, very difficult. So and I think in one of the questions, you brought up, the interesting word of "peak globalization". That's also a good one. And but as I've just said, I would not speak of de-globalization, but maybe re-globalization would be the right word. There was also a question about Chinese brands. What did you mean, whether Chinese products would be accepted and sold elsewhere? Or what do you mean?

Marie Rasche

I think basically just sourcing products from nations such as China, India, and the Emirates. Obviously, that would propel international trade and also lead to a more international presence of logistics companies. We know that for example, DHL is operating globally, in all countries, except for Afghanistan. But how important is international trade for the company? So I think it will increase with increasing acceptance of like, Chinese brands and also increasing globalization?

Interviewee

Well, I mean, for a company like DHL. I mean, it's actually more than one company. I mean, they have several divisions. And without disclosing too much about Deutsche Post DHL, I think it's fair to say that these divisions are not totally integrated. Because even though they're all doing logistics, they have different business models. So Deutsche Post DHL, they don't try to integrate everything, they have different KPIs. And that's why I would say for some of their divisions global trade is of course extremely important. I mean, for DHL Express, that's naturally a global business. If you take PNP, post and parcel, they're doing German business only; letters and parcels within Germany. So it depends a bit but generally, it's of course they are global. They're a global company. And the same is true for shipping companies that operate on global markets. The big; Maersk, Hapag Lloyd, etc. They operate globally. For them, it's absolutely natural and key that global supply chains keep on existing, of course.

Anna Mettler

What role do regulations play then in this context for you?

Interviewee

Well, regulation is again very big. Well, first of all there is global trade with almost all territories, and it's relatively free, I mean, it used to be highly regulated in China. But I think that has changed quite a bit. I think some of those free trade agreements, of course, help a lot. Like the EU is now doing it with Canada, for instance. These free trade agreements have helped a lot to spur trade. And thus, logistics, between those two regions. Sanctions, of course, are our big showstopper. That's clear. So that's where I see regulation coming in. What companies usually struggle with is customs clearance. That's always a big, big issue. Especially now as we have so many delays and bottlenecks in ports and

airports, and so on. So easing customs processes, that's quite an important thing for companies.

Marie Rasche

Do you think companies can take an active role in easing those custom policies? Like, are they in conversation with governments or governmental institutions to speed up processes at ports, for example?

Interviewee

Absolutely. On the one hand side, that's, I think that's sometimes happening at the very local level. So people will really work on premises in the big ports and so on. They have their direct relationships, which helps. On the other hand, on a higher level. You know, I will come to technology. Everybody's talking about that supply chain ecosystem and that ecosystem would involve customs agencies. So finding solutions and digitizing things could speed up processes quite a lot. If you think of freight documents like the "Frachtbrief" in Germany or the bill of lading in global trade. The bill of lading is a document which has been existing for I think, 500 years. And until today, it's usually on paper today. So, digitization is a big key here. But that needs to be done together with the customs authorities. So they need to be involved, they also need to be included in those platforms where freight documents are stored. So a clear yes. The big companies should look after that.

Marie Rasche

So as you already mentioned, digitalization plays a huge role here. How far do you think are logistics incumbents with digitalization, like what's the status quo? And what still needs to be done?

Interviewee

Well, overall, I would say; there is still a big need in logistics to automate and digitize physical processes and also the information flows. I would say the speed of innovation in logistics in recent years or even looking back a few decades. I would classify that as moderate, at best. So it's really slow. And there are many technologies, you also mentioned the trend radar, the DHL trend radar, that's where you find all those technologies, which can help. But I see many of these technologies to really take another five years, 10 years or even more than 10 years to really make a big, big difference in the logistics industry. And I think one of the technologies was blockchain that you're interested in. I mean, there are quite a nice, quite a few nice use cases in logistics, the main use case is actually that end-to-end monitoring of deliveries. Which however, requires equipping containers etc, with IoT applications or logistics 4.0. application sensors and so on. And you need to integrate many numerous actors along the entire supply chain, from the shipper, the shipping company to the recipient, and in between there's maybe a trucking company, a shipping company, and a logistics service provider, a customs specialist, the customs agencies. So many, many organizations get involved and they all need to be on one platform. And you may have seen that between today and the last call we had two or three weeks ago, it was announced that Maersk and IBM would discontinue their TradeLens platform. Which is absolutely amazing. Because I mean, I think they started it in 2018. And they are real Frontrunners. It's really a very strong and well thought-through initiative and a great offering. But it failed. That's amazing. And it's a shame. Because that will really, I don't know, take us back a couple of years. And as I said last time, I'm not too deep into blockchain. Actually, I have a colleague who understands blockchain much better than I do. But you may also have someone on your list, who is from a different organization. not PWC who can elaborate more on that.

Anna Mettler

Why do you think is it so difficult for the big companies to digitize and to create these platforms? Because I mean, some of them already have platforms, right? So Kuehne + Nagel, DHL, they all have platforms. But then you have, as you probably discussed in the previous meeting, you had those new entrants who actually do what you just said, who digitize their whole supply chain who connect all the different players in one platform. Why can't the big incumbents do that? What is in your opinion, what hinders them from doing that?

Interviewee

It's yeah, I mean, that's a very good question. I think part of the problem is the complexity, because they cannot simply do it on their own. There are so many involved parties that need to be on the same platform. Different business models; I mean, I know big companies, take Deutsche Post DHL, they're all looking at their ERP systems, which is a huge challenge as such. The ERP system is not the operational logistics systems. So they need warehouse management systems, transport management systems, supply chain management systems, so many different kinds of systems that need to be integrated. And again, we have totally different business models. I mean, freight forwarding is one, that's probably what we're talking about when we talk Kuehne + Nagel or DHL Global Forwarding. DHL Supply Chain has a different business model. And DHL Express has a different business model. They all need to set up their own operational systems. So there is indeed a little bit of complexity in it. It's not easy to say why don't they fully succeed? I would say it's not so easy. I don't know if you compare it; take an automotive company. They probably have their internal logistics, their Intralogistics, maybe better organized, but it's their own thing. It's just one organization to really manage the material flows and information flows within one manufacturing company. That should be okay. And maybe with some suppliers here we talk about 1000s of companies.

Anna Mettler

I've been researching a bit about the business models as well. And as I explain it to myself, I think it's just that the incumbents. I mean, they've been doing their business for I don't know how many years. So it's a this is a pure like pipeline business, as you would call it, basically. And then suddenly, if they want to create such a platform, they will have to rethink everything they've been doing so far. And it's just too big. And then you would also have to implement it worldwide, because they are global companies. And then you have the new players who just would come into the market and that don't have the operations yet. They don't have the assets that maybe the incumbents have, and they can more easily provide these solutions than the big ones.

Interviewee

That's right. And that's probably a very good observation, which may be true for each and every industry. Yeah, incumbents are in many cases "too big to fail", you could say, but maybe also "too big to disrupt themselves". Because there's too much complexity. Also, in terms of decision making, it's like in politics, you have people who have different agendas, people who have different goals and KPIs. And bringing all that together is sometimes really difficult. And you really have to say, okay, that company is that big tanker and it is difficult to move it, to navigate it. That's true, a small company, and this is why some very young agile startups seem to be ahead of the curve. Because they can simply do and this is why also incumbents and the big incumbents when they think of innovation, they either cooperate with startups, or they create their own startups and try to get them out of the organization. So that these innovation cells don't have to bother with all the reporting, etcetera, budgeting and so on issues that you usually have in a large corporation. So when it comes to technology, I think a lot of things are going on. Interestingly, there used to be a bit of talk a couple of years ago about 3D printing and how disruptive it might be because you can produce products decentrally, and maybe that would replace transportation, and thus really disrupt the logistics industry. But I don't really see that happen. It is a

manufacturing technology, which was in the very beginning, it was introduced for rapid prototyping. And then I heard a that's already a couple of years ago, a good presentation from Boeing who said: Yes, they can print parts for aircrafts to make those parts lighter, or to produce complex parts in one go. With other manufacturing technologies, you have to do two or three or four parts and then assemble them by screwing. So that's a reason. But today, I don't think there is not that much 3D printing that Kuchne + Nagel for instance would recognise a decline in volumes. That's not the case. So there's not so much really disrupting technology, of course, a lot of technology that is increasing efficiency, like autonomous vehicles. Organizing especially the freight forwarding business; that's a big, big thing. And we'll see what Maersk is coming up with next. As TradeLens obviously has failed. I saw two articles in Computerwoche by the way about TradeLens, one a 2019 article and now a very new article in November 2022.

Marie Rasche

I think I will just have one last question also adding on to what Anna and you just discussed. So what do you think would be needed to make leaps forward? Because one could assume that big crises such as COVID-19, or geopolitical conflict, such as, like wars in Europe, would prompt organizations to be more innovative to be prepared to face these situations in the future better? But it looks like COVID-19 didn't really push organizations to innovate delivery processes, for example, or data availability? Although it would have been very needed maybe.

Interviewee

Well, I think there was some progress, I wouldn't see it that negative. But what is needed? I mean for transport and logistics, actually, during the COVID crisis, some of the big companies in transport and logistics are achieving record profits. Which is funny. Many of them are, you could even say, they are winners of the pandemic. Now interestingly, and maybe we can also touch a little bit on M&A. The big shipping lines actually made huge

acquisitions; Maersk, MSC, CMR CGM, and they acquired other companies in shipping but also in logistics. So there are more aiming at end-to-end solutions. I foresee stronger moves of vertical integration in the industry. And some of those bigger players coming up. And somehow I also think they have to solve the issue of efficiency, especially as far as logistics information is concerned. So consolidation is probably a good thing for the industry in terms of creating. And I'm saying consolidation vertically, but also horizontally; creating bigger organizations, which have more power to innovate, because it's still very fragmented. And there are so many small and really small companies, which will not be the front runners in innovation, who also work on very thin margins.

Marie Rasche

Thank you so much for your careful preparation and insights.

Interview Tender Manager – DHL

Anna Mettler

So just for you to understand again, what we're doing. So we are writing the thesis together. So it's a group project. And then in that group project, we are looking at the logistics industry and trying to figure out what different scenarios could arise in 10 years from now in 2032, based on trends that are already appearing right now, and then from that arriving some like strategic options for companies in the logistics sector, what could they do if scenario ABCD takes place. So for that, we are conducting several interviews, just to find out if what we have analyzed as the most uncertain developments, if that is actually also what the companies see as a very uncertain but high impact development. So that's where you come into the game. So can you first tell us real quick what your task is, what is your position as a tender manager, just so we understand more?

Interviewee

So my role is, let's say I'm the second point of contact from our top 80 customers. So the department that I worked for, we are taking care of our top 80 customers. So basically more like Key Account managing. And let's say, I'll give you an example of, let's say, Dell comes up with a requirement that they need to, I don't know, transport from one place to another from A to B. So they have this service requirements and everything. And it's my job and the customer manager's job to get in touch with these 80 customers, take their service requirements, and then bring the service requirements within the company, then, let's say understand what the requirements are according to the requirements, then identify the right people who will be able to support us for providing that solution. And then of course, then finding someone from the operation. So it's basically, let's say, I'm kind of a middleman who's striking deals with these top 80 customers that we have. So we also have a customer director or customer manager, who is the first point of contact, and after the customer manager, it's me, the tender manager who's the second point of contact. So these companies, they launch tenders, tenders, as I said service requirements and what they need. And then

it's my job to translate those tenders identify the right people, the right stakeholders within the company, bring them together, formulate a solution, formulate an operation, and from solution, to operation, to implementation and then afterward review, is all my job. So that's basically where I come into play, I have a close contact with the customer manager and the customer itself. And I and I have a close contact with all the stakeholders that will basically make that thing work within our company. So that's what I do. And our KPIs are basically to get as much new business as possible.

Anna Mettler

Are you only doing it for domestic tenders? Or is it international?

Interviewee

Global. So right now I'm heading the EMEA region, so let's say, Europe, Middle East and Africa. But mostly these tenders that come in from our top customers, they are never, I mean, sometimes they are regional, but most of the times they are global. So well, let's say the decision makers are sitting in Europe. So basically, it's my responsibility to get in touch with them, align with all the different regions, depending on how big the requirement is. So let's say if something is picked up from China and then dropped in France, for example, then I will be the person since the decision makers of those company are sitting in Europe, then I would be that person who will engage people in China or Asia Pacific, and then explain them the tender, ask them what is required from them and then try to propose a solution and bring a proposal offer to the customer sitting here in Europe. For me the important thing is that the customer should be sitting here in Europe. That is why I'm in this European region at the moment.

Anna Mettler

Okay, so speaking then about Europe, have you seen any developments in the number of tenders you have been supervising in the past, specifically taking into consideration the current Ukraine Russia war. Do you see any connection between like political developments and tenders coming in?

Interviewee

Of course. I mean, as I said, these top customers they're, let's say are quite intact with the global economy, and whatever is going on around the world affects them. In resultantly, it also affects us getting more business. I'll give you a small example. After COVID, when the whole world's economy was going back to normal, I would say, I wouldn't say that it was getting better. But it was going back to normal how it was before the pandemic. And during that we received a lot of tenders, we received a lot of business, we received a lot of revenue. But the problem now is, that now since everything is getting back to normal, and now in Europe, specially we have this crisis going on the volumes that we signed with our customers. So let's say we signed a customer that we're gonna bring 1 million, I'm just giving an example, 1 million pallets from point A to point B. But the problem is with the current crisis, and due to the restraints that we are having, let's say, due to this crisis, everything that we will be signed for, let's say 1 million pallets, now the customer doesn't want to ship 1 million pallet because it's too expensive for him, he reduced the pallets to, let's say, 500,000, and now 500,000, but we signed for 1 million. So our volumes are dropping, that means we are making less money. At the end, it can also be to the point that we are making no money at all, we are making a loss. But that's one of our concerns regarding to the crisis that is happening in Europe. So volumes are going down. And that is our number one concern at the moment. And we are trying to tackle that.

Anna Mettler

Okay, so with decreasing volumes, I don't know if you can tell me anything about that. But, I was just earlier thinking about the whole fixed cost in terms of like fleet, like the, the trucks and everything. If the volumes go down, then you have a lot of extra...

Interviewee

Yes, fleets and everything. But no, but that's the thing. Our goal moving forward is to reduce our assets as much as possible. Because we have 4PLs in the market available that can perform that same, let's say, function or duty that we ourselves are providing. And at the moment, one of our BUs or business units, only one business units have assets, which

is having their own planes and fleets and trucks. But for the rest, we are trying to get rid of as much assets as you can because it's like you said, it's a fixed cost, running those assets is a fixed cost. And it's getting expensive, expensive day by day. So that's our number one goal, to reduce as much assets as we can, reduce fleets as much as we can and try to engage 4PLs, trusted 4PLs of course, because at the end our name is based on our service that we provide. And if you're not providing good service, then of course, we're losing our customers. And that's something that we cannot afford. So we are quite conscious on let's say deciding on our partners. But we are also trying to reduce as much cost as we can by just reducing as most assets as we can, and trying to invest into that same more sustainable options. But rather than having those contemporary options of having planes and trucks, and vans, etc.

Anna Mettler

Makes sense. So it's also a lot about digital transformation, right?

Interviewee

A lot of our digital transformation... I mean at the moment, our goal is to, I can send you the documents as well as on our website, but our goal is to digitize every process that we have at the moment. The problem is that since it's a global company, digitalization can be, let's say beneficial, but as well as can be a curse, because it's quite difficult to globally digitize the whole company, have the same systems running in every region. Some countries have, let's say, embargoes placed on some software's or some applications that those countries they are not allowed to use in those countries. So we need to find a solution for that. So being a global company, like I said, it's good, but also comes along with these kind of issues that we have, that the reason why other companies are getting more digitalized faster then, let's say my company, is just because they're less global than us. And being global, can cause such problems. We are trying, that's our goal at the moment. But it's still a work in progress. It's not there yet. But we have solutions, we are coming up every day with let's say... we are convincing our stakeholders and to so far we have had a lot of success, which makes sense because at the end it makes our life easy. It makes our

processes easy. So it's not tough to convince stakeholders but it is tough to implement because so many countries, so many regions and training, so it will take time for us but our goal is to achieve 100% digitization in all our processes, nothing manual.

Anna Mettler

I recently read that DHL also implemented a freight platform now. I don't remember the name... MyDHLi?

Interviewee

Yes, yes, MyDHLi. This is a service that we provide to our customer in which they can basically see within, even within a container, which position their let's say package or whatever they're sending out is. Even there are some, so for example, lately, we have a huge amount of business coming in from the life science health care sector in which a lot of medicines, let's say life saving medicines, cancer medicines, vaccines, they have been transported, and we need to provide full visibility to our customer on where their packet is, which location is at what temperature it is in as well. So in case they need to get something changed or something they can always get in touch with some operator, let's say on a ship, on a train, or on a truck. We have this MyDHLi, but basic, its basic goal is to give as much visibility to our customer on their packet or pallet or whatever they're sending.

Anna Mettler

And that's done via sensorization, or how do you provide this transparency and traceability of where the package is at each specific time?

Interviewee

I mean, basic technology that we use is GPS. Then on top of GPS, we have active loggers as well as passive loggers. Then we have infrared technology as well, within containers and on ships as well, that basically gives live information in which state that packet or which state the pallet is. So depends on what the requirement is from the customer and what we are transferring, or what we are moving from one place to the other. And depending on that we have active loggers and passive loggers, and then we have almost

more than 350 vendors that are providing us these tracking loggers. And that's how we come up with the solution. But it all depends on what the customer wants. Because as I mentioned, our top 80 customers are our customers that are making a lot of money. So for them, even if we have to give them a customizable solution, we give it to them. We don't tell them, you have Option A or Option B, option C, choose one of these. We give them all the options, tell them what they want. They can be: "I want this from option A, I want this from option B and I want this from option C", and we give them that solution. And that's our job.

Anna Mettler

So the customers are very demanding?

Interviewee

Yes, I mean, they're giving a lot of money. They're giving a lot of money. So, they are quite demanding. And we cannot afford to lose our key accounts. So we have to fulfill their demands.

Anna Mettler

How's it with, like implementation of blockchain technology? Is there any developments already?

Interviewee

Recently, we had a presentation that was given to the top stakeholders. I have to keep it a bit confidential, but we are moving it in that direction. Because we see, even when we are representing it as well, we see a lot of benefit into it. With strategy, just the strategy point I'll keep confidential but apart from that, I mean, it's a lot of benefits that are coming out. I mean, smart contracts, you can sign quick SLAs with your customers, it's all decentralized, you don't need to have extra layers of making decisions and having you know, like issues with okay, it cannot pass from this border to this border, because we need an approval from there, and we have a decentralized system that is working over them and doesn't require anything to come first to Bonn or go to Singapore or go to Miami to get an approval and

then we can move. So it has a lot of benefits. And we are, at the moment, monitor like looking at it as a as an option. And you will hear something coming up from our company, as well that we might move into this direction. But we see it as a positive indicator. As I said, I mean we are one of the largest logistic providers in the world and if we are left behind on this, definitely our competition is gonna move forward so we cannot afford that. So we are looking into it, at the moment.

Anna Mettler

In your personal opinion, just your opinion. Wouldn't you say that the DHL is kind of late with implementing like these digital solutions like the myDHLi. I feel like there are a lot of new startups already in the market that offer solutions like that. What's your opinion on that?

Interviewee

Yes, I do. I mean, that's one of my, always one of my concerns as well. Because I mean, I also am, I mean, I'm a business student, but I'm also, let's say, an IT student as well. So I did kind of my majors were IT and business. So I've always been in favor of digitizing. But the problem as I said before, as well, it's a global company, implementation of it takes years, and what myDHLi, we are right now, giving visibility to our customer globally. For some startup, they can only give that visibility where they are or where they are within the region. But for us, we need to have... I mean, if we are giving visibility to our customer globally, then we need to train. I mean, I'm just giving you example, we have 600,000 employees all over the world, and it's just an unofficial number. I'm pretty sure it's more than this. And to train, let's say people, it's quite difficult. And and that is the reason why it takes more time with that with our company. Sometimes I say I will keep it as, as my personal view. Yes, we are. We are dinosaurs. But like I said, we have... it's not that we are not proactive. We are quite proactive. But the problem is just implementation, that's one of our major let's say hassle or major obstacle that comes into our way. But I completely get your point. And I completely agree with your point that we are a bit late. And startups are providing such services. But at the end, they are startups so they don't have enough people

to train within the company. I mean, it's quite easy to implement something but for us, we need to go through a lot of bureaucracy countries, you know, so it's tough. It's tough.

Anna Mettler

Do you see any threat from startups? I know, as you just said, they're still small. But in the future, would you say that those that are currently coming into the market that offer these purely digital business models – do you think that could be a threat for DHL?

Interviewee

I wouldn't say that would be a threat to us. We are basically in contact with a lot of startups who are coming in with smart solutions. Instead of looking at them as a threat, we are looking at them as future potential partners. A lot of acquisition planning is going on as well. So we don't take it as a threat. At the end, I mean, we have a brand name that we have made for it for years and years. And we kind of have an advantage because of that. But the way we look at startups is gaining more vendors, gaining more acquisitions, and gaining more services for them. So we're not looking at them, as let's say, threat for now. But for example, like I said, everything is evolving and evolving at a very fast pace, I cannot predict. But they can be some revolutionary idea coming up from a startup that can destroy, you know, that can just penetrate the whole market. But at the moment, we have these market leaders, we enjoy our position in the market. And we don't like I said we don't consider startups as threats. We consider them as part future partners, potential partners and acquisitions.

Anna Mettler

Do you see any market consolidation in the future that the top players right now, like DHL, Kühne+Nagel... that you guys will just increase your market share? And the number of players in the market will just be reduced?

Interviewee

I wouldn't say we, we would consolidate because it's a fierce market. And the problem is that I would say the top players of this market has made their name within the market and has gained as much business as possible. So I don't think we are going to consolidate, we always consider our competitors as competitors. We have a strategy which is quite, let's say competitive, rather than I wouldn't say friendly, but rather than being more close to our competition, just to create more barriers for new new companies to come in. But I don't see that going because the problem is, the business outside is so saturated, that we cannot afford to form partnerships or let's say, we need to let's say win everything for ourselves. So I don't see it becoming consolidated, but maybe some policies regarding future or regarding environment. Right now we had this, what was it called COP27 was going on in Sharm El-Sheich and the policies that came out.. it's not that the policies that DHL is going to implement for itself, it's a policy for all logistics company. And on these issues, or I would say on these things, I see companies or competitors coming together to form solutions and form partnership in order to, let's say, protect the environment. We provide more sustainable options of logistics, and be as carbon neutral, I wouldn't say zero, but be as carbon neutral as possible. It is tough for us to be, let's say, zero emissions, because it's just at the end, we are a logistics company. But we are trying to compensate what we are emitting by being carbon neutral. And by 2050 I mean, for 2032 will, by 2032, our, let's say 2030, our goal is to be carbon neutral, and by 2050, to be globally carbon neutral. So that's one of our goals that we are trying to achieve. And I don't think we will be able to achieve if we are not, let's say, closely aligned with our competitors. And I think the competitors also have the same targets and objectives moving forward. Because that is also, like I said, our customer requirements. Provide one thing from point A to point B. But also one of the requirements is to provide them carbon, that's a co2 report, in which how much carbon has been emitted by lets say, their requirement. And then we have to provide them, let's say carbon neutral options. And that kind of gives us a more, let's say advantage when we are bidding for a tender. So on such situations, yes, but I think on competition, it would still be difficult, because right now every company is trying to win as much business as possible, especially with the last two years, with the pandemic and everything. And also

one thing I mean, off topic, I mean you guys are studying as well, and you guys are studying into logistics, off topic, is also something that I didn't understand that, during the pandemic, the logistics was stopped. And that's something that you know, we within a company also have question marks, how can a container or a ship ... Why was the ship stopped? Why were the containers stopped? Why were the trains stopped? Because they don't infect you, you know, so that's some questions, but I will just keep it off topic. But these are some questions. And just because of that, we are quite, as a company, we are quite, I wouldn't say, but we are quite cautious now making our moves. And, we're trying to win as much as possible, because being a global company also comes up with a big cost. And we need to maintain that, that level of employees and everything and for that we need to be in as much business as possible. So that's what we're doing now.

Anna Mettler

Okay, I would have one more last question before we, like move to the end. You were earlier talking about cooperating with other companies to tackle climate change or to tackle the policies for sustainability? Is there any other, like any other topic where you see competitors cooperating to handle like a global issue or something, besides sustainability?

Interviewee

I mean, if there was another pandemic, during the pandemic, that's let's say, the movement of vaccine or the logistics behind vaccine was done under cooperation with all logistics company. No company was looking into profits or revenues, companies were doing it just for the sake of, of the crisis that the whole world was going through. So in such situations, I see. We might move into that. But at the end, we are competitors. But for such situations, which was really appreciated as well across the, let's say, the sector, across the market sector of Logistics, was quite appreciated. And in such situations, yes, crisis in cases of war, in case of pandemics, we see cooperating with our competition as well and for the sake of saving lives. Yes. So for the Life Sciences and Health Care Sector, yes we see cooperations going on between...

Anna Mettler

Is there any technology exchange between companies?

Interviewee

So we are always looking into each other's vendors, but there is no technology exchange. But on hindsight, if you guys get a chance to come to Bonn, or if you guys get a chance to go to Singapore or Miami, let me know, we have three innovation centers fully dedicated to, let's say, future of logistics. I can, I mean, if you are in Bonn or so, I can give you guys a tour, I can book a tour for you guys, I think would be very interesting for you guys. Your topic is future of logistics. So in Troisdorf we have this innovation center. And over there you see the new technology being used within warehouses, within transportation, within, let's say, value added services that we provide to our customers, robotics within our warehouses. Our goal, for example, for all our European warehouses is to be automated, fully automated, to reduce labor as much as possible and become fully automated. And at the moment, we are reaching to that goal in which I think by 2030, all the European warehouses, not just, let's say France, Germany, in the UK, and all, also Eastern Europe as well, all European warehouses will be fully automated. And by fully automated, I really mean robots working within warehouses. And all of this you can see in Troisdorf, and right now, one of the most, let's say, amazing robots that are working within warehouses are sorters. So pickers and sorters, so before we needed specialized person standing there who can understand, who can read different barcodes and stuff, and then sorting, picking and this kind of stuff. And we already in all of our warehouses have this technology being implemented, which is being highly appreciated by customers, and also saving us a lot of cost because it's much more cheaper to be automated than like having someone there standing there and working, and also more efficient. No.

Anna Mettler

Okay, great, I might actually take you up on the offer on the innovation center once I'm back.

Elisa Nunes

What you think the future of logistics in 2032 will actually look like, if you would see some self driving cars, drones, if you would see companies coming together?

Interviewee

What I see in 2030, I see EV. So electronic vehicles doing first and last mile deliveries, which we already are doing in Germany and in France, and Netherlands. And our goal is to make it at least regional within Europe. So that's I mean, I'm taking care of Europe. So I could say by 2032, First Mile and last mile delivery will be fully electric, by electric vehicles. Self-driving vehicles we just tested in Finland, at the moment, it is successfully running. And we are trying to, let's say, expand it out of Finland. So hopefully by 2032, we will have self-driving cars as well self-driving delivery trucks, self-driving delivery that we'll probably see. Drones, I think four years ago, when I when I joined (...), it was my first year in the company, we did that test in one of the islands of Germanys North, Juist, we did a drone test from the mainland to Juist, because with Juist, the problem is that you can only go there once during the day because of the low and high tides. So you can only go, let's say, around 10:30am is the time that you need to get on a ferry, you go to Juist, and then you have to wait the next day to come back. So now we have successfully tested that and on these islands and we are currently delivering, let's say parcels and packets on these small islands, where there are no roads, no cars or anything, by drones. So we have successfully tested it, fully implemented in these islands of Netherlands and Germany. And we try to bring it forward within the cities as well, but the problem is, Anna might know as well, the problem is within cities you need, it's the regulations are quite heavy. You need approvals from Stadt and all to fly, even fly a drone, your own personal drone as well you need, you need approvals. And that's one of let's say the major obstacles in, let's say, drone delivery. Otherwise, I think within the cities as well, we are quite capable because now since we have 5G in all the major cities, we are quite capable to do drone deliveries. But just as I said, you need permissions you need, you need approvals. And that's let's say one of the major obstacles that we are having within Europe to get it implemented. I think in the US, we already have drone delivery systems going on. If you get a chance to go to

Miami as well, there is a dedicated fleet of drones, where we are basically doing all our operations through drones. So by 2032, for sure, I see this happening. And also one of the major things that I really look forward to is us being as carbon neutral as possible. Because being a global company, we are emitting a lot. And that is something that I'm more interested in, that we come up with solutions that are carbon neutral, at the moment, all of our fleet, the airplanes that we're using for freight, air freight operations, they're all operating on sustainable aviation fuel. It's basically vegetable oil. And I think Qatar or Etihad Airlines is also doing the same as well. So all the air, we are basically now promoting sustainable aviation fuel amongst airlines who are doing our 4PLs, who are basically 4PLs. And we are trying at the moment to, let's say, advertise it as much as possible so that these airlines, who are doing our operations on our behalf, they're also flying with sustainable aviation fuel. And at the end, we can go back to our customer to tell him that yes, you are paying us extra for this fuel. But look, on the hindsight, that your airplanes, or whatever is being used to transport your pallets or your packages are emitting less carbon than that's your normal contemporary plane. So that's something that I'm really looking forward to by 2032.

Elisa Nunes

So how do you think your clients, your customers perceive those new technologies? Do you have any feedback regarding that, like, if they are willing to accept that or they don't trust that so much?

Interviewee

No. I would say maybe if you would have asked this question. 10 years from now, maybe the trust element would have been one of the major concerns. But right now, the requirement for my customers is to be as automated as possible, because at the end, they are saving costs as well. They're saving costs, they're making more money in return, we are saving costs as well, and we're making more money. So it's a win win situation for both parties. So that's something that is being highly accepted by our customers. And just like us, one of our KPIs to be carbon neutral, as much carbon neutral as possible. It's not just

our KPI. Also, these companies have their their strategies are changing as well, because there's so much pressure coming in from everywhere, from government and all, that they also have the same KPIs as us. So let's say, if we are providing them a better, more carbon neutral solution. They would also, in their KPIs, put in those numbers that "Hey, guys, look, we have achieved ... we have done this project ABC," whatever, and it has emitted less carbon than let's say it would have emitted if it was a normal situation, or let's say a contemporary solution. So just like us, they also have the same KPIs. They also have to be answerable to what they're doing. And for them, now when I read tenders and what I used to read tenders, I don't know one or two years before, there's a huge difference and the huge difference is and mostly are related to being as sustainable as possible and providing the solutions. So just like us, they all have their targets that they have to achieve. And they appreciate when we bring in such sustainable, let's say carbon friendly, or environmentally friendly solutions.

Anna Mettler

Okay, then my last question, and then we're done. Okay, so you were mentioning obstacles earlier, especially you with focus on drones. But speaking generally, what would you say are the major obstacles for logistics in the future? Is it rather in terms of like regulatory frameworks, politics? What's your take on that?

Interviewee

I mean, regulations has always been an obstacle for us. But we have dedicated teams working with legal, people from the legal department, working on it 24/7. And regulation is something that we can tackle. But the other, let's say, obstacles that I see is a crisis like Ukraine and Russia, you know such things when that happens, it really affects our way of working as well and really does as a logistics company. As I mentioned, the example when the pandemic came, all the trucks and ships and all were stopped, and that really hit us quite bad. And just because of that, if, let's say, if everything goes well, regulation is not a problem. But if we have such political crisis, if we have an across border crisis, if God forbid, you know, like, there is a threat to let's say, a European Union to have let's say,

countries having more borders. If we see another Brexit kind of a situation happening to one of the European countries then, we see such things as a very big obstacle. And till now, from the Brexit, we are still coming out of Brexit and our operations are, let's say, not fully back to normal yet just because we are still trying to balance out what can we keep in UK what can we keep out from UK? Even offices whether we keep in UK or we bring them out in the UK? What are the tax situation what is that say cross border movement within these countries? What is the labor situation in that country as well? These are, let's say, the obstacles. But regulations is something that I think, we have very smart, dedicated teams working around the clock to bypass such obstacles.