



Managing volatility in logistics markets

Challenges – Practices – Tools

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Managing volatility in logistics markets

Challenges – Practices – Tools

Laurin Zemmrch

Prof. Dr. Erik Hofmann



University of St.Gallen
Institute of Supply Chain Management

***“Science-based,
practice-driven”***

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ISCM – Institute of Supply Chain Management

The Institute of Supply Chain Management (ISCM-HSG) at the University of St. Gallen sees itself as an international platform for dialogue between science and practice in the field of supply chain management, especially purchasing, logistics, and transport. The ISCM-HSG researches complex problems of global value-added networks in the form of concepts, methods, and instruments, thereby building a bridge between research and applied solutions. This promotes the further development of supply chain management in industry, trade, services, and the public sector. In addition, the ISCM-HSG provides a comprehensive range of training and continuing education aimed at managers, young scientists, and students.

Promotional Association

This study was conducted on behalf of the promotional association of the ISCM-HSG. With more than 20 companies in the promotional association, its members benefit from research insights and a targeted exchange on current supply chain and logistics challenges. Please contact the study authors for more information concerning the promotional association and membership options.

Management Summary

This study of managing volatility in logistics markets published by the Institute of Supply Chain Management at the University of St.Gallen investigates volatility in freight rates for sea, road, rail, and air as modes of transport and sheds light on management practices from the perspective of shippers, intermediaries, and carriers. Based on a three-stage research design, this study presents the following key findings:

Volatility sources

This study provides an improved understanding of the origin of volatility in logistics markets and the underlying effect of the variables investigated. We examine 35 freight price volatility sources and assign these complex factors to four meta-dimensions (shipper, logistics service provider (LSP), market, and exogenous factors).

Volatility management

This study provides a holistic framework for identifying and investigating strategies for addressing freight price volatility. The investigation framework distinguishes between three management stages (ReStrain, ReAct, ReThink), four management dimensions (informational, organizational, partner, provider), and three actors (shipper, intermediary, carrier) to efficiently manage freight price volatility. Based on this reference framework, the present study draws the following key findings regarding four logistics scenarios:

Study context

The Institute of Supply Chain Management at the University of St.Gallen and its promotional association conducted a consortium study on freight price volatility in logistics markets. This study provides answers to the challenges, practices, and tools to address freight price volatility and thus provides a clear picture for actors in logistics markets.

To answer the research questions, we conducted an extensive interview series involving 44 experts in logistics markets. The results reveal the different viewpoints of the respective actors, and thus provide a triangulation of perspectives.

The key players represented in this study are shippers, intermediaries, and carriers involved in transportation via sea, air, road, and rail.

In response to the Russia-Ukraine crisis that began in February 2022, we extend the study by a short discourse on the focus topic of volatility in times of geopolitical crisis to capture relevant effects on logistics market, derive conclusions regarding the volatility of freight prices, and provide insights for responding to this crisis based on the study findings.

ISCM-HSG

Laurin Zemmrich
Prof. Dr. Erik Hofmann

Scenario 1: Sea freight – global – container

Sea freight is famous for its boom-and-bust cycles with many years of low rates where shipping lines were not earning their cost of capital, followed by the COVID-19 crisis and shipping lines passing the buck to shippers. Besides these unexpected fluctuations in prices, sea freight exhibited very low reliability during recent years. To avoid similar situations in the future, shippers, intermediaries, and carriers need to go beyond treating the symptoms to addressing the underlying conditions. While shippers can commit to higher quantities in advance and use longer-term, enforceable take-or-pay contracts, intermediaries could extend warehouse spaces to ride out market dislocations due to limited port operations. In addition, carriers should rethink their last-call and first-call port selections to shave multiple days off transit times.

Scenario 2: Road freight – international and national – full truckload (FTL), less-than-truckload (LTL), and general cargo

Freight rates in road freight have been subject to significant fluctuations, especially due to the high spot market activity in international FTL. However, road freight faces severe capacity constraints beyond price dynamics, including driver shortages, long delivery times for new equipment, and rising energy costs. Therefore, actors need to find ways to use capacities more effectively and consistently. For example, shippers need to facilitate faster driver turn times at pick-up and delivery locations, while intermediaries and road haulers need to eliminate barriers and build competencies within their commercial, planning, and fleet departments.

Scenario 3: Rail freight – international – container

In contrast to other transport modes, rail freight is characterized by price stability due to limited providers and a comparably transparent cost structure. Consequently, rail freight is primarily concerned with utilizing its capacities and increasing flexibility and reliability. Besides, there is still a considerable backlog in establishing necessary infrastructure, such as multimodal terminals for intermodal transport. To improve capacity utilization, shippers should identify “predictive” product categories that require less flexibility (e.g., consumer goods) and exploit rail freight. In addition,

intermediaries need to develop concepts to achieve traffic pairings, while rail undertakings need to leverage automation (e.g., shunting operations).

Scenario 4: Air freight – global – belly, freighter, and charter

Since belly carries more air cargo than full freighters worldwide, the COVID-19 crisis resulted in a 28% global decline in air cargo shipping and sky-rocketing spot market prices, which eventually exceeded standard freight rates by ten or more. In light of these developments, shippers need to rethink their “have” and “have-not” products with high margins to justify air freight. In addition, intermediaries need to improve cooperation between shippers and carriers, with the latter being challenged to rethink flight economics, as we expect business class to lag behind leisure travel.

Mini cases

Six case studies extend the scope of this study to demonstrate relevant approaches logistics actors can adopt when managing freight price volatility. The six cases of Coop, DB Cargo, EK Procurement, Fygen, Heraeus, and Migros provide insights into how companies have directly addressed the study's guiding theme in practice.

Indices and digital business models in freight

As indices often only capture one-dimensional data and do not allow any forecasting function, they frequently fail to deliver the promised benefits to practitioners. In this context, the present study differentiates between three tiers of indices that include 60 distinct information sources. In the appendix, we provide a handy and compact summary of each index, providing practitioners with a neutral overview and profound input for price planning, management, and control processes (Resch, 2012). Beyond the indices, this study also responds to the fact that the landscape of available digital services and software providers in logistics lacks transparency for legacy players. Building on an existing classification of nine archetypes of digital business models in freight, we also provide a compact summary of 142 company profiles covering emerging digital businesses in the appendix. The identified companies can help shippers, intermediaries, and carriers improve the information flow in existing business relationships or establish new ones.



Foreword

Fluctuations between supply and demand always influence logistics markets. The same applies to disruptions in supply chains during singular events such as (natural) disasters, terrorism, and social or political upheavals. However, we have experienced a new dimension of volatility during the last two years. Almost every economic sector is affected by more frequent supply bottlenecks, interruptions, or the collapse of supply networks. Anyone who attributes this solely to the COVID-19 crisis is missing the point. The causes are as complex as the approaches to mitigation and defense. Various studies have long documented the need for resilient supply chains and adaptive risk management. In Gartner's Hype Cycle for Supply Chain Strategy 2021, the latter was put in the trough of disillusionment. A clear signal that the real progress in managing volatility has not kept pace with expectations. In reality, we underestimate the scope and challenges of the transformation. In this vein, the present study will lead to an "aha" moment for those concerned. The comprehensive presentation of volatility dimensions and different logistics scenarios promotes the necessary understanding of distinct interrelationships. Therefore, the original study objective has even been expanded by classifying problems and assigning practical solutions. The intensive cooperation between science and practice has resulted in a handbook for broad practical application. Anyone entrusted with implementing sustainable risk management for supply chains will significantly appreciate this. Based on our many years of experience, we have contributed with great pleasure and wish all readers a significant knowledge gain.

Company profile

AEB's cloud software supports logistics and foreign trade processes for industrial, service, and retail companies. More than 5,500 customers in over 80 countries use AEB solutions for shipping, transport and warehouse management, customs clearance, import and export processing, and export control. Through process automation and IT integration of supply chain partners, customers benefit from greater transparency, efficiency, and legal certainty. AEB solutions also increase flexibility and responsiveness. With more than 600 employees, AEB has its head office and data centers in Stuttgart, Germany. In addition, AEB has offices in 13 other locations, including the United Kingdom, Singapore, Switzerland, Sweden, and the United States. Further information at: www.aeb.com.

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Markus Meissner
CEO



Foreword

Berger Logistik faces a significant challenge due to the overall volatility in the price and equipment segment. We also see a problem in the shortage of drivers, aggravating the challenge of missing loading space in road freight. Since we operate on both the contract and spot market, it is essential to weigh up very carefully how the overall situation will develop in the coming months. Due to our field of activity, we are strongly affected by the volatility of prices and equipment available in the pre-, main-, and aftermarket. Since we must ensure the availability of capacities throughout the entire transport chain, it will be vital to have correct figures recognizing capacity bottlenecks at an early stage to take adequate countermeasures.

With this study, Berger Logistik GmbH would like to take the opportunity to obtain the latest scientific findings on how to counteract price and capacity volatility in the logistics sector with the renowned Institute of Supply Chain Management at the University of St. Gallen.

Company profile

Berger Logistik GmbH is one of the leading logistics companies in Austria and will further strengthen its market presence and drive forward its expansion course through strategic alliances. Since 1961, the traditional Tyrolean company has been offering tailor-made logistics services throughout Europe and worldwide to renowned customers with the help of state-of-the-art information technology. Berger Logistik provides a wide range of products, has access to a global network, and is centrally located in Europe with, among other things, an international logistics center in the middle of Germany, covering an area of 100.000 square meters with 42.000 pallet spaces. Furthermore, the company has its own fleet of vehicles (consisting exclusively of BERGERecotrail® trailers). Therefore, it is the proud market leader in this segment with the largest payload-optimized fleet in Europe and a pioneer in sustainable logistics and innovative supply chain solutions. Further information at: www.berger-logistik.com.

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CEO



Foreword

Logistics is emerging from its shadowy existence. Delivery delays in production and trade are increasingly bringing it to the forefront. It is no longer the sole responsibility of logisticians but reaches the boardrooms via the end consumers. It is becoming a strategic task because volatile markets and fluctuating quantities create problems that logistics service providers have been unable to solve on their own for a long time.

In conjunction with increasingly scarce resources, this development is forcing joint and strategic action. The present study brings shippers and logistics service providers together at one table; practice and theory meet. The study structures its guiding theme around a clearly defined question. It describes all the influencing factors and plays out various logistics scenarios. The associated discussions broaden the horizon, encourage a change of perspective, and stimulate exchange. This promotes mutual understanding across all company boundaries and modes of transport.

From experience, we know where levers could be applied. In addition to the measures, the most important thing for us is the attitude of all those involved, making active action and forward-looking planning possible throughout the entire logistics chain. If we want to equalize quantities in terms of time and better utilize capacities, we can only succeed together. Therefore, research projects are an essential building block for a predictable service in markets that will be even more volatile in the future.

Company profile

BTK Logistik is an owner-managed logistics company with headquarters in Rosenheim, Bavaria, and a branch in Heilbad Heiligenstadt (Thuringia). Three hundred thirty employees realize national and international transportation and a broad portfolio of handling, storage, and value-added services for customers from industry and trade. The company operates its fleet of 159 truck units with 200 trailers and manages around 30.000 square meters of logistics space in the greater Rosenheim and Munich area. BTK is a member of the European Freight Association of International Freight Forwarders (ELVIS AG) and the Europe-wide general cargo network SimCargo. Further information at: www.btk.de.

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CEO



Foreword

Supply and demand unpredictability is here to stay and not expected to go away anytime soon. Regardless of the specific characteristics of different transport modes, a handful of patterns repeat in variation when discussing freight price volatility and related management strategies. The present study takes a holistic view of the different transport modes. It analyzes them in-depth, which is particularly relevant for us as a terminal operator since different transport modes are subject to cannibalization effects and must therefore be thought of holistically. In addition to highlighting practices for the acute management of disruptions and the accompanying crisis management, we particularly enjoyed the collaboration with the study participants and the engagement with the ReThink. In this context, the study shows medium-term perspectives on how the current crises will further exacerbate the problem of rising costs and delivery times in logistics processes. We hope you will enjoy reading the study.

Company profile

Contargo is one of Europe's major container logistics networks, integrating container traffic between western ports, German North Sea ports, and the European hinterland, with an annual transit volume of 2.1 million TEU. Contargo has 25 container terminals in Germany, France, and Switzerland, with additional locations in Germany, the Netherlands, Belgium, and Poland. The company also operates its shipping and rail lines. The 1,158 employees generated an annual turnover of 513 million euros in 2020. Further information at: www.contargo.net.

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Holger Bochow
CEO



Foreword

Also, the lawyer who looks after and advises clients in the field of logistics, and here above all transports, has to deal with the strongly fluctuating prices on the market because this is one of the requirements that clients, especially on the industry side, make – the costs must at least be predictable. Today, this requirement is more complicated than ever, especially if the market position of the individual client is small, for example, in the area of international sea freight. Moreover, in the last two years, especially in containerized sea freight, unpredictable moments arise here, which are difficult to manage.

It is complicated to balance the duration of prices, the level of costs, the admissibility of surcharges, and adjustment mechanisms. For this reason, this study is also of fundamental interest to us: On the one hand, we can contribute the experiences of various clients of different sizes and from different sectors, but at the same time, we can learn what others have experienced in a similar situation and which approaches emerged there to get the difficulties under control.

The cooperation between the Institute and the study participants was close and conducive to the discussion – we are grateful to have been able to participate and hope that this will also benefit the readers.

Company profile

The law firm GvW Graf von Westphalen is one of the large so-called full-service law firms in Germany, with approximately 200 lawyers at six locations in Germany. A unique feature is that in addition to the usual areas of corporate law, labor law, IT/IP, and others, the area of transport and logistics, and overall, the supply chain in the focus area of purchasing and logistics, also play a formative role. We advise clients – mainly from the industry – on their logistics projects, from transport contracts to storage contracts to internal logistics processing, starting with the definition of the project and the specifications to the design of the SOP and even the remuneration agreements, which have recently become increasingly complex in order to meet changing requirements. Further information at: www.gvw.com.

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Dr. Marcus Schriefers
Lawyer and expert in logistics solutions



Foreword

The interdependencies in international and multimodal transport became very clear to us in 2021. As an inbound and outbound shipper, the LKE Group must rely on the smooth running of transports and constantly monitor all factors that may cause delays or cost increases. Therefore, we are also interested in analyzing the possible situations early to adjust our planning.

The present study provides profound insights into what is happening in the market in exchange with relevant players and, as a result, will provide guidance that will secure valuable advantages for the LKE Group in the transport process and the supply of goods.

The direct exchange and the further joint development of the study content with the very experienced consortium members broaden the view of actors in logistics markets and reveal new possibilities.

Company profile

Excellence in Material Handling since 1994: The LKE Group manufactures sophisticated transport equipment for internal and cross-company transport and material flow solutions. LKE is remarkably flexible in developing and implementing complete planning concepts, as an extensive and highly flexible product portfolio is available.

One focus is on letter container, parcel, and mail delivery trolleys for the courier, express, and parcel services (CEP). In addition, many projects are implemented in distribution logistics and intralogistics. LKE products are used and appreciated in industrial manufacturing, supply or textile logistics, the beverage industry, and the e-commerce trade. Further information at: www.lke-group.com.

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Head of Purchasing



Foreword

The Militzer & Münch organization is a family business and has been privately owned since 1880. From this history and background, we consider social responsibility for our employees, among other things, to be a significant characteristic of our corporate DNA. At the same time, this corporate structure offers a management culture that enables us to make quick and efficient decisions in the interest of our customers. The customer himself is the focus of our daily work. Our organization and internal hierarchies are designed to motivate young colleagues, mainly inspired to implement innovative ideas in transport handling. The approach drives us and the claim always to act and decide in the interest of our customers. We considered it a great advantage and added value to concentrate and focus on the so-called niche markets. Volatility plays a significant role in these logistics markets in particular. Therefore, we are pleased to contribute to this study.

Company profile

The Militzer & Münch organization has a worldwide network with over 100 branch offices in 30 countries. Almost 2.000 employees are at the service of our customers every working day to ensure the safe transport of goods by road, air, sea, or rail. We see ourselves as a service provider for markets and regions that require unique experience and expertise, such as the Maghreb states, Africa, Central Asia, or the CIS states. At the same time, we see ourselves as specialists for traditional markets and transport handling to and from Asia, Oceania, and North America. Further information at: www.mumnet.com.

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Holger Seehusen
CEO



Foreword

Vifor Pharma is committed to identifying and serving underserved therapeutic areas. As a pioneer in iron deficiency therapies, we have significant scientific, regulatory, and commercial expertise. This enables us to identify opportunities contributing to markets' creation, development, and maturation. Volatility in the logistics and transport market is inevitable in Vifor Pharma's tightly managed supply chain, which must be mitigated.

We understand what it means to take calculated risks and plan the next breakthrough for our patients and innovative medical therapies. As a global company, we face global challenges and the expectations of our stakeholders who want to contribute to a better world together with us. We are aware of our responsibility to the environment and society, and we take this responsibility seriously.

With adaptive solution models and a dynamic logistics infrastructure, Vifor Pharma can be agile in response to capacity constraints, price fluctuations, and environmental factors affecting transport chains to fulfill orders reliably. We also focus on our core competencies and work closely with our strategic service providers to minimize volatility in the logistics market in a controlled manner. The present study approaches this matter and provides detailed insights.

Company profile

Vifor Pharma Group is a multinational pharmaceutical company. It aspires to be the world's leading provider of iron deficiency, nephrology, and cardiorenal therapy. The firm is the ideal partner for pharmaceutical goods and creative, patient-centered solutions. Vifor Pharma Group aspires to improve the health of individuals with severe and chronic illnesses worldwide. Our collaboration with major partners worldwide has enabled us to strengthen relationships with our patients, healthcare professionals, and payers, drive innovation, create awareness and give patients access to therapies that are right for them. Further information at: www.viforpharma.com.

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Head of Logistics and Distribution



Foreword

Volatility is a constant factor in the daily business of W+P Weber und Partner AG as general planners, architects, logistics consultants, and client representatives. The fluctuations in the market make economically sensible planning and implementation increasingly tricky. Volatility in freight prices poses new challenges for all players in the supply chain. Predictability is becoming a foreign word, flexibility a buzzword. Increasing transparency in our supply chains through disruptive technologies offers us new ways of thinking about logistics and will permanently change it. The unique needs of the players are fascinating to us. What does it mean for us if logistics service providers and shippers increasingly rely on rail in the future? When assembly lines come to a standstill due to component shortages and end customers still want to receive their goods "same day"? Players want to have their supply chains under control, which currently results in an increased need to bring back foreign production sites, for example. Production and logistics locations are in demand, where geography plays a significant role. Sites must have a high degree of flexibility and be multi-client capable. New technologies in the area of the last mile also have a strong influence on locations. Our operational business is logistics real estate, industrial sites, and intralogistics solutions. To remain fit for future requirements, we must and want to think outside the box and look at logistics in its entirety, which is why we were delighted to participate in this study.

Company profile

Form follows function: that is how we plan factories. Rapidly changing markets often require further development through new construction, conversion, change of use, or refurbishment. Our core competence is the conception, project planning, and realization of clever industrial construction solutions. We are leaders in industrial construction and logistics and operational planning. Passionate about detail, innovative in implementation. The basis of our successful logistics projects is conscientious, individual, and economical logistics planning. To find the most economically viable solution this is always done in a practical, manufacturer-independent, neutral, and field-tested manner. Our more than 90 experienced experts develop solutions in close cooperation with our customers tailored to their needs. Further information at: www.wpag.ch.

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1

Introduction

The development of freight prices in logistics markets is subject to notable fluctuations. In addition to seasonally and regionally observable trends, particularly in recent years, changes in freight rates have been challenging to investigate and mitigate. Moreover, in the wake of the COVID-19 crisis, the already volatile logistics industry has undergone unprecedented developments in freight prices, stemming from an overall imbalance between the supply and demand of goods. In this context, sky-rocketing freight rates for individual transport modes have increasingly attracted the attention of practitioners and the media. Consequently, due to increasing external uncertainty and turbulent fluctuations on both the supply and demand sides, actors in logistics markets such as shippers and logistics service providers (LSPs) are increasingly exposed to volatility and urged to develop strategies to mitigate related risks. As such, the COVID-19 crisis revealed that transport prices could become prohibitively expensive, thus necessitating that shippers rethink their supply chain design. At the same time, building inventory levels to minimize supply chain disruption, ensuring overall supply security, and adjusting to a changing market environment have become central themes of logistics markets. Accordingly, shippers, carriers, and LSPs are challenged to evaluate appropriate measures to reduce volatility in logistics markets in addition to their day-to-day operations.

This study seeks to address this problem by providing practitioners with a set of practices with which to manage volatility in a standardized and concise spreadsheet format. The study findings are based on a broad series of interviews in which 44 experts, consisting of shippers, carriers, and intermediaries, were asked about their challenges, views, and approaches in

dealing with volatility in logistics markets, thus ensuring triangulation of the different perspectives. The present study also adopts a change of perspective by considering the possibility of consolidating information and coherently portraying different management approaches. In this way, this study offers a unique selling point by providing the three primary actors in logistics markets with a comprehensive overview of possible measures by which to reduce their respective volatility exposure. Thereby, the practical relevance of the study facilitates the transfer and application of the research results for practitioners.



1.1 Study objectives

The primary objective of this study is to present good practices in dealing with freight price volatility in logistics markets in a standardized spreadsheet format summarizing relevant measures from the perspective of shippers, intermediaries, and carriers to derive individual recommendations for action. To derive good practices in responding to volatility in logistics markets, a better understanding of volatility sources and related effects is necessary. Therefore, this study also seeks to shed light on the myriad of factors driving freight price volatility. Finally, by incorporating the perspectives of shippers, intermediaries, and carriers, the present study aims to contribute to a stimulating and constructive discourse by ensuring that the different perspectives of three key actors in logistics markets are considered.

To summarize, this study aims to identify management strategies concerning freight price volatility by considering the heterogeneity of volatility sources, leading to the central research question:

"How can shippers, intermediaries, and carriers better manage the volatility of freight prices in logistics markets?"

The following underlying research questions are developed and answered incrementally throughout this thesis to answer the above question:

RQ1 – Challenges:

What are the general sources of freight price volatility in logistics markets?

RQ2 – Practices:

What are good practices in dealing with freight price volatility in logistics markets?

RQ3 – Tools:

Which indices and digital business models can legacy players use to deal with volatility in logistics markets?

1.2 Study structure

To answer the above research questions and achieve the overall objective, this study features a funnel-shaped structure, with the breadth of analysis decreasing and the depth of analysis increasing as the investigation progresses. As a result, more accurate and detailed conclusions are presented as the research unfolds. Therefore, the present study is structured as follows:

Chapter 2 provides a brief overview of practical challenges facing logistics markets and related theoretical gaps, thereby explaining the general motivation for conducting this study.

Chapter 3 presents the methodological background of the present study. In doing so, the main building blocks of desk research (DR), nominal group technique (NGT), and expert interviews (EI) are briefly introduced.

Chapter 4 presents a guideline on how practitioners can apply the research results based on the methodological approach.

Chapter 5 highlights sources of volatility in logistics markets and clusters these sources into four dimensions to better understand the problem space.

Chapter 6 introduces a general systematization of measures and practices for dealing with volatility in logistics markets to derive practices with which to address the identified volatility sources.

Chapter 7 applies this systematization to derive a set of practices for four exemplary logistics scenarios, namely air, rail, road, and sea freight.

Chapter 8 demonstrates the application of approaches employed by logistics actors when managing freight price volatility, highlighting six practical case studies. In addition, Chapter 8 highlights key challenges and future trends introduced by the Russia-Ukraine crisis.

Chapter 9 presents a meta-list of indices and digital business models, thus providing practitioners with an overview of relevant information sources and (solution) providers. For each index and company, we provide key information in the appendix.

Chapter 10 presents an integrated discussion and evaluation of the study results, critically examining, in particular, the contribution and limitations of the present study.

Finally, **Chapter 11** draws conclusions for practitioners, summarizes the study results, and identifies the potential for further development regarding related challenges, practices, and tools when managing volatility in logistics markets.

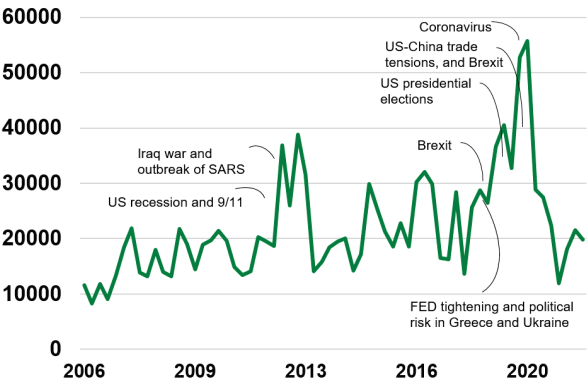
2

Motivation

This section presents a status quo analysis of practical challenges and theoretical gaps, that serves to highlight the need for the present study.

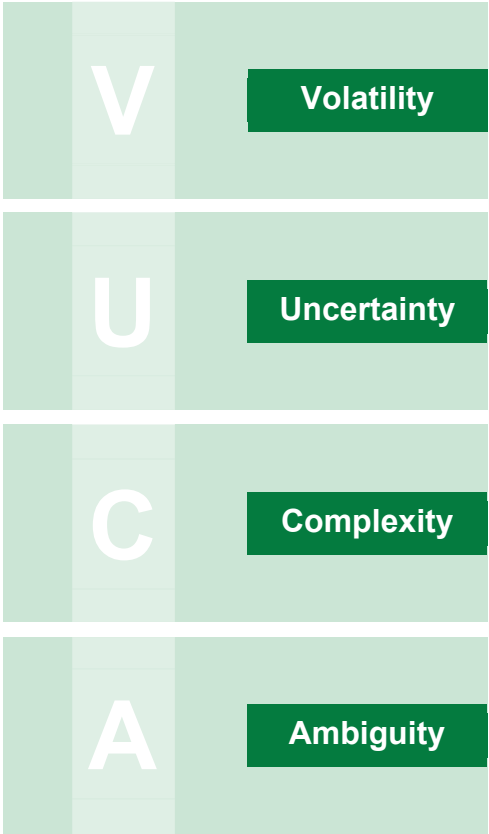
As indicated in Chapter 1, the entire logistics market is in a state of upheaval caused by the COVID-19 crisis. Consequently, actors in logistics markets must operate in a constantly changing environment. Given this structural dynamic, the acronym VUCA (volatility, uncertainty, complexity, ambiguity) describes the insecure environment in which businesses operate (Bennett & Lemoine, 2014). Figure 1 illustrates the increasing extent of global uncertainty based on the Stanford University World Uncertainty Index. In the first quarter of 2020 the index hit a new high, rating 152% higher than the average value between 2006 and 2020.

Figure 1
World Uncertainty Index (Ahir et al., 2018)



In this context, the logistics industry is increasingly exposed to rising costs and inflation rates fueled by external disruptions such as the COVID-19 and the Russia-Ukraine crisis.

In addition to escalating energy prices, the logistics industry suffers from a shortage of personnel, particularly in road freight transport, which said crises have only exacerbated. As a result, freight rates are highly volatile and soaring, putting extreme strain on LSPs and shippers. Against this background, a fundamental understanding of the root causes and effects of different volatility drivers and the implementation of reasonable practices would be crucial in the years to come. To this end, we first describe how the challenges posed by VUCA affect logistics markets and the resulting practical problems for shippers and LSPs within the individual transport modes. Second, we describe the theoretical gaps that this study seeks to address.



PESTEL analysis



Different drivers in a volatile, uncertain, complex, and ambiguous (VUCA) environment can be explained by political, economic, social, technological, environmental, and legal (PESTEL) factors, which can cause a significant change in today's logistics markets (Diaz Ruiz et al., 2020). We discuss and illustrate challenges within the PESTEL framework below with brief examples from logistics markets:

Political:

As a legislative force, politics (e.g., government policies) significantly impact logistics actors located in a particular jurisdiction and their supply chains due to dependencies on other transport modes and countries. For instance, geopolitical tensions with corresponding import tariffs, airline re-routings in restricted airspace (e.g., those prompted by the Russia-Ukraine conflict), or a complete economic boycott can contribute significantly to the volatility of freight prices.

Economic:

Since players in logistics markets, such as shippers or LSPs, are dependent on the general economic situation and trading activity, financial risks are considered a significant volatility component (Lim et al., 2019). For example, freight rates are affected by exchange rates, general stability of oil prices, or raw material availability, which are also subject to external influencing factors, so precise forecasts are often impossible, and the costs are often incalculable. For this reason, clauses such as the diesel floater have emerged, especially in the contract market, to hedge

existential risks.

Social:

Demographic changes and a changing job profile pose challenges to the job market for the logistics industry. For example, the current shortage of truck drivers in road freight in Germany, estimated at 80,000, could reach 185,000 truck drivers by 2027 (IRU, 2019). Therefore, logistics personnel is already a determinant variable regarding the load space and a significant price trigger in logistics markets.

Technological:

The transport and logistics industry is undergoing a massive structural transformation, including different fields such as data analytics, automation, and new propulsion technologies (Tipping & Kauschke, 2016). On the one hand, competitive pressure is rising as shippers increasingly use technology to influence logistics processes while new entrants are seizing a value creation share through digital business models. On the other hand, incumbent LSPs are challenged by the need to determine how and to what extent they should commit themselves to adopt technological improvements and radical innovations.

Environmental:

The ongoing climate crisis and increased emphasis on environmental factors increasingly create pressure for shippers and LSPs to reduce (carbon) emissions during transport. In this regard, The EU considers emissions trading schemes using CO2 certificates in transport logistics, especially in road and sea freight (Hütten, 2021). For example, the EU's Fit for 55 package for marine shipping intends to reduce greenhouse gas intensity of energy by up to 75% by 2050.

Legal:

In Germany, the Supply Chain Act, which sets requirements for the due diligence of companies to monitor social and environmental standards, will come into force at the beginning of 2023 (BMW, 2021). Within supply chains, this

will likely result in significant changes in supplier structures and may lead to a re-regionalization of production, thereby directly impacting logistics markets and the freight price volatility of individual transport modes.

Practical challenges



Based on the PESTEL analysis, several variables affect the overall volatility of freight prices. Applied to the individual transport modes, different practical challenges for transportation via air, sea, road, and rail emerge, pushing shippers, intermediaries, and carriers to adapt to a constantly changing environment. We discuss and illustrate critical challenges within each transport mode below:

Sea freight is characterized by its boom-and-bust cycles, with many years of low rates where shipping lines did not earn their cost of capital (Saxon & Remes, 2021). However, amplified by the COVID-19 crisis, sea freight was confronted with a myriad of challenges: Congestion at ports, blank sailings, container misallocations, the Suez Canal blockage, and an overall increasing supply chain slowdown, leading to widespread supply bottlenecks and an explosion in sea freight (spot) rates. As a result, shipping lines "passed the buck" to shippers who were challenged to remain profitable due to increased rates. On the one hand, LSPs generate higher revenues but at the same time face uncertainty in operations (e.g., port congestions), complicating transportation planning. On the other hand, shippers must spend more for shipping services, face long lead times for their shipments, and accept increased costs of tied-up capital, indirectly increasing the attractiveness of other modes of transportation, such as air freight.

Air freight rates have historically been stable at a low level, given the global underutilization of capacity (at 50%) as passenger airlines expanded into new markets (Häberle & Stölzle, 2020). However, during the COVID-19 crisis, rates exploded due to the sudden loss of belly capacity, with airlines withdrawing contracted volumes. In addition to a shrinking availability of cargo space, the need for personal protective equipment (PPE) led to severe freight rate increases. While carriers faced the challenge of maintaining their operations in compliance with sanitary regulations, shippers were confronted with margin pressures as spot market prices increased tenfold (Whelan, 2021).

Road freight is characterized by low profitability margins, poor asset utilization, and multiple competing providers, leading to a commoditization of transportation services. In addition, new (digital) entrants are upsetting the industry by depressing prices, shifting volumes, and further intensifying competition among carriers and freight forwarders. Meanwhile, mandated rest periods further aggravate the ongoing truck driver shortage. In light of these developments, intermediaries and carriers must improve asset utilization and eliminate empty runs to remain competitive, while shippers are encouraged to secure capacity for their transportation needs.

Rail freight is affected by comparatively low price fluctuations, resulting in high price stability. However, this stability results from an oligopoly of rail operators on the supply side (Vanelislander, 2019). This market situation implies less market efficiency in terms of profit maximization. Instead, prices are adjusted based on developments in competing transport modes. Accordingly, shippers face the challenge of paying higher prices for historically stable logistics services. In addition, there are problems related to customs and border crossing on international routes, such as the Małaszewicze-Brest border crossing between Poland and Belarus on the New Silk Route (van Leijen, 2022). Lastly, severe storms or infrastructural disruptions (e.g., the Rastatt Tunnel in Germany 2017) have repeatedly led to operational delays or even the closure of essential rail routes in the past, posing significant challenges for shippers and rail operators.

Theoretical gaps



Given the practical challenges shippers and LSPs face in the market, research has – until now – mainly focused on price changes in maritime trade, for example, by identifying economic-related shipping cycles such as trough, recovery, peak, and collapse within which freight rates develop (Ferrari et al., 2018). Although authors such as Christopher and Holweg (2011, 2017), Barlas and Gunduz (2011), and Nitsche (2019) have already addressed the causes of volatility in supply chains, their research primarily focuses on volumes and the study of specific drivers of these fluctuations. In contrast, authors such as Childerhouse et al. (2008) or Handfield et al. (2013) only address supply chain volatility mitigation capabilities. A holistic overview of the problem space of relevant freight price volatility sources and the solution space covering actor-specific practices is not yet available. However, a basic understanding of the phenomenon is necessary to derive appropriate mitigation measures. In addition to these prevailing theoretical gaps, rapid advancements have brought about a host of new influencing factors that have fundamentally altered the fluctuations of volatile market prices. Key factors to consider include globalization, increasingly complex material flows, and the emergence of supply chain networks (Nitsche, 2019). Simultaneously, digitization is giving rise to new digital business models and new trade relationships that are not, or insufficiently, highlighted in the literature (Mikl et al., 2021). As already shown, companies operating in the logistics markets, such as shippers and LSPs, are not unaffected by these changes. Therefore, research on managing volatility in logistics needs to be revisited.

Conclusion

Given the practical challenges and theoretical gaps, it is

essential to provide recommendations for shippers, intermediaries, and carriers to navigate through an increasingly complex environment. Contrary to the intuition arising from the above, the management of price fluctuations in practice is rare, and the question arises as to why systematic volatility management is only practiced to a limited extent. A possible explanation is that freight procurement was not (as) necessary in the past as shippers focused extensively on the procurement of goods by cutting costs and taking advantage of lower labor costs in emerging markets (den Butter & Linse, 2008). Accordingly, freight purchasing was assigned a minor role compared to the procurement of materials and commodity groups. Furthermore, fluctuations in transportation costs were often attributed to volatile wage costs and uncontrollable external variables such as oil prices (Nitsche, 2019). The COVID-19 crisis has made it clear how immature the management of volatility has been so far and what impact (e.g., bullwhip effect) different volatility drivers can have on the existence of companies if not managed appropriately (e.g., visibility). If nothing else, the COVID-19 crisis has made the need for a deeper examination of volatility and related drivers evident.

This study starts at the interface between theory and practice and attempts to fill the gap between practice and academic research in understanding and dealing with freight price volatility in logistics markets. To this end, the present study makes a significant contribution by identifying the various sources of volatility and deriving reasonable practices to address the inherent volatility of freight prices. In this context, the scientific examination and reappraisal of freight price volatility management shed light on management approaches for handling different logistics scenarios.

3

Methodological approach

The following chapter outlines the underlying methodology of the present study. Due to the high practical relevance of the underlying study topic, engaged scholarship, following Matthiassen (2017) and Van de Ven (1971), was chosen as a methodological framework. Engaged scholarship is fundamentally characterized by a participatory approach to research, using multiple viewpoints and ideas from relevant stakeholders to examine complicated real-world situations (Mathiassen, 2017).



Following Kuckartz (2014), we propose a mixed-method approach to answer the underlying research questions. Therefore, Chapter 3 is divided into three parts, which are discussed in more detail below to explain the methodology step-by-step.

First, Chapter 3.1 describes the desk research conducted for the literature review and the definition of logistics scenarios.

Second, Chapter 3.2 deals with the nominal group technique (NGT), which was applied within the consortia to develop an understanding of freight price volatility sources.

Third, Chapter 3.3 elaborates on the interview process used to extract practitioners' knowledge concerning practices by which to reduce freight price volatility.

3.1 Desk research

Period

- August 2021

Objectives

- Definition of homogeneous logistics scenarios for the analysis of adequate measures by which to deal with freight price volatility

Approach

To address the high complexity of transport price developments in logistics markets, we do not consider a homogeneous analysis of transport prices appropriate for the entire logistics market. Instead, due to the high diversity of services offered, there is a need to divide the logistics market into homogeneous submarkets to reduce complexity and identify segment-specific dynamics (Gleissner & Femerling, 2016; E Hofmann & Wessely, 2012; König, 2001). To this end, we identify segments susceptible to different market fluctuations. Following pertinent literature (Hofmann & Wessely, 2012), we use established criteria for segmenting logistics scenarios to investigate the volatility of freight prices in logistics markets. Hofmann and Wessely (ibid.) distinguish the following eight segmentation criteria: type of logistics object, means (and technologies) of transport, size of logistics object, logistical function, industry reference of the logistics object, performance character, dimension of goods transformation, and type of goods. Since not all segmentation criteria are equally relevant for the analysis of freight price volatility, we exclude individual criteria for the study of logistics scenarios in the following.

First, we exclude the criteria **type of goods** and **size of logistics object**, as we assume that the size or weight of goods do not fundamentally drive freight price volatility but that other, often macroeconomic factors are underpinning them. In addition, although transport prices for certain goods certainly vary by season (e.g., fruit season), this criterion exceeds the scope of the present study due to the large variety of products. Accordingly, it seems less suitable as a criterion for segmenting logistics scenarios to

analyze freight price volatility.

Second, we ruled out the criterion of **logistical function** in the context of this study, as we have already limited our object of investigation to the transportation process of shipments. Therefore, we do not consider further distinctions between logistical functions such as warehousing or order fulfillment.

Third, we omit the criterion **industry reference of the logistics object** from our investigation since addressing the specific details of individual industries and product diversity would place too much focus on individual industry segments. Accordingly, this study does not present results for specific industries (e.g., temperature-controlled transportation for the pharmaceutical industry).

Fourth, we exclude the criterion **performance character**. Although transport prices in the spot market and the contract market on different transport modes sometimes develop entirely independently, this view is implicitly taken into account in the study and is not used as a strict criterion to distinguish between different scenarios.

Based on our exclusion measures, we consider the following criteria to be essential for the study of price volatility in logistics markets:

First, there are significant differences in freight prices depending on the **transport mode**. In this context, air, road, rail, and sea freight are subject to different dynamics. For example, while road freight primarily suffers from a shortage of drivers, air freight struggled with the loss of belly capacity during the COVID-19 crisis, and sea freight experienced a bottleneck of containers in certain regions.

Second, we consider the **dimension of goods transformation** by distinguishing between national, international, and global transportation. While national transports are subject to regional effects that affect transport prices, a

further distinction between international and global transport seems useful. One reason for this is that country-specific features characterize international transport (e.g., cabotage restrictions in road freight transport), while global transport is often subject to increased complexity.

Third, we include the segmentation criterion **type of logistics object** to distinguish between freight shipping of FTL, LTL, general cargo, containers, and unit load devices (ULD). This is because other transport objects are subject to different dynamics and are, to some extent, based on different types of production. For example, cargo networks (e.g., Elvis) usually govern general cargo transport in road

freight, requiring a significantly higher coordination effort and resource input in the “production” of the service compared to FTL and LTL transport.

In summary, we propose a segmentation of logistics markets according to the **mode of transport**, **dimension of goods transformation**, and **type of logistics object**. Based on this three-level segmentation, we differentiate our study of freight price volatility into four different logistics scenarios. Figure 2 illustrates the four scenarios based on the underlying segmentation:

Figure 2

Overview of the four selected logistics scenarios



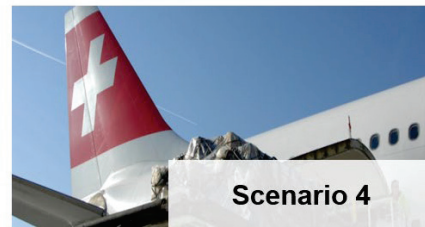
Sea – Global – Container



Road – National, International – FTL,
Road – National – LTL, general cargo



Rail – International – Container
(wagonload, blocktrain, intermodal)



Air – Global – ULD
(Belly, Freighter, Charter)

3.2 Nominal group technique

Period

- August 2021 to May 2022 (seven workshops)

Objectives

- Classification of influencing factors and their relations in the context of transport prices
- Elaboration and validation of management practices within each scenario

Approach

In addition to the desk research described in Chapter 3.1, we apply the NGT following Delbecq and Van de Ven (1971) to ensure practical examination of relevant factors and data triangulation. The NGT is a suitable methodological instrument for this purpose, as it distinguishes between the description of a problem and its solution (Schoenherr et al., 2012).

In the first step, we prepared the group exercise and assembled a group of 10 participants. The consortium's practitioners were all logistics experts who worked in either a supply chain role (shipper, LSP) or acted as service providers who, based on their claims, suffered severe freight price unpredictability in their own companies or those of their clients. We conducted three group exercises in August, September, and October 2021 (workshop series 1) dealing with freight price volatility sources and four group exercises in November and December 2021 and March and May 2022

(workshop series 2) dealing with management practices. Each workshop was supervised by two scholars (one professor and one Ph.D. student), with seven practitioners participating on average. Due to COVID-19 regulations, we performed each workshop digitally, as we were not allowed to conduct them face-to-face. In the first workshop series, we asked participants to identify their understanding of volatility and the underlying sources. Based on the participants' knowledge, the concept of volatility was first defined and delimited in the group discussion. Then, following the round-robin procedure, participants were asked to present sources of freight price volatility to the consortium. Each practitioner explained how a particular source impacts business operations and detailed their evaluation. Based on the discussion, a longlist consisting of 35 sources of freight price volatility was created and revised based on pertinent literature (Barlas & Gunduz, 2011; Christopher & Holweg, 2011; Christopher & Holweg, 2017; Nitsche, 2019). In a final step, the researchers presented the longlist, discussed it with the practitioners, and derived four overarching dimensions for the drivers of volatility. Chapter 5 presents descriptions of each dimension and volatility source. In the second workshop series, we elaborated on management practices in dealing with the defined volatility sources in each scenario. Thereby, the consortium of practitioners allowed for data triangulation by elaborating on and validating the practices collected via expert interviews.

3.3 Expert interviews with practitioners

Period

- August 2021 to February 2022

Objectives

- Identification of good practices in dealing with freight price volatility in logistics markets

Approach

After exploring different sources of freight price volatility based on the NGT proposed in Chapter 3.2, the derivation of concrete measures in dealing with the volatility of freight prices provides insight into the practical implementation of practices by which to deal with associated volatility sources. For this purpose, we conducted extensive expert interviews to answer the research questions. We used a non-standardized interview approach by pre-structuring an open questionnaire (Spöhring, 1989) to ensure that the questions relevant to the research would be addressed in their entirety. Against the background of the high complexity of freight price volatility (management), a qualitative guideline interview was considered beneficial to gain a deeper understanding of the research questions under investigation (Mayer, 2013).

The expert interview is a survey instrument used in empirical social research to obtain qualitative data and divulge individual perspectives and knowledge. As a qualitative research method, expert interviews are beneficial for exploring emerging phenomena (Recker, 2013) which applies to the present study since managing freight price volatility remains an under-researched area.

In this section, we explain our methodological procedure based on (1) the design of the interview guideline, (2) the selection of experts within the research project, (3) the underlying interview process, and (4) the coding of the interview results.

Step 1: Design the interview guideline

First, we designed a comprehensive interview guide to provide a foundation for the expert interviews based on the four logistics scenarios. The discussions covered shippers', intermediaries', and carriers' own experiences within the different logistics scenarios regarding appropriate measures for addressing the volatility of freight prices. In formulating the guide, we took care to keep the questions as precise as possible without suggesting specific answers to the respondents. We divided the interview guide into three overarching management stages, which are briefly described below and further explained in Chapter 6.2.

Question cluster 1 is dedicated to the **ReStrain** management stage and addresses practices that have proven to be effective from the perspective of the individual actors in dealing with the volatility of freight prices in the context of "business as usual."

Question cluster 2 focuses on the **ReAct** management stage and thus on good practices actors in the individual logistics scenarios apply during disruptions.

Finally, question cluster 3 addresses the **ReThink** management stage and examines potential developments experts envision in the future to rethink existing strategies to better manage the volatility of freight prices.

We asked the experts which practices individual actors can implement for each of these management stages by leveraging information sources, organizational capabilities, partnerships along the supply chain, or digital business models and solution providers. By making distinctions between different management stages and different dimensions of practices, we intend to draw a holistic picture of the practical situation. Table 1 briefly illustrates the central questions for conducting the expert interviews.

Table 1

Overview of the interview guideline

Interview guideline	
Question cluster	Expert knowledge
Introductory questions	Personal experience of the expert concerning freight price volatility
ReStrain	Applied practices to manage freight price volatility during the "business as usual"
ReAct	Applied practices to manage freight price volatility during a disruption
ReThink	Future practices and strategies to manage freight price volatility

A semi-structured interview protocol was developed based on the four topic clusters presented in Table 1. We designed the questions to first ask about the respondents' personal experiences concerning freight price volatility and the experts' firm understanding. Then, in a second step, practices were examined based on the cluster-specific questions to assess good practices in dealing with freight price volatility. A detailed overview of the questionnaire can be found in the Appendix.

Step 2: Selection of experts

The selection of experts primarily aimed at generating as much information as possible to answer the underlying research question. The expertise obtained using this approach makes it possible to establish connections to other bodies and forms of knowledge to reflect on the relevance of one's knowledge (Hitzler, 1994). For this purpose, we contacted 224 potential interview partners to conduct the guided interviews. The potential candidates for the expert interviews were sought and selected from the author's project network. Experts were approached based on their competence profile in logistics markets and their experience with freight price volatility. In selecting experts, care was taken to adopt different perspectives (Mayer, 2013). We interviewed roughly the same number of shippers, intermediaries, and carriers for each logistics scenario. In line with Gracht and Darkow (2010), the following expert selection principles were applied:

- (1) position and responsibilities within the company,
- (2) knowledge and experience within the field,
- (3) willingness and time to participate.

Step 3: Conducting the interview

We conducted the potential experts by mail, informed them about our research, and briefed them on the pre-defined questions of the guideline. Finally, we conducted 44 semi-structured interviews with respondents within the four logistics scenarios. To ensure consistency and comparability of the interview results, we ensured that the same researcher interviewed all 44 respondents. An overview of the interviewed experts can be found in the Appendix. Interviews were conducted between September 2021 and February 2022 using the "Microsoft Teams software" and lasted 40 to 75 minutes. During the interview, statements were first digitally recorded and then transcribed with "Word Web 365". During the transcription process, we took care to adapt dialect expressions into written language and transcribe statements as literally as possible to maintain a high level of authenticity and information quality. In addition, we only summarized or abbreviated the respondents' statements when sentences were highly complex. Finally, the statements were structured thematically and assigned to the individual, predefined topic clusters.

Step 4: Coding the interview

In a qualitative research approach, data available in text form must be analyzed and interpreted. In the case of this study, the text data is primary data from the self-collected expert interviews, which we systematically analyzed according to Gioia et al. (2013).

In line with Gioia et al. (ibid.), the overall goal of the coding process is to cluster first-order interview concepts and coding patterns into second-order themes and further distill the resulting clusters into more aggregated dimensions. Thereby, a degree of order reflects the compression of data material within the coding process (Mayring, 2015). To identify good practices in dealing with freight price volatility in logistics markets, we coded and interpreted the interview results using a deductive research approach (Ezzy, 2002). The analysis grid consists of four sections: the logistics scenario to be studied, the management stage, the management dimension, and the assignment to a specific actor perspective. In the first step, a rough structure for coding was applied based on the relevant logistics scenario and the management stage. This general pattern was refined and complemented in a second step by encoding the generated interview data into the four pre-defined management dimensions. Finally, we assigned interview results to a specific actor perspective as codes within each management dimension and stage and condensed the data into superordinate observations. Chapter 7 presents the results of the coding procedure and the overall interview series, along with an analysis of logistics scenarios.

SECTION A

Key study results

Section A evaluates various sources of freight price volatility and analyzes best practices in four different logistics scenarios. Thereafter, it provides practitioners with guidance on developing appropriate strategies for dealing with freight price volatility based on six analyzed mini cases. Finally, we derive challenges and trends related to the Russia-Ukraine crisis for logistics markets.

4

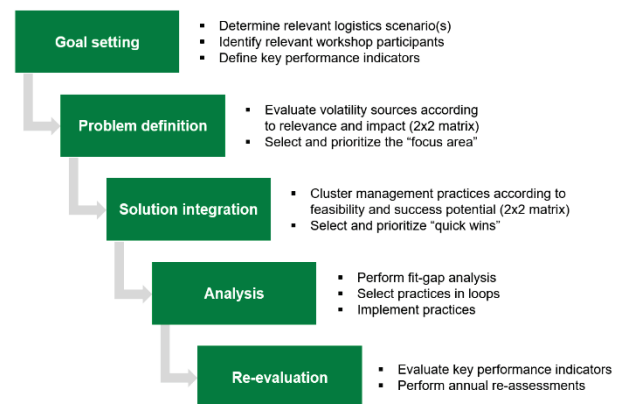
Practitioner's guide



This study aims to provide practitioners with a compendium and working material to examine freight price volatility management more closely and encourage actors in logistics markets to explore alternative management approaches. Therefore, before we present the study results in the following chapters, this chapter offers a concise overview in the form of a guiding volatility management process to help practitioners better understand the applied research design along with the obtained results, thus offering the reader an understanding of feasible implementation options. The volatility management process aims to assess the current company-specific exposure to volatility sources and identify good practices to compute volatility management gaps, which can be used to direct managerial actions toward creating and maintaining balanced freight rates. Figure 3 illustrates the different steps of the volatility management process.

Figure 3

Overview of the volatility management process



Step 1: Goal setting

The first step in the volatility management process is to define the scope of logistics scenarios. If more than one logistics scenario applies, it is rational to assess which logistics scenario is most affected by volatile freight rates. We distinguish four different logistics scenarios:

- **Scenario 1:** Sea – Global – Container
- **Scenario 2:** Road – International, National – FTL, Road – National – LTL, general cargo
- **Scenario 3:** Rail – International – Container (wagonload, blocktrain, intermodal)
- **Scenario 4:** Air – Global – ULD (belly, freighter, charter)

Managing volatility requires considering the viewpoints of different logistics actors. Therefore, we recommend running a cross-functional workshop covering the different perspectives on freight price volatility. Workshop participants should include different actors (shippers, carriers, and intermediaries) and team representatives from multiple levels (strategic, tactic, operational).

In addition, participants should represent different functional areas (e.g., LSP: commercial department, planning department, fleet operations), which must be tailored to the scope of operations. This approach ensures complete insights concerning a logistics scenario and facilitates implementing functioning volatility management and a structured volatility assessment.

Lastly, to allow for goal setting, participants should agree on logistics-related key performance indicators (KPIs) that

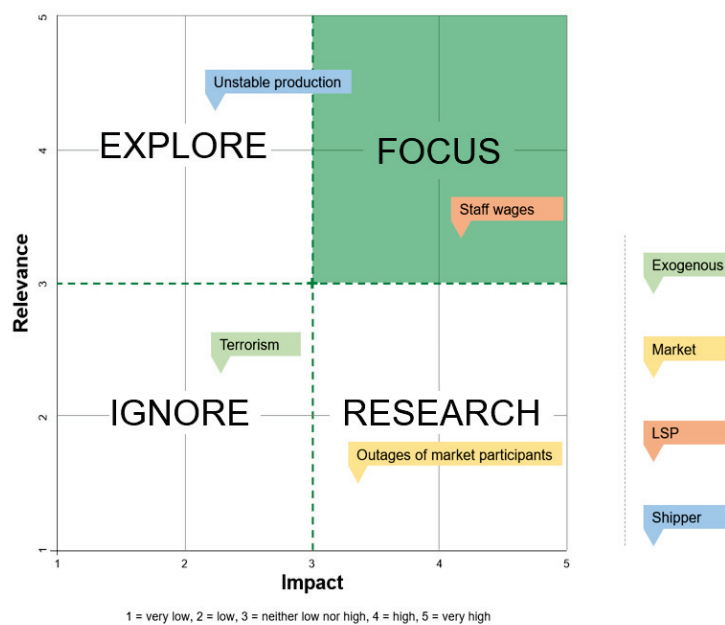
they want to improve, such as transportation cost, asset utilization, or perfect order fulfillment.

Step 2: Problem definition

The assessment includes a discussion concerning each identified volatility source based on the tables in Chapter 5 to better understand the problem space and analyze the different perceptions of volatility exposure. Participants can indicate their level of agreement with each volatility source on a scale ranging from 1 (do not agree) to 5 (fully agree). Our process involves classifying the different volatility sources in a matrix with the two dimensions of relevance and impact. It is important to discuss where each participant's problems lie to understand the shipper's or logistics partner's perspective. We recommend consolidating the assessment of each participant and focusing on high-relevance, high-impact volatility sources by using the template illustrated in Figure 4.

Figure 4

2x2 matrix for assessing the volatility sources according to relevance and impact



Step 3: Solution integration

Based on the identified practices within each logistics scenario in Chapter 7, we recommend selecting adequate practices for the pre-defined logistics scenario and categorizing them in a similar 2x2 matrix by indicating a specific

level of agreement on a scale from 1 (do not agree) to 5 (fully agree) concerning the two dimensions of success potential and feasibility.

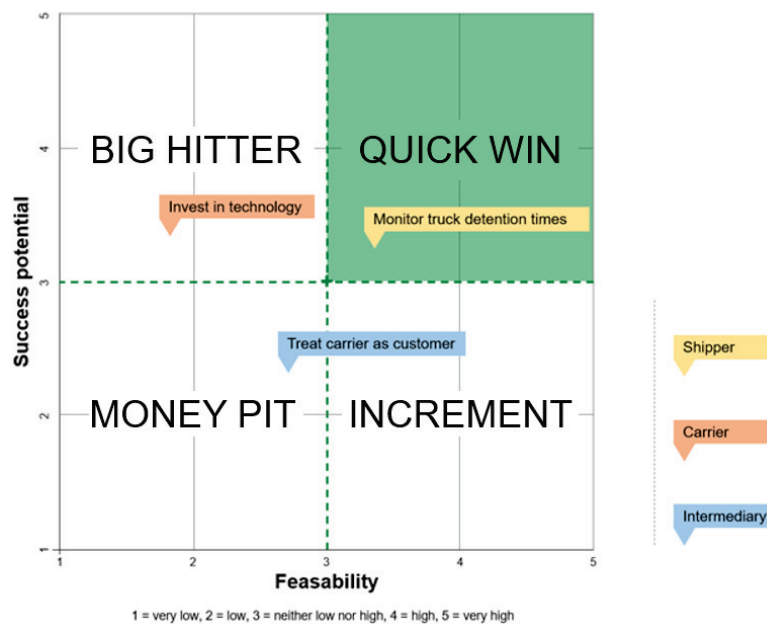
On the one hand, the dimension of success potential should encompass achieving cost savings, efficiency in

logistics processes, or reliability and service quality. On the other hand, the dimension of feasibility should confirm that implementing a distinct practice is possible and does not present a participant with an unsolvable challenge.

Therefore, we recommend consolidating the assessment of each participant and prioritizing those efforts with a high potential for success and high feasibility for implementation by using the template illustrated in Figure 5.

Figure 5

2x2 matrix for assessing adequate practices according to feasibility and success potential



Step 4: Analysis

Place the created matrices of relevant and impactful sources with the most successful and feasible measures on top of each other and determine whether there are matching points. If this is the case, discuss options to implement the identified practices (“quick wins”). If not, look for measures with lower success potential (“big hitter”) or feasibility (“increment”) to mitigate the volatility sources. Our process involves questioning whether implementing identified measures is feasible without external help or whether implementation requires a partnership approach. For this purpose, we recommend using the segmentation into the four management clusters, informational, organizational, partner, and solution provider, which is detailed in Chapter 6.1. For further information regarding external information

sources or solution providers, we present a comprehensive analysis of tools and indices in Chapter 9.

Step 5: Re-evaluation

Organizations and markets are inherently dynamic (as indicated by the concept of VUCA). Therefore, we recommend putting periodic (re-)assessments in place. These should encompass continuous (re-)assessments of implemented measures to determine whether the desired effects have been achieved or whether further efforts are needed to reduce the volatility of freight prices. This requires monitoring pre-defined KPIs that can illustrate changes in volatility to re-evaluate the measures put in place over time. We recommend aligning and harmonizing KPIs among logistics partners and re-administering the volatility management process at least annually.

Working with the guideline and the study results

Prepare a workshop

We propose adopting the practitioner guide offered in Chapter 4 in the context of a workshop to obtain the greatest potential benefit from the study findings. Integrating different viewpoints ensures a group formation as varied as possible (e.g., team representation from many levels). We recommend going through the five phases in smaller groups (option 1) or discussing them in a large group (option 2).

Make use of our workshop template

Our MURAL template (see QR-code) provides a basis for workshop planning in a clear and organized manner as an addition to the written practitioner's guideline. The template allows running a digital workshop immediately based on the five steps mentioned in this chapter. However, we believe physical interaction and communication between workshop participants are at the heart of any workshop ideation. Therefore, we propose converting our digital template into a physical workshop environment and conducting a session on-site to tailor the procedure to a specific business setting.

Create an action plan

We consider it critical to emphasize the actual workshop results by capturing key insights in a precise and digestible way. Summarizing and writing down the results will not only sharpen understanding and help communicate the next steps but also help to refine the identified practices in the future. We propose not to carve an action plan in stone after the workshop since managing freight price volatility is an ongoing process requiring regular re-evaluation.

Workshop template in MURAL:

QR code:



URL: shorturl.at/mprsO

5

Volatility sources

Following the practitioner's guide to implementing the results of the present study and the volatility management process, this chapter examines the different volatility sources investigated in this research. In general, volatility is a quality or state that tends to change quickly and unpredictably (Merriam-Webster, 2022). Changes can be expressed in absolute and relative terms, where the degree of variation determines the extent of volatility. In finance, variance and standard deviation are common measures used to describe volatility in a time series (Pinches & Kinney, 1971). Applied to logistics markets, the term volatility can describe the development of different logistical parameters such as delivery quantity, freight prices, or capacity utilization over time (Bridgman, 2010; Childerhouse et al., 2008; Wong & Hvolby, 2007).

After years of relative stability, various studies indicate an increase in the overall volatility of logistics markets (Christopher & Holweg, 2011; Christopher & Holweg, 2017), with the industry facing a steady rise in the volatility of transport volumes, especially in international traffic. As a result, LSPs are increasingly experiencing costs to cover peaks and unused capacities, putting pressure on transport rates (Wittenbring & Gburek, 2013). However, despite the theoretical debate and the broad exposure to volatility by practitioners, an initial survey showed that freight price volatility is defined differently among actors in logistics markets. Table 2 presents several practitioners' statements regarding their understanding:

Table 2
Practitioners' understanding of volatility

Expert	Individual understanding of freight price volatility
A	"The relatively short term but substantial change in freight prices or surcharges."
B	"Freight prices in the spot market versus longer-term developments, related to supply and demand fluctuations, fuel prices (floaters), traffic pairings, and regional and seasonal effects."
C	"Constant fluctuations of transport prices, especially from overseas/Asia. The level can usually not be estimated in advance."
D	"Seasonal factors such as Chinese New Year, year-end business, undercapacity of containers and means of transport, high demand, and controlled capacity reductions (blank sailings)."
E	"We consider freight price volatility to be influenced by the market, seasonality, oil prices, supply and demand, and many more."
F	"The availability of loading spaces for different modes of transport, the influence of the oil price (carbon footprint), and external, political influences."

Table 2 indicates that freight price volatility is perceived as manifesting in different ways depending on the stakeholder perspective and that a uniform understanding of relevant volatility sources is lacking. Therefore, building on the group exercise we conducted within our consortium, we developed a conceptual framework illustrating 35 observed sources of freight price volatility. We attribute each volatility source to one of the following dimensions:

- (1) Shipper
- (2) LSP
- (3) Market
- (4) Exogenous factors

Figure 6 illustrates the relationships between the sources and dimensions of freight price volatility. The following sub-chapters illuminate each dimension in more detail.

Figure 6

List of volatility sources induced by the shipper



5.1 Shipper

According to the participating experts in our group exercise, shippers determine a significant part of the mismatch between supply and demand, leading to sometimes unpredictable freight prices, especially in the spot market. As such, the dimension **shipper** includes volatility originating from the focal firm itself and represents the demand side. Table 3 provides overview descriptions of all the individual sources of volatility induced by the shipper in more detail.

In particular, we identify 11 sources contributing to this dimension: unstable production, inaccurate forecasting, availability of raw materials, world economic and trade activity, commodity cycles, supply chain design, irrational or disruptive consumer behavior, over- or underestimation of demand or supply signals, structural mismanagement, supplier capacity, and supplier reliability.

Table 3

List of volatility sources induced by the shipper

Unit of observation	Description
Shipper	Describes the volatility share caused by the fluctuating demand of shippers for transport services.
Unstable production	Describes the volatile demand as a direct result of the instability of a production process and mismatched or unstable production schedules.
Inaccurate forecasting	Describes the volatile demand as a direct result of inaccurate forecasts and the resulting discrepancy between forecast and actual customer demand.
Availability of raw materials	Describes the volatile demand as a direct result of the increase or decrease in imports caused by the availability and seasonality of raw materials and products (e.g., fruits).
World economic and trade activity	Describes the volatile demand as a direct result of changes in the world economy and, consequently, a shipper's own trade activity.
Commodity cycles	Describes the volatile demand as a direct result of seasonal and cyclical changes affecting commodities (e.g., spikes in demand for copper due to new technologies).
Supply chain design	Describes the volatile demand as a direct result of the supply chain design, including freight tonnage and average transportation distance measured in ton-miles.
Irrational or disruptive consumer behavior	Describes the volatile demand as a direct result of the unpredictability of consumer behavior (e.g., toilet paper shortage during the COVID-19 crisis).
Over- or underestimation of demand or supply signals	Describes the volatile demand as a direct result of erratic reactions to demand or supply signals from the shipper's side.
Structural mismanagement	Describes the volatile demand as a direct result of structural mismanagement regarding inventory, lead times, and sourcing strategies from the shipper's side.
Supplier capacity	Describes the volatile demand as a direct result of capacity deviations (inaccurate quantity or quality) originating from the supplier's side.
Supplier reliability	Describes the volatile demand as a direct result of low supplier reliability, including on-going costs and prices originating from the supplier's side.

5.2 LSP

Apart from the shipper's fluctuating demand, the experts believe that the supply side for transport capacities plays a significant role in driving volatile freight prices. Besides actual available capacity (e.g., loading space), behavior-related sources (e.g., blank sailings) constitute essential variables in this regard. Consequently, the dimension **LSP** includes the volatility share caused by fluctuating capacities and associated costs for transportation.

Table 4 provides overview descriptions of all the individual sources of volatility induced by the LSP in more detail. In particular, we identify nine sources contributing to this dimension: lead times, fuel prices, availability of loading space, availability of load carriers, availability of staff, staff wages, blank sailings, structural mismanagement, and price-fixing.

Table 4

List of volatility sources induced by the LSP

Unit of observation	Description
LSP	Describes the volatility share caused by the fluctuating capacity and associated costs offered for transportation.
Lead times	Describes the price volatility as a direct result of shorter shipping lead times, correlating with tighter capacities, higher prices, and fewer delivery options.
Fuel prices	Describes the price volatility as a direct result of fluctuating fuel prices and energy cost (minor role due to bunker adjustment factor and diesel floater).
Availability of loading space	Describes the volatile supply as a direct result of capacity deviations in loading space, including fleet stock, production, scrapping, and pairing of transports (e.g., missing belly capacity during COVID-19).
Availability of load carriers	Describes the volatile supply as a direct result of capacity deviations of load carriers, such as the shortage of (reefer) containers.
Availability of staff	Describes the volatile supply as a direct result of capacity deviations of staff, especially the shortage of truck drivers in road transportation.
Staff wages	Describes the price volatility as a direct result of fluctuating staff wages, especially in road transportation, due to the dependency on subcontractors.
Blank sailings	Describes the volatile supply as a direct result of skipped ports or canceled sailings as a behavioral measure to balance supply and demand from the carrier's side.
Structural mismanagement	Describes the volatile supply as a direct result of structural mismanagement regarding fleet management, especially fleet reduction, general overhaul, and scrapping rate.
Price fixing	Describes the volatile supply as a direct result of consolidation and potential price-fixing, giving carriers greater capacity control.

5.3 Market

In addition to volatility sources originating from individual actors in the logistics chain, experts indicate that the market in which shippers and LSPs operate strongly determines the price level of transport services. Consequently, the dimension **market** influences freight price volatility due to the market conditions in which the transport service is offered.

Table 5 provides overview descriptions of all the individual sources of volatility induced by the market in more detail. In particular, we identify eight sources contributing to this dimension: seasonal volatility, e-commerce, route volatility, competition, changing supply and demand behavior, market cycles, digital platforms, and outages of market participants.

Table 5

List of volatility sources induced by the market

Unit of observation	Description
Market	Describes the volatility share caused by the market conditions in which the transport service is provided.
Seasonal volatility	Describes the price volatility as a direct result of seasonal market cycles and customer demand, including Chinese New Year, Single's Day, Christmas, or Black Friday.
E-commerce	Describes the price volatility as a direct result of e-commerce, resulting in consumption peaks and an increased effort for carriers (e.g., road freight).
Route volatility	Describes the price volatility as a direct result of route characteristics, including higher volatility on longer routes with a lack of return cargo and a low frequency of offered services.
Competition	Describes the price volatility as a direct result of the level of competition, the balance between demand and supply, and thus, the prevalence of tight and soft markets with over-or under-capacity.
Changing supply and demand behavior	Describes the price volatility as a direct result of the changing behavior from LSPs ("cherry-picking" capacity, "bidding fatigue") and the shippers' side (low interest in long-term contracts, low quality, and frequency of tenders).
Market cycles	Describes the price volatility as a direct result of economic cycles, especially in the shipping market when supply and demand are out of balance.
Digital platforms	Describes the price volatility as a direct result of the growing adoption of digital platforms, including increases in spot-market activity.
Outages of market participants	Describes the price volatility as a direct result of the collapse of central market participants and a potential chain of insolvencies triggered by a domino effect.

5.4 Exogenous factors

As a fourth and final dimension, **exogenous factors** to the logistics chain such as political measures (e.g., national regulation), financial aspects (e.g., banking crisis), or environmental events (e.g., pandemics) influence the volatility of freight prices. Consequently, this dimension includes exogenous factors to the supply chain causing freight price volatility.

Table 6 provides overview descriptions of all the individual sources of volatility induced by exogenous factors in more detail. In particular, we identify seven sources contributing to this dimension: national regulation, pandemics, geopolitical disruptions, natural disasters, ecological factors, terrorism, and banking crises and liquidity shortages.

Table 6

List of volatility sources induced by exogenous factors

Unit of observation	Description
Exogenous factors	Describes the volatility share caused by factors stemming exogenous to the supply chain.
National regulation	Describes the price volatility as a direct result of national regulation, for example, the mobility packages or the Green Deal of the European Commission.
Pandemics	Describes the price volatility as a direct result of pandemics affecting shipping (e.g., port congestions) and air freight (e.g., belly capacity) directly and other modes of transport indirectly via plant closures.
Geopolitical disruptions	Describes the price volatility as a direct result of trade wars and isolation, including tit-for-tat tariff fights, for example, regarding customs clearance fees and protectionism leading to a decline in global trade and re-routings.
Natural disasters	Describes the price volatility as a direct result of natural disasters (e.g., tsunamis, volcanic eruptions) leading to delays or even shifts in cargo transportation.
Ecological	Describes the price volatility as a direct result of ecological awareness, leading to the utilization of alternative fuels or technologies, shifts in transport modes, or even production networks.
Terrorism	Describes the price volatility as a direct result of terrorism or sabotage, especially in sea freight, with, for example, carriers imposing piracy risk surcharges to cargo owners.
Banking crisis and liquidity shortages	Describes the price volatility as a direct result of a financial (e.g., stagflation) or global banking crisis leading to high uncertainty, risk, and liquidity shortages.

6.1 Dimensions

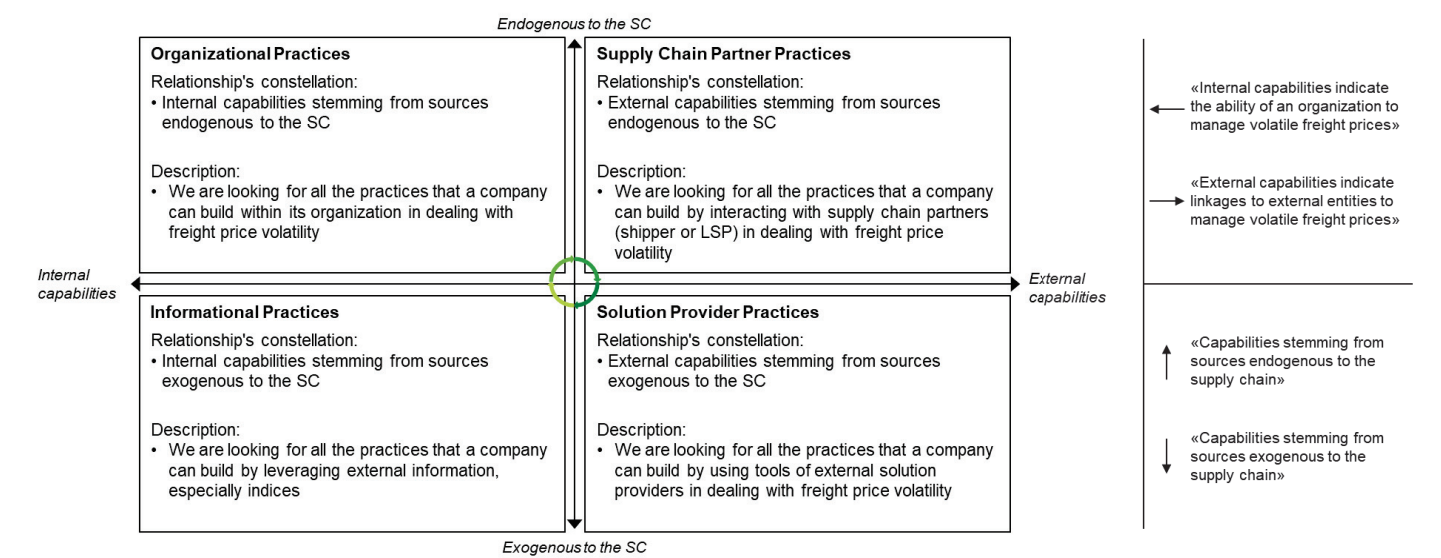
Our analysis of volatility sources shows that managing volatile freight prices requires establishing both internal and external management practices. Since the shipper or LSP itself induces a significant share of volatility, efficient management of freight price volatility starts with generating external information and aligning the organization (internal capabilities), as managing external partners and selecting adequate solution providers is impossible without internal alignment (external capabilities). In contrast, logistics actors need to distinguish whether a capability can be cultivated within the existing supply chain (endogenous to the SC) or whether it can be acquired from outside the supply chain (exogenous to the SC). Using these two criteria (internal vs. external capabilities; endogenous vs. exogenous

to SC), four management dimensions to navigate volatility in logistics markets can be differentiated:

- (1) Informational practices,
- (2) Organizational practices,
- (3) Supply chain partner practices, and
- (4) Solution provider practices

Figure 7 illustrates the freight price volatility management cycle within these four dimensions. In the following, we describe each management dimension in more detail to provide a firm understanding of freight price volatility management.

Figure 7
Four dimensions of freight price volatility management



Informational practices refer to internal capabilities stemming from sources exogenous to the supply chain and include all the practices that a company can build by leveraging external information, especially indices. Here we can identify different index categories measuring freight prices (e.g., spot price indices, charter rates), trade and economic activity (e.g., purchasing indices), navigation statistics (e.g., Suez Canal), and product information (e.g., oil prices), or sentiment indices. We discuss and present a

systematization of these index categories in chapter 9.1.

Organizational practices refer to internal capabilities stemming from sources endogenous to the supply chain and include all the practices that a company can build within its own organization to deal with freight price volatility. First, practitioners must build intra-organizational alignment of activities and goals among different departments. Especially for shippers, this means building interfaces

between the logistics department and others (e.g., sales and operations planning). In that sense, it is critical to establish proactive risk management structures to mitigate the effects of behavioral decisions and structural mismanagement. For instance, companies might introduce cost thresholds for freight (e.g., sea freight), where additional expenditures must be authorized. Second, practitioners must establish cultural governance, including organizational learning structures, to communicate the sources of volatility within an organization. This means that practitioners must discuss the adverse effects of their decision-making on the volatility of freight prices to identify and mitigate its impact. Especially in times of disruptions, it becomes crucial to increase the communication speed, for example, by deploying firefighters and task forces in critical times. Third, forecasting management must be anchored as a critical discipline within the organization and should include historical or statistical data (i.e., rolling forecasts) to get transparency into the forecasting process and review of order books. In this vein, practitioners must identify underlying drivers of deviations and reassess the forecast model to attain improved accuracy. Lastly, shippers and LSPs should continuously benchmark freight costs and identify inefficiencies during the transportation process. On the one hand, shippers should continuously monitor if other transport modes become more attractive for their transportation needs. On the other hand, carriers should constantly monitor how they can achieve higher efficiency within their transportation processes.

Supply chain partner practices refer to external capabilities stemming from sources endogenous to the supply chain and include all the practices that a company can build by interacting with other shippers or LSPs in dealing with freight price volatility. First, practitioners must target data exchange between logistics partners to initiate countermeasures early and generate a single source of truth that is easily accessible by relevant stakeholders (e.g., expected time of arrival). Second, practitioners must target trusting long-term relationships in dealing with increasing price dynamics, including early involvement in the forecasting process and joint behavioral analysis of forecasts.

Third, shippers and LSPs must define strategies regarding their contract management. For instance, actors must determine which capacities are fulfilled by fixed contracts and the spot market. For intermediaries, this process includes questioning their fleet management regarding inhouse ownership, subcontracting, and spot market. Fourth, shippers need to work with suppliers on the transportation process and develop joint strategies to address volatility. For instance, shippers might take an active role in the process instead of relying on a supplier to choose the carrier. Lastly, shippers and LSPs need to develop strategies to reduce the dependency on single partners and diversify business relations among industries and networks.

Solution provider practices refer to external capabilities stemming from sources endogenous to the supply chain and include all the practices that a company can build by using external tools to address freight price volatility. These digital business models typically include (1) marketplace solutions to exchange loads and capacities between shippers, carriers, and intermediaries; (2) service providers that offer their own production means and brokerage for shippers, and (3) software providers that provide transportation management services for logistics actors. We will further discuss these business models in Chapter 9.1.

6.2 Stages

In addition to the four dimensions described in Chapter 6.1, it is also necessary to distinguish between different management stages when addressing freight price volatility. For instance, while certain practices such as achieving planning certainty through long-term contracts are well established in many logistics areas, the consequences of disruptions (e.g., contract breaches) require an adaptation of measures.

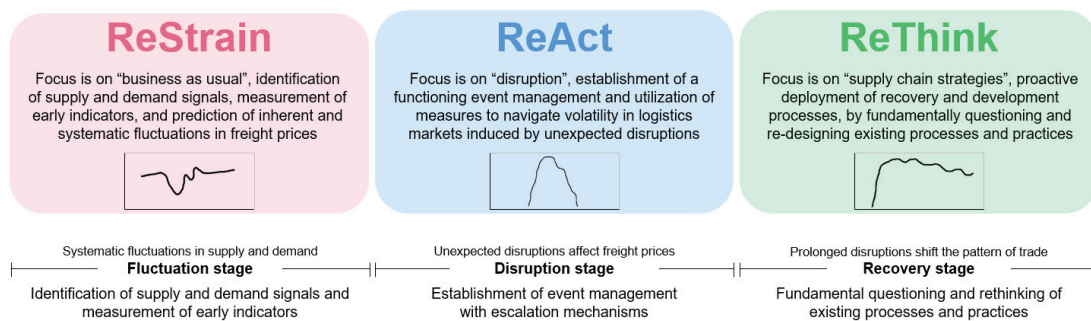
Therefore, we identify and differentiate between the following three stages of volatility management:

- (1) ReStrain
- (2) ReAct
- (3) ReThink

Figure 8 illustrates the three stages of freight price volatility management. In the following, we describe each stage on a step-by-step basis.

Figure 8

Three stages of freight price volatility management



ReStrain focuses on practices during "business as usual", encompassing the identification of supply and demand signals, measurement of early indicators, and prediction of inherent and systematic fluctuations in freight prices. Practitioners must apply distinct practices within the four selected management dimensions (informational, organizational, partner, and provider) to accommodate and address fluctuations in the business as usual.

ReAct focuses on practices during a "disruption", encompassing the establishment of functioning event management and the utilization of measures to navigate volatility in logistics markets introduced by unexpected disruptions. In this case, practitioners must adapt the individual practices within the four selected management dimensions based on the individual disruption facing logistics actors.

ReThink focuses on practices by which to develop new "supply chain strategies", encompassing a proactive deployment of recovery and development processes by

fundamentally questioning and re-designing existing logistical procedures. Again, actors are urged to adapt to a new environment and carve out new practices within the four selected management dimensions.

To conclude, each management stage requires an adjustment of practices within each management dimension. In addition to the different stages and dimensions, it is necessary to distinguish between different actors in logistics markets and their individual perceptions to derive good practices in dealing with freight price volatility. Given the interrelationships in logistics markets, practices should not be considered unidimensional but always in relation to each other. Therefore, the following section sheds light on three key actors requiring differentiated investigation within the framework of volatility management

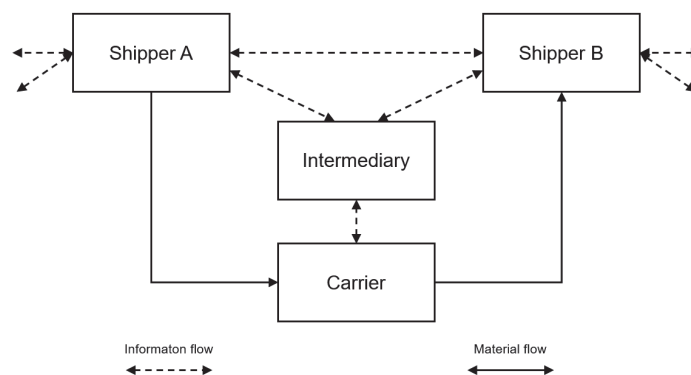
6.3 Actors

As indicated in the previous chapter, the interrelationships in logistics markets require a differentiated approach to identifying good practices in dealing with freight price volatility. Therefore, it is vital to set conceptual constraints regarding the unit (i.e., the entity under investigation) and level of analysis (i.e., the context the entity is placed in) for the volatility management framework (Halldórsson Á. & Arlbjörn J.S., 2005; Yurdusev, 1993). For example, a basic vertical cascade in logistics markets entails a shipper outsourcing logistics to a logistics intermediary, who in turn subcontracts with carriers covering different transport modes (Cui & Hertz, 2011). Consequently, we investigate

the perspectives of shippers, intermediaries, and carriers as units of analysis, in terms of how they manage freight price volatility. To narrow the scope, we observe the management practices of these three investigated actors in the context of dyad relationships as our level of analysis. In this way, the management framework ensures that the individual practices of the shipper, intermediary, and carrier are not viewed in isolation but rather placed in relation to each other. Figure 9 illustrates the three critical actors for freight price volatility management. In the following, we briefly describe each actor's role on a step-by-step basis.

Figure 9

Three critical actors in freight price volatility management (adapted from Stefansson, 2006)



Shipper (also 1PL)

Shippers are the party that tender goods for transportation from point A to B. Generally, the shipper bears the freight cost, except when otherwise stated in the transport contract before shipment.

Carrier (also 2PL)

Carriers are primarily involved with the transportation process. As such, carriers constitute the most basic form of LSP (Hofmann & Lampe, 2013; Sink et al., 1996) and are often called “second-party logistics providers”. We distinguish between airlines, shipping lines, road carriers, and rail operators for each of the four transport modes.

Intermediary (freight forwarder or 3PL)

Logistics intermediaries operate as a link between shippers and carriers, focus on the coordination of logistics processes, and may be asset-based or non-asset-based (Cui & Hertz, 2011). In general, logistics intermediaries include freight forwarders, consolidators, or brokers that focus on specific transport modes (Coyle et al., 2000). Intermediaries are often subcontractors of 3PLs. However, for the sake of simplicity, we do not further distinguish between these types of LSPs.

7

Logistics scenarios

Based on the previous distinction into three management stages, four dimensions of practices, and the three different actor perspectives, this chapter illustrates the key results of the present study. To this end, we present good practices in dealing with freight price volatility in a standardized spreadsheet format summarizing measures from the perspective of shippers, intermediaries, and carriers to derive individual recommendations for action.





Sea freight

886%

The increase in spot freight rates from China to Northern Europe for a 40ft container in 2021 compared to 2019

35%

The global schedule reliability stagnates at a record low of around 35%

65%

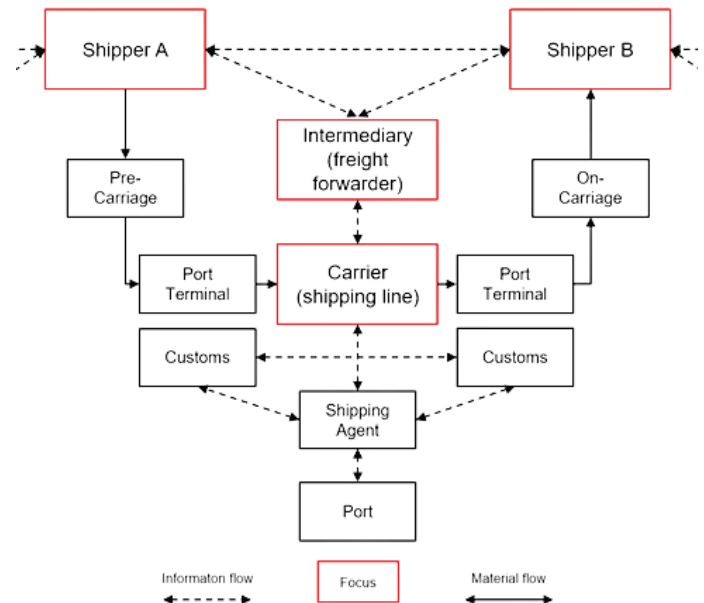
The container capacity provided by the top 5 shipping lines (Maersk, MSC, COSCO Shipping, CMA CGM, Hapag-Lloyd)

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Outlook

Background of the scenario

Sea freight represents the most important global transport mode and is characterized by its boom-and-bust cycles – many years of low rates where shipping lines were not earning their cost of capital, followed by skyrocketing freight prices during the COVID-19 crisis with shipping lines passing the buck to shippers. Within this scenario, we focus our unit of observation on shippers, intermediaries (who generally work as freight forwarders that do not own ships but organize the transportation process), and carriers (i.e., shipping lines). For these three actors, we analyze management practices within two business relationships: First, direct business relationships where large shippers (e.g., automotive) directly contract with shipping lines to receive discounts, and second, an indirect relationship where small to medium-sized shippers negotiate and contract with intermediaries. Figure 10 illustrates the analyzed actors, their relationships, and industry dynamics in sea freight.

Figure 10
Key actors in sea freight



Industry dynamics

Relevance

Implications

- **Most important global transport mode:** Efficiency gains in transport capacity and costs (manual bulk loading replaced by cranes; modular, standardized containers) and trade liberalization (e.g., lower taxes, tariffs) as drivers of globalization
- **Global Trade:** 80% by volume, 70% by value

Business relationships

- **BCO business:** Large shippers (e.g., automotive) directly contract with shipping lines to receive discounts
- **Intermediaries:** Especially small shippers negotiate with intermediaries

Rate development

- **Boom and bust cycles:** Many years of low rates where shipping lines were not earning their cost of capital
- **“Black Peter”:** With COVID-19 shipping lines passed the buck to shippers, where shippers are not able to do their business due to high rates

Competition

- **In the past:** Shipping lines were highly heterogeneous and competitive, i.e. some did not have optimal CRM systems; intermediaries were overselling since shipping lines were not networked. Thus, intermediaries earned a fortune as orchestrators and gold-plated their business
- **Today:** Block Exemption Regulation by the EU allows cooperations, 3 alliances constitute 11 shipping lines that are well networked, communicate with each other, and partially erode the forwarders' business

Managing business as usual (ReStrain)

Summary: Managing the business as usual in sea freight usually encompasses generating planning stability concerning freight volumes and prices by performing and optimizing annual tender negotiations. Pre-Covid, there was general overcapacity on most trades since shipping lines flushed new ships and capacities on the market, which partially led to opportunistic behavior to profit from cheaper sea freight rates. Shippers resorted to shorter contract terms (quarterly tenders) or the spot market to profit from cheaper freight rates, while carriers made opportunistic acquisitions to reduce costs, improve ship capacity management, and enhance efficiency. The following pages shed light on challenges and associated practices to better deal with the business as usual in sea freight.

Management stage	Challenges
Business as usual	▪ Shipper: Inaccurate forecasting (e.g., rolling forecast) as well as world economic and trade activity. ▪ LSP: High availability of loading space and overcapacity on most of the trades since shipping lines flushed new ships (~24.000 TEU) and capacities on the market leads to a low degree of volatility. Sky high fuel prices (e.g., in 2008) lead to shipping lines introducing Bunker Adjustment Factors and generating fuel savings by going slower (14 to 18 knots) ▪ Market: Seasonal volatility (e.g., Chines New Year) leads to fluctuations in prices. Route volatility, especially longer routes with lack of return cargo (import countries) and low frequency of transportation services suffer from higher volatility

Observation 1: Shipper, carrier, and intermediaries require planning stability concerning freight volumes and prices

Dimension	Actor	Practices
Organizational	Shipper	▪ Forecast and seek planning stability regarding the predictability of own (product) prices and budgets
	Intermediary	▪ Create baseload to diversify shipping lines and hedge (shippers) against risk (force majeure, blank sailing)
	Carrier	▪ Seek planning stability from shippers to make significant investments, such as investing in new equipment (e.g., sustainability), purchasing new terminals, expanding into new ports and shipping lanes, and diversifying shipping lines

Observation 2: Annual freight tenders are well established in the freight rate procurement process of (major) shippers

Dimension	Actor	Practices
Organizational	Shipper	▪ Tender (RFQ) for designated lanes (point to point), benchmark shipping lines (first capacity then prices) to secure power, and rates
	Intermediary, Carrier	▪ Tender business to secure volume (baseload) and revenue flow

Managing business as usual (ReStrain)

Observation 3: To optimize tender negotiation, actors especially consider the market, competition, and peak seasons

Dimension	Actor	Practices
Organizational	Shipper	- Monitor market, especially seasonal volatility in Asia, price fluctuations of commodities in the US - Understand industry and carrier competition on lanes - Avoid tenders in peak seasons (e.g., Asia-Europe after Chinese New Year)
	Intermediary	Consider the possibility of negotiating FAK rates with shipping lines
	Carrier	Participate only in those tenders focusing on essential lanes and geographical areas

Observation 4: Actors leverage external information sources to understand market developments

Dimension	Actor	Practices
Informational	Shipper, Intermediary, Carrier	- Consider reports (e.g., Alphaliner, Sea Intelligence) and spot price indices (e.g., BDI, FBX, SCFI, WCI) to understand market developments - Consider direct contracts of large shippers (BCO contracts) as early indicators for price developments of the overall market and trade lanes

Observation 5: Annual contracts and early renegotiation have proven to be effective in sea freight

Dimension	Actor	Practices
Partner	Shipper	- Commit and renegotiate contracts early. Receive transport cost transparency, improved service, and reduced costs in return for accepting minimum order quantities - Build consortium partnerships with other shippers (BCO network) to build bargaining power
	Intermediary	Commit to cargo volumes by consolidating cargo volumes of multiple shippers (attractive for shipping lines) and expanding the ocean carrier base (attractive for shippers)
	Carrier	- Offer “early bird” discounts for shippers who first start (re-)negotiating freight contracts to secure baseload - Introduce surcharges (e.g., bunker adjustment factor, port congestion, peak season) to cover existential risks

Observation 6: Pre-Covid: Partial tendency to opportunism to profit from cheaper sea freight rates

Dimension	Actor	Practices
Partner	Shipper	Resort to shorter contract terms (quarterly tenders) or the spot market to opportunistically profit from cheaper freight rates
	Carrier	Make opportunistic acquisitions to reduce costs, improve ship capacity management, and enhance efficiency

Managing business as usual (ReStrain)

Observation 7: Actors increasingly (seek to) leverage tools or provide services to build interfaces along the supply chain

Dimension	Actor	Practices
Provider	Shipper	Develop control towers to ensure data sovereignty and monitor disruptions (e.g., Migros LTOPEX Control Tower)
	Intermediary	Develop digital storefronts to offer up-to-date information and allow for predictive supply chain risk analytics (e.g., Kühne+Nagel sea explorer, DHL Resilience360 now everstream.ai)
	Carrier	Invest in marketplaces (e.g., Loadsmart) and develop platforms (e.g., Maersk Flow) to pursue end-to-end logistics

Managing disruption (ReAct)

Summary: Disruption management in sea freight encompasses shippers not being served with agreed quantities (only a flat quantity, canceled contracts, or blank sailings) and face high transportation costs, which, especially for low-value and low price-dense products, make up a vital part of the selling price. In addition, shippers and intermediaries are challenged as paying higher prices does not infer more control and not necessarily more reliable transport services offered by carriers. As such, shippers try to make deals with intermediaries and carriers to primarily secure capacity, not necessarily rates, and actors are increasingly dealing with the transportation process (e.g., time and port call). In addition, due to high uncertainty during a crisis, new relationships emerge, typically based on short-term contracts. The following pages shed light on challenges and associated practices to better deal with the disruption stage in sea freight.

Management stage	Challenges
Disruption	▪ Shipper: Irrational or disruptive consumer behavior (e.g., COVID-19) ▪ LSP: Blank sailings, availability of load carriers (e.g., (reefer) container bottlenecks and geographic imbalance), and increased lead times (e.g., congestions) lead to exploding sea freight rates ▪ Market: Changing supply and demand behavior (e.g., high imports in the US) ▪ Exogenous: Disasters (e.g., Suez Canal blockage) and port closures with increasing supply chain slow down (delivery delays and lower shipping reliability)

Observation 8: Shippers make deals with intermediaries and carriers to primarily secure capacity, not necessarily rates

Dimension	Actor	Practices
Organizational	Shipper	▪ Dodge to spot market ▪ Shift transport to air, partly rail, road, and postpone specific shipments (prioritize shipments with out-of-stock relevance) ▪ Consider shipper owned containers (SOC)
	Intermediary	▪ Strengthen own value propositions, for example, building warehouse space in dealing with restricted port operations
	Carrier	▪ Manage available capacity (e.g., blank sailings and refusing SOC) to maintain rates and margins

Observation 9: Actors are increasingly dealing with the transportation process (time and port calls)

Dimension	Actor	Practices
Organizational	Shipper	▪ Use cargo status reports in case of low reliability and accuracy of delivery time (e.g., ETA) ▪ Improve container use (e.g., container sizing, load configuration) ▪ Extend and adjust lead times (e.g., supplier lead time, delivery lead time, and tender lead times for carrier bookings)
	Intermediary	▪ Focus on “on-time reliability” to differentiate from the market
	Carrier	▪ Delete port calls from loops to improve on-time reliability

Managing disruption (ReAct)

Observation 10: During the crisis, new sources of information emerge and are increasingly used in sea freight

Dimension	Actor	Practices
Informational	Shipper	Use vessel tracking websites (e.g., Vesselfinder, marine traffic) to know, e.g., "which goods are in front of the Suez Canal?"
	Intermediary	Introduce market updates (e.g., DHL Ocean Freight Market Update) highlighting challenges in key markets and trade lanes
	Carrier	Introduce market updates (e.g., Maersk Asia Pacific Market Update) highlighting challenges in key markets and trade lanes

Observation 11: Due to high uncertainty during a crisis, new relationships emerge, typically based on short-term contracts

Dimension	Actor	Practices
Partner	Shipper	- Secure capacity on a monthly, enforceable basis - Do not enter long-term contracts in case of high uncertainty regarding price developments - Communicate with an extended portfolio of intermediaries and shipping lines - Charter small container ships (especially in BCO networks) - Review risk management policies (splitting cargo flows between shipping lines and intermediaries)
	Intermediary	- Intensify existing carrier partnerships - Charter (small) container ships to gain direct control of vessel assets as shippers struggle to secure space
	Carrier	- Cancel contracts (force majeure) and introduce surcharges (re-positioning, peak season) on existing contracts - Offer new contracts at A) fixed (increased) prices, B) fixed prices and binding volumes including "dead freight", or C) via the spot market - Introduce more value-added services (pre-carriage or on-carriage) - Offer long-term contracts (3 years) with staggered prices and assurance of loading space

Observation 12: Shippers and intermediaries claim carriers breach contracts to demand higher rates

Dimension	Actor	Practices
Partner	Shipper, Intermediary	Seek legal counsel for unserved volumes and terminated contracts with the objective of repressive measures and claims for compensation against them

Managing change (ReThink)

Summary: Disruptions such as the Suez Canal blockade or the COVID-19 crisis highlighted the need for shipment visibility to allow for fast decision-making. As such, visibility tools and control tower solutions will gain importance in sea freight to enable route optimization of shipments based on real-time data. In addition, shippers are rethinking their supply chain structures by reducing regional and modal dependency and shortening supply chains to improve time to market. Therefore, intermediaries and carriers are challenged to redesign their service offerings in new trade lanes. The following pages shed light on associated practices to manage change in sea freight.

Observation 13: Actors rethink freight procurement to address the underlying conditions, not just treat the symptoms

Dimension	Actor	Practices
Organizational	Shipper	Rethink regional (e.g., China) and modal dependency: ▪ Rethink inventory levels closer to production and customer especially concerning products affected by out-of-stock relevance ▪ Improve intra-organizational alignment (comprehensive sales and operations planning) ▪ Commit to higher quantities in advance (e.g., higher baseload and advancing volumes in fashion & retail) ▪ Rethink sources of supply, shift sourcing (China+1), production, and/or distribution locations (e.g., Southeast Asian countries) ▪ Postpone and shorten supply chains to improve time to market (e.g., Europe's best cost countries) ▪ Improve shippability of products and load configuration
	Intermediary	Rethink value propositions: ▪ Intensify services (e.g., warehouse space to help shippers ride out market dislocations due to limited port operations) ▪ Build supply chain visibility as a standard requirement ▪ Leverage informational and organizational capabilities as technology enable the combination and coordination of actors, and information arbitrage (through physical presence by local agents) will gradually disappear ▪ Intensify intermodal competencies as modal shifts (e.g., New Silk Road) become more important
	Carrier	Redesign service loops in new trade lanes: ▪ Build more capacities on (expected to be) more competitive routings (e.g., Suez Canal, Southeast Asia to Europe) ▪ Rethink last and first call port selections to shave multiple days off transit times ▪ Build competencies (e.g., air freight capabilities) to take off as vertical integrators and cut out intermediaries (one-stop-shop)

Observation 14: Actors require more accurate information for decision-making

Dimension	Actor	Practices
Partner	Shipper, Intermediary, Carrier	▪ Work on own data and information sources, especially in North America, where indices tend to be approximations, as there is a high dependency on on-carriage for costs (inland access, dedicated truck versus rail), and indirect BCO business, as Shanghai Containerized Freight Index (SCFI) or World Container Index (WCI) only capture spot rates

Managing change (ReThink)

Observation 15: Actors need to rethink their contractual agreements and opt for long-term relationships

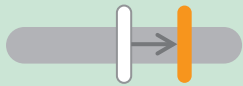
Dimension	Actor	Practices
Partner	Shipper	Rethink container allocation strategies (e.g., better capacity forecasting, sharing benefits with carriers, and concentrating volume with fewer partners): - Commit to a yearly allocation of volumes broken down by port pairs assigned to service strings, regular review of performance (on both sides), and rolling, shared forecasts every week (at least eight weeks out) - Rethink contractual agreements (e.g., longer-term, enforceable take or pay contracts, peak and slack season rate) to accommodate carriers, depending on the product value - Spread volume commitments among partnerships (freight forwarder, carrier, BCO network, or 4PL) to hedge bets while consolidating volume with fewer carriers to increase leverage with each one
	Intermediary	- Facilitate transport shifts and intermodal traffic - Develop proactive event management strategies (action plans) together with partners, e.g., offering carriers more choice and flexibility concerning port calls from which freight can be dispatched or received for shippers (port bundling) - Introduce dynamic pricing to leverage own margins
	Carrier	- Introduce transparency into sailing schedules to help shippers understand when bottlenecks (e.g., blank sailings, capacity shortages) occur and prioritize shipments (better control) - Demonstrate shippers where to find open capacity according to their agreements (e.g., traffic light approach for port pairs) - Introduce dynamic pricing to steer cargo to the optimal vessel voyage

Observation 16: Technologies enabling collaboration are key drivers in the shipping industry

Dimension	Actor	Practices
Provider	Shipper, Intermediary, Carrier	Leverage TMS systems (e.g., SAP, Cargowise) and visibility tools (e.g., project44, four kites, shippeo, cardinal) to enable route optimization of shipments based on real-time data

Expected price level and associated levers for short- to mid-term outlook

Instead of sidestepping the presented management challenges in sea freight, shippers, intermediaries, and carriers must face the causes head-on. The objective should be to achieve cost benefits and lower volatility in sea freight through a targeted application of the outlined practices. This is even more important as increased price levels in sea freight can be expected in short to medium term. The following figure summarizes key levers arguing for a short- to mid-term increase in freight rates.



Outlook:

Sea freight rates will not fall to the unhealthy level before COVID-19, as these were partly below the shipping companies' contribution margin. Shipping rates may normalize in 2022 but will likely be (little) higher than in 2019.

Actor	Lever	Price
Shipper	Demand: Ordering behavior remains high (consumption instead of travel), e.g., massive imports (supply-demand imbalance), especially in the US. On the other hand, nearshoring production sites can induce a demand reduction on certain trades	
Intermediary (forwarder)	Distribution and warehousing: The COVID-19 crisis speeds up e-commerce which leads to transformed consumer shopping habits and fueled demand for distribution and warehousing facilities that provide value-added services	
Carrier (shipping line)	Sustainability: Sustainability leads to rising costs due to modernization of technology, increasing energy costs, and (green) inflation Personnel: Shortage of workers to unload goods Capacity: Open ship and container orders provide new capacities to the market and economies of scale	
Boundary conditions	Infrastructure: Upgrading the infrastructure, e.g., port capacities for larger ships leads to further costs. However, mid- to long-term investments into transport facilities (can) increase logistics efficiency and reduce shipping costs	



Road freight

65.000

The estimated shortage of truck drivers in Germany

14%

The share of truck driver's license (C1, C1E, C, E) in cohort 18 to 44 years in Germany in 2021

76%

The average annual freight to vehicle space ratio from and to Germany in 2021, according to TIMOCOM

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Background of the scenario

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ReStrain: Managing business as usual

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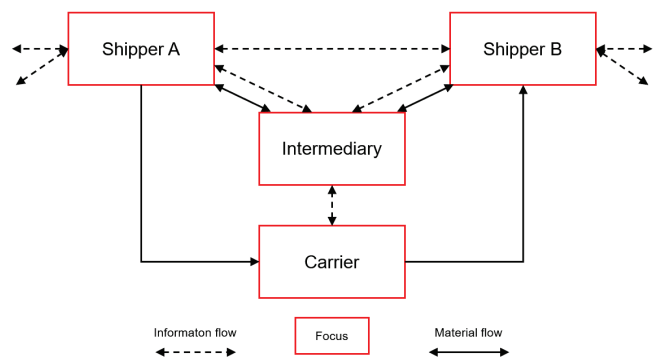
Outlook

Background of the scenario

Road freight represents the most important transport mode nationally and in the DACH region, accounting for 80% of Germany's total transport volume transported in 2020. In recent years, road freight has been subject to enormous, unexpected fluctuations, especially on the spot market, while on the contract market, volatility is often covered with a time delay (e.g., diesel floater). Within this scenario, we focus our unit of observation on shippers, intermediaries (who generally subcontract a large part of their business to carriers but often do handle transportation themselves), and carriers (i.e., road haulers). Although the role of intermediaries and carriers in road freight is sometimes becoming blurred, a separation of the actors is even more important to emphasize the buffer function of intermediaries. We analyze management practices within international and

national transportation for FTL, LTL, and general cargo for these three actors. Figure 11 illustrates the analyzed actors, relationships, and industry dynamics in road freight.

Figure 11
Key actors in road freight



Industry dynamics

Implications

Relevance	▪ Most important transport mode nationally and in the DACH region: Road freight accounts for 80% of total transport volume transported in 2020 in Germany
Business relationships	▪ Direct and indirect: Business relationships between shippers, carriers and intermediaries either via contracts or the spot market (freight exchanges) ▪ Subcontracting: Intermediaries (forwarders) typically subcontract a large part of their business to carriers ▪ LTL, general cargo (national): Cargo networks (e.g., Elvis, CargoLine)
Rate development	▪ FTL, LTL, general cargo (international, national): Freight prices are subject to enormous, unexpected fluctuations in recent years especially on the spot market, contracts cover volatility but often with time delay (e.g., diesel floater) ▪ FTL (international): Transport prices are due to the high spot market activity more dynamic in the DACH region and Europe
Competition	▪ Fragmentation: High competition among carriers; especially in national and international FTL also from Eastern Europe ▪ New entrants: Digital forwarders and platform providers intensify competitive pressure, as these new players (finance-based) do not necessarily have to be profitable but primarily aim for growth strategies

Managing business as usual (ReStrain)

Summary: Managing the business as usual in road freight usually encompasses generating planning stability concerning freight volumes and prices by bringing transparency into transport orders and demand. In general, logistics service providers in road freight are challenged by slim profitability margins due to the plethora of competing road haulers, emerging market-places, and digital forwarders. However, transport prices are dynamic due to the high spot market activity. To deal with these fluctuations in demand and price, intermediaries subcontract with carriers and cover peaks via the spot market. The following pages shed light on challenges and associated practices to better deal with the business as usual in road freight.

Management stage	Challenges
Business as usual	▪ Commoditization: Road freight is characterized by slim profitability margins, low asset utilization, and many competing providers ▪ Seasonality: Fluctuations in prices are mainly induced by seasonality (for instance Christmas time, 4 days in summer) ▪ Route volatility: Areas with lack of return cargo suffer from overcapacity leading to lower transport prices and overall lower price volatility ▪ Customer-driven volume fluctuations, short notice of transport orders: Especially in retail, sales promotions pose major challenges for intermediaries and carriers ▪ Digital disruption: New market entrants disrupt the industry by compressing rates and shifting volume away from an annual shipper–forwarder to carrier contract toward a much higher share of spot business (especially in FTL), causing a loss of intermediaries' buffer function

Observation 1: Above all, shipper, carrier, and intermediary manage (seasonal) volatility of quantities during the year

Dimension	Actor	Practices
Organizational	Shipper	Forecasting transparency ▪ Focus and identify seasonal breakouts to mitigate ▪ Provide customer incentives (e.g., share inventory levels for sales promotions)
	Intermediary, Carrier	Forecast short-term market developments (price, capacity) ▪ Leverage historical data of seasonal fluctuations (e.g., Christmas business) as well as sales promotions of retailers to react to volume fluctuations via the spot market ▪ Generate market view through dispatchers (scheduling and optimizing transport routes)

Observation 2: Shippers and intermediaries pre-dominantly “cherry-pick” individual trades

Dimension	Actor	Practices
Organizational	Shipper	▪ Perform annual tenders and benchmarks, where A) the same carrier is usually chosen in the end, or B) carriers run relations via “cherry-picking”, i.e., year one relation A, year two relation B
	Intermediary	▪ Design a stable fleet or increase own fleet capacity in times of high prices, sell off fleet capacity in times of low prices (demand as an incentive scheme)
	Carrier	▪ Hire drivers and equipment in times of higher demand

Managing business as usual (ReStrain)

Observation 3: Actors reflect on their experiences from daily business and consider various information sources to gain insights into current market development and as a basis for price negotiations

Dimension	Actor	Practices
Informational	Shipper, Intermediary, Carrier	- Negotiate with price indices (e.g., TIMOCOM Transport barometer, Transporeon Market Monitor, ASTAG-Strassentransport-index) - Monitor economic cycles (e.g., IFO-Geschäftsklimaindex, Destatis Mautfahrleistungsindex)

Observation 4: Shippers outsource transportation to intermediaries, who in turn primarily subcontract business with carriers

Dimension	Actor	Practices
Partner	Shipper	Manage small provider family (asset-based carriers and non-asset-based intermediaries) to control complexity, reduce costs, and get better performance in terms of on-time pick-up and on-time delivery
	Intermediary	Build (small) own fleet, subcontract most transports (baseload) with carriers, and cover peaks via the spot market
	Carrier	Build lane density by specializing in specific routes and building up assets

Observation 5: Transport prices are subject to considerable volatility (also due to partnership structures). From the shipper's point of view, the transport price is a market price for the transport (stable mid-to long term). However, from the intermediary's point of view, price is rather cost-driven by the carrier's pricing (volatile in the short term)

Dimension	Actor	Practices
Partner	Shipper	- Perform annual negotiations concerning offers and contracts to set a flat price for loading meter, distance, and day for one year - Specialize in purchasing transport services and use platforms to obtain lower rates
	Intermediary, Carrier	- Negotiate transport prices on a fixed basis or variable (e.g., daily) via the spot market (flexibility) - Introduce clauses (e.g., diesel floater, toll) to eliminate existential risks for intermediary and carrier

Observation 6: TMS tools and freight exchanges are partially applied and established but are not (yet) the most common interface between actors in road freight

Dimension	Actor	Practices
Provider	Shipper	Leverage TMS tools to communicate with intermediaries, hybrid managers, and freight exchanges (e.g., TIMOCOM) for matching
	Intermediary, Carrier	Leverage freight exchanges especially regarding (international) return cargo in new or unknown regions with no partners

Managing disruption (ReAct)

Summary: Disruption management in road freight encompasses mainly the driver shortage, as staff wages are increasingly dominating costs in road freight and limit the fleet of intermediaries and carriers. Due to the increasing shortage of capacity (also in the procurement of new equipment), shippers and intermediaries cannot rely on the spot market to secure capacity on individual relations in the short-term (especially FTL) but must instead seek to expand their partnerships in order to secure capacities. As such, intermediaries and carriers pay higher wages, improve working conditions, and plan schedules in a way that drivers can stay at home on weekends, while shippers reduce driver activities to core competencies (e.g., no loading, unloading, or quality control of pallets). The following pages shed light on challenges and associated practices to better deal with the disruption stage in road freight.

Management stage	Challenges
Disruption	▪ Availability of truck drivers and increased staff wages: Carriers calculate roughly 1/3 fuel costs, 1/3 driver costs, 1/3 other costs (e.g., truck toll, vehicle, administration, insurance, overhead, etc.). The availability of drivers now determines fleet, even more so for general cargo with increased B2C ▪ Asset utilization: Rising cost structure and the limited ability to control pricing, intermediaries and carriers must improve asset utilization and eliminate deadhead ▪ Availability of loading space: Intermediaries and carriers suffer from long delivery times for new equipment ▪ Cherry picking: Shippers and intermediaries cannot rely on the spot market to secure capacity on individual relations in the short-term (especially FTL)

Observation 7: Task forces have established themselves during times of under capacity (and uncertainty)

Dimension	Actor	Practices
Organizational	Shipper	▪ Revert to emailing and calling multiple carriers to deal with rejections of tendered loads on the spot market
	Intermediary	▪ Adapt freight prices and fleet management ▪ Resort to the spot market in search of loading space (partly critical loss area for an intermediary)
	Carrier	▪ Look for and hoarding of drivers (driver's shortage) ▪ Actively screen technologies, considering dependency on fossil fuels, maintenance costs, acceptance for night driving, infrastructural needs, altering maintenance organization, changing supplier relations, and investment needs to reach scale

Managing disruption (ReAct)

Observation 8: Shortage of drivers in road freight is a primary, disruptive concern for shippers, intermediaries, and carriers

Dimension	Actor	Practices
Organizational	Shipper	- Reduce driver activities to core competencies (e.g., no loading, unloading, or quality control of pallets) - Focus on “on-time reliability” as an opportunity to differentiate from the market
	Intermediary	Leverage regional carriers as they can offer... - Provide steady day runs that get drivers home every night - Guarantee capacity and (better) next-day service
	Carrier	- Pay higher wages - Improve working conditions, reduce hierarchy, upgrade image, and conduct lobby work for the profession of truck drivers - Plan schedules in a way that driver stays at home on weekends - Build more infrastructure for resting periods (e.g., permanent housing for drivers at locations on significant transportation routes) - Establish driving schools for training (driver's license C and CE)

Observation 9: Actors demand further differentiation regarding road freight price and cost indices. Considering the increasing driver shortage, actors are looking for new information sources

Dimension	Actor	Practices
Informational	Shipper, Intermediary, Carrier	- Leverage newsletters (e.g., job match) and other information sources to recruit staff and as a basis for discussion in price negotiations - Demand more differentiation regarding indices (e.g., clarification between market prices and cost levers of carriers, the inclusion of data points from both LSPs and shippers, and differentiation by transport objects such as FTL, LTL, and general cargo)

Observation 10: Due to high uncertainty, relationships between shippers and intermediaries are put under pressure

Dimension	Actor	Practices
Partner	Shipper	- Tender total volume (higher share of fixed contracts), use spot market (e.g., critical goods) partially - Do not supply (contracted) quantities to carriers (e.g., automotive) due to supply bottlenecks (semiconductors)
	Intermediary	- Renegotiate increased costs (e.g., truck drivers) during the year - Do not conclude annual contracts instead on sight if the price situation becomes more foreseeable - Tend to slightly shorter contracts due to uncertainty
	Carrier	- Prioritize higher-paying loads by other shippers via the spot market when market conditions change Reject tendered loads from contracted shippers in case... - contract rates are too low compared to current market rates - tendered load is more than the committed capacity - shippers expect unrealistic delivery times

Managing disruption (ReAct)

Observation 11: Digital platforms primarily function in times of a very even and consistent workload. In contrast, actors cannot rely (purely) on digital solutions (marketplaces, digital forwarders) in times of low capacity. However, challenges caused by undercapacities also lead to lower switching costs and the use of various options to search for capacities, especially for shippers

Dimension	Actor	Practices
Provider	Shipper, Intermediary	▪ Search for capacities by contracting, working with digital forwarders (e.g., sender), and freight exchanges (e.g., TIMO-COM) ▪ Demand more security via intermediary and carrier (e.g., using own equipment, not even subcontracting)

Managing change (ReThink)

Summary: Capacity bottlenecks in road freight will continue to be relevant in the coming years. In particular, the Russia-Ukraine crisis is expected to lead to a further structural worsening of the driver shortage and the procurement of equipment. Therefore, shippers, intermediaries, and carriers must look for ways to use capacities better and more consistently by creating faster driver turn times at pick-up and delivery locations, building a stable fleet, and entering long-term and consistent contractual ties (e.g., 3-year deals). In the future, relationships between shippers, intermediaries, and carriers need to be strategic, not transactional, as shippers need to become “shippers of choice” in tight capacity markets. The following pages shed light on associated practices to manage changes in road freight.

Observation 12: Actors are looking for ways to use capacities better and more consistently

Dimension	Actor	Practices
Organizational	Shipper	Rethink (inter-)national truckload transportation not only as rolling warehouses and cost centers: - Consider for which products “road flexibility” is needed (e.g., shifting the main carriage to railways) - Create faster driver turn times at pick-up and delivery locations (e.g., monitor truck detention time, create flexible appointment times, and initiate drop and hook programs to allow drivers to “drop and go”) - Build more inventory to reduce dependency on “rolling warehouses”
	Intermediary	- Rethink fleet management policies since relying on the spot market to cover peaks does not work in times of lack of capacity - Rely less on spot market business via freight exchanges but build a stable (own) fleet, leverage fixed subcontractors (e.g., agreements regarding capacity utilization risks) - Design (less efficient) routes to allow drivers to get home more often to retain drivers
	Carrier	Reduce deadhead and drivers' shortage: - Break down barriers from asset sharing and horizontal collaboration through digitization - Stock up and proactively hoard drivers - Invest in technology (e.g., autonomous driving, platooning)

Observation 13: Incumbents (i.e., intermediaries and carriers) must adapt to the digital game as quickly as possible as new entrants (i.e., technology companies) will eventually take over road haulers

Dimension	Actor	Practices
Organizational	Intermediary, Carrier	Eliminate barriers and build competencies within functional silos: - Create visibility into how booked loads will be executed and moved (Commercial department) - Simulate and integrate truck and load movements in the planning process based on driving, loading, and rest times as well as truck availability, appointment windows, and order forecasts (Planning department) - Introduce remote maintenance diagnostics and predictive maintenance, driver behavior monitoring, congestion monitoring, driver speed monitoring, and platooning) to provide exact ETA and plannability for other departments (Fleet operations)

Managing change (ReThink)

Observation 14: Long-term and consistent contractual ties (e.g., 3-year deal) are honored in tight capacity markets. Thus, relationships between shippers, intermediaries, and carriers need to be strategic, not transactional

Dimension	Actor	Practices
Partner	Shipper	Longer-term contracts and inter-organizational alignment are critical. Shippers can become “shippers of choice”: ▪ Create data forecasting transparency (demand, capacity, rates) and involve intermediaries and carriers ▪ Increase flexibility together with intermediaries and carriers (e.g., shipping on off-peak days, offering night pick-ups, and identifying time slots tailored to the needs of the carrier, for example, extended delivery windows and lead times) ▪ Rethink relationships with intermediaries (buffer function vs. high-risk cherry-picking) ▪ Seek synergies through “service provider days” to reduce rates as carriers build lane density to solidify the partnership ▪ Co-load freight and consolidate loads with other shippers to create lower-cost shipments ▪ Choose carriers with lower driver turnover, as consistent drivers are more productive and on-time ▪ Assumption of (part of) the utilization risk of the forwarder
	Intermediary	Forward-thinking intermediaries are looking for new ways: ▪ Build long-term shipper commitments, helping to mitigate their significant operational challenges and understand critical products and customers for shippers (premium service vs. more extended delivery schedule) ▪ Make freight as attractive as possible to the correct carrier base (“Treat carrier as a customer”) ▪ Connect and use digital tools and players for efficient interface capabilities with shippers while increasing customer coverage
	Carrier	Amplified by the COVID-19 crisis and supply shortages (e.g., semi-conductors), carriers need to: ▪ Build long-term contracts to mine for “area customers”, creating a network with minimal deadhead miles (network efficiency) ▪ Diversify their customer base to reduce dependencies and cluster risks of individual industries (e.g., automotive) ▪ Shift and focus on pre-post-carriage to decrease the demand for driving time by long-distance drivers

Observation 15: Due to the growing role of e-commerce, sustainability goals, and the shortage of drivers, contract structures and pricing models are (again) discussed among actors in road freight

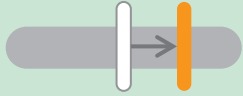
Dimension	Actor	Practices
Partner	Shipper	▪ Further use of time-cost models that are paid according to performance (e.g., waiting times of drivers) to create transparency ▪ Think intermodally and rethink which shipments to shift from road to rail
	Intermediary, Carrier	▪ Examine dynamic pricing strategies: Daily or quarterly prices and peak season rates for the spot market ▪ Service level agreements: Build time priorities into contracts ▪ Dedicated fleet: Shift asset utilization risk to the shipper

Managing change (ReThink)

Observation 16: Traditional transportation procurement is being challenged by the rise of new technologies. In this (new) environment, (especially) visibility tools (sixfold, shippeo), transport managers (BlueYonder, Cargowise), hybrid managers (Transporeon, Alpega), and marketplaces (TIMOCOM) emerge as (potentially) being helpful for prevalent actors

Dimension	Actor	Practices
Provider	Shipper	▪ Gain better insights into the freight market (e.g., equipment usage, on-time delivery) ▪ Increase coverage for easy access to additional orders, and automate bidding for complete automation and optimization ▪ Gain visibility to loads and (near term) prediction of ETA
	Intermediary	▪ Secure capacity further in advance, enabling intermediaries to quickly and efficiently identify and book continuous moves for carriers
	Carrier	▪ Increase plannability and asset utilization (pairing of transports, avoidance of deadheads) to keep trucks loaded and moving

Expected price level and associated levers for the short- to mid-term outlook



Outlook:

An overall increase in transport prices can be assumed in the road transport sector. For the short to medium-term price development, the driver shortage is decisive, because the driver availability already determines the carrier's loading space today

Actor	Lever	Price
Shipper	Demand: Shippers increasingly consider reshoring production sites from Asia to Europe (e.g., Europe best cost country strategies), leading to an increasing demand for transportation services in (international) full truckload transports	
Intermediary (forwarder)	Infrastructure: Cost pressure on logistics real estate Efficiency gains: Avoidance of deadhead by eliminating inefficiencies and leveraging traffic pairings to maximize asset utilization (limited by driving times and rest periods) Competition: High competition intensified by digital forwarders leads to (further) minimization of margins	
Carrier (road hauler)	Driver shortage: Mobility packages (cabotage) exacerbate the capacity situation, especially in national transports, as foreign vehicles are less available. Demographic change, and COVID-19 (closure of road infrastructure and training facilities) as structural and disruptive amplifiers. UK shows possible consequences Transport costs: CO2 prices for fossil fuels and persistently higher energy costs with few alternatives, additionally toll costs and increases in congestion	
Boundary conditions	Technology and automation: Autonomous driving and Platooning have potential to reduce costs especially for the control of driving times and resting periods in long-distance traffic but only in the long term Sustainability: Ecological drivers including the EU „Fit for 55 Package“ lead to higher prices	



Rail freight

2500 -
4500

The Chinese subsidies in USD/FEU to support the Silk Road rail cargo development (40% subsidized)

300

The number of freight trains to replace one ship with 23,000 TEU

25%

The minimum modal share in 2030 issued as a target by the German federal government

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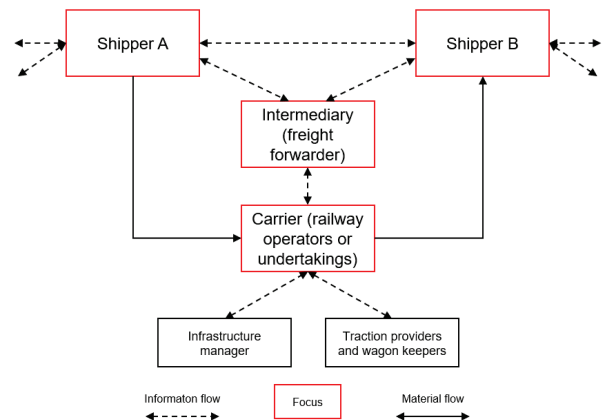
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Outlook

Rail freight represents the transport mode with the lowest price volatility among all transport modes and is characterized by an oligopoly on the supply side with low fragmentation among carriers and high market entry costs. This limited supply and demand base creates a stable price environment for shippers, intermediaries, and carriers. In general, single wagonload and intermodal transport are more volatile due to the price competitiveness with other transport modes such as road and sea freight. However, in contrast to single wagonload and blocktrain business, intermodal transportation via rail indicates a high growth rate, in particular, to shift transports from road to rail. Within this scenario, we focus our unit of observation on shippers, intermediaries (who generally work as freight forwarders that do not own locomotives but organize the transportation process), and carriers (i.e., railway operators and railway undertakings, providing services by rail). We analyze

management practices within single wagonload, blocktrain, and intermodal transportation by rail for these three actors. Figure 12 illustrates the analyzed actors, relationships, and industry dynamics in rail freight.

Figure 12
Key actors in rail freight



Industry dynamics

Implications

Relevance

- **Products:** Due to shunting and vibrations during transport, rail freight services are not operated in some industries (e.g., pharma, healthcare)
- **Single wagonload:** 27% of total rail freight (ton-km) in Europe, two-thirds of European single wagonload traffic is cross-border, **blocktrains:** profitable segment, especially bulk and liquid cargo (kerosene), **intermodal:** highest growth rate

Business relationships

- **Shipper:** Directly contract with intermediaries (forwarder) or carrier (railway operator and railway undertaking)
- **Intermediary:** Possess own wagon fleet, usually sub-contract with operators (e.g., intermodal operator, terminal operator) and carriers
- **Carrier:** Contract with infrastructure managers to get track access to provide transportation and shunting services. For single wagonloads and blocktrains, carriers may provide services directly for shippers

Rate development

- **Price transparency:** Especially blocktrain (cost categories known and predictable), stable rates
- **Low volatility:** Capacity restrictions, long-term contracts, limited supply and demand base create a stable price environment compared to other transport modes. Overall, single wagonload and intermodal transport are considered more volatile with price competitiveness to road and sea freight
- **New Silk Road:** Dependency on international flows of goods, increased volatility (e.g., uncertainties concerning customs clearance)
- **Quantities:** COVID-19 led to a reasonable decline in quantities (20-30%), however, due to contracts minor effects on prices

Competition

- **Oligopoly:** Low degree of fragmentation among carriers, high market entry costs
- **Single wagonload:** Competition with road freight, **blocktrain:** competition with other carriers, **intermodal:** competition with air, road, sea

Managing business as usual (ReStrain)

Summary: Managing the business as usual in rail freight usually encompasses limitations concerning the infrastructure, such as the availability of railway tracks and resources allocated to it (e.g., locomotives), as schedules are generally fixed for one year. In general, these bottlenecks usually limit the service offered by railway undertakings due to limited capacity and accordingly increase the route length and transit time in case of deviations, which does not affect the price, but the capacity and reliability of rail freight transportation. As such, shippers seek long-term contracts (one to three years) to receive planning stability, while carriers build partnerships with shippers to benefit from recurring traffic. The following pages shed light on challenges and associated practices to better deal with the business as usual in rail freight.

Management stage	Challenges
Business as usual	▪ Flexibility: Insufficient resources (e.g., personnel), schedules generally fixed for one year, availability of railway track and resources allocated to it (locomotive, drivers, wagons) have a limiting effect ▪ Risk: In principle, the customer bears the risks of capacity utilization in blocktrain business, while in single wagonload business the carrier bears the risk, e.g., empty wagons due to inefficient fleet management leading to higher costs ▪ Track and Trace: Inadequate freight tracking may result in misled trains or wagons, increasing inefficiencies but also to the fact that shippers perceive rail freight as unreliable due to a lack of visibility ▪ Intermodal transport: Efficient and effective intermodal rail transport is hampered by interoperability issues and lack of coordination between actors

Observation 1: Organizationally, shippers outsource inbound rail logistics while logistics intermediaries and carriers primarily try to anticipate volume fluctuations through pre-forecasts and react flexibly by making their own resources variable

Dimension	Actor	Practices
Organizational	Shipper	▪ Apply few practices, usually place freight responsibility on suppliers with shipping agreements delivered duty paid (DDP) ▪ Focus on demand forecasting to ensure high-capacity utilization (especially block trains) ▪ Pursue strategies such as rail-affine timing of logistics processes, building rail loading facilities, and building data interfaces with intermediaries and carriers
	Intermediary	▪ Seek to increase reliability by providing additional services ▪ Seek to relieve the north-south corridor by focusing on routes from southern ports to blockade and to save costs
	Carrier	▪ Variabilize own resources through staggered rental contracts for locomotives and personnel to adjust to volume fluctuations ▪ Adapt new (contract) prices if fuel price and labor costs on the road vary (national) or prices in sea freight (international) increase ▪ Analyze volumes from other transport modes and trends from different industries (e.g., automotive) to anticipate volume increases and transport needs (e.g., intermodal transports) ▪ Analyze historical volume data and knowledge sharing with other rail carriers to estimate volume development

Managing business as usual (ReStrain)

Observation 2: Freight prices in rail transportation are determined individually based on the cost of the service package offered by intermediaries and carriers

Dimension	Actor	Practices
Organizational	Shipper	Approach intermediaries to request specific transport services to achieve the highest possible capacity utilization
	Intermediary, Carrier	- Determine economic requirements for transportation via rail (e.g., minimum operational size, minimum distance: in Switzerland competitive (to road) from 100km, in Europe from 300km, and type of goods) - Calculate freight price based on the number of required transport modes (unimodal vs. intermodal), requirements such as customs clearance for cross-border transport, special goods requirements (height, width), cadence (recurring vs. one-off transports), infrastructure (shipper's rail access), shunting possibilities, required resources (locomotive, locomotive driver, wagon, shunting teams, containers) - Balance time requirements of shippers, operational efficiency of wagons, and operational efficiency of the locomotive

Observation 3: As far as indices are concerned, there is a lack of reliable price, cost, or volume indices in rail freight

Dimension	Actor	Practices
Informational	Shipper, Intermediary, Carrier	- Draw on business climate and economic data to anticipate developments across sectors (e.g., industry and trade) - Investigate the current business climate of the railway industry (e.g., SCI Global Rail Index) - Estimate demand-side developments by using economic data (e.g., IFO economic outlooks)

Observation 4: Since railway availabilities are usually bound to an annual transportation plan with minor changes during the year, contractual relationships in rail freight are usually negotiated in the long term to ensure planning stability

Dimension	Actor	Practices
Partner	Shipper	- Seek long-term contracts (one to three years) to receive planning stability (especially blocktrain) - Benchmark and shift partnerships, especially full truckload vs. intermodal
	Intermediary	Introduce clauses, especially in intermodal transport, to adapt prices (e.g., proximity between terminals and destination, ability to carry return cargo)
	Carrier	- Build partnerships with shippers to benefit from recurring traffic - Optimize coordination constellations between different shippers (single wagons) - Early renegotiation of route availability and resources (locomotive, drivers, wagons) based on (multi-) year contracts - Develop cooperative horizontal partnerships (e.g., cooperation between national carriers in international corridors) - Seek to become efficient and attractively priced through intelligent mid-to-long-term integration into the supply chain and through adjustments in upstream and downstream operations

Managing business as usual (ReStrain)

Observation 5: Actors build different alliances to improve access to rail freight services

Dimension	Actor	Practices
Partner	Carrier	- Improve and develop rail-traffic and intermodal transport (e.g., Allianz Pro Schiene) - Develop shared data platforms among carriers (e.g., Rail Freight Data Hub by VDV) to increase accessibility in rail freight (e.g., through central booking platforms)

Observation 6: Data sharing between relevant stakeholders is often limited to selected information types such as reliability which are exchanged via mail and telephone as widespread types of communication

Dimension	Actor	Practices
Partner	Shipper	Request information concerning infrastructure conditions, load capacities, ETA, and share stock availability directly with intermediaries and carriers ("What quantities can you handle on route X to Y?") to ensure the reliability of services
	Intermediary, Carrier	- Share information concerning the shipment status and time schedule with shippers - Communicate with other intermediaries and carriers to exchange information across countries (best practice: knowledge sharing) in order to clarify infrastructural bottlenecks (e.g., national revision of rail systems) - Share information concerning train positions and current tariff policy

Managing disruption (ReAct)

Summary: Disruption management in rail freight encompasses volume drops, delays in customs and border clearance (e.g., New Silk Road), weather, route outages, and lack of personnel. Compared to other transport modes, it is intrinsic to rail freight that disruptive factors have a cascading effect, as disturbances on one train (freight or passenger) due to track closures can cascade through the railway network, creating significant challenges over time slots in rail freight are limited. As a result, shippers tend to shift transport to alternative modes during route outages while carriers build capacities, re-route, and bypass interrupted sections based on available capacity and product characteristics. The following pages shed light on challenges and associated practices to better deal with the disruption stage in rail freight.

Management stage

Challenges

Disruption

- **COVID-19:** Volume drop, delays in customs and border clearance in international transports, e.g., New Silk Road border crossing at Malaszewicze-Terespol-Brest
- **Disruptive factors:** Weather, route outages (Rastatt 2017, Ukraine 2022), and lack of personnel (train operator, shunting personnel), rising or missing electricity, track prices, taxes, and charges
- **Cascading effects:** Disturbances on one train (freight or passenger) due to track closures can cascade through the railway network, creating significant challenges as time slots in rail freight are limited

Observation 7: In case of unforeseen route outages (i.e., Rastatt 2017) or soaring freight rates for transportation via road, sea, and air, shippers, intermediaries, and carriers divert to alternative routes and transport modes

Dimension	Actor	Practices
Organizational	Shipper	▪ Shift transport to road or alternative transport modes ▪ Shift demand to rail freight (e.g., New Silk Road during the COVID-19 crisis) ▪ Prioritize shipments according to their out-of-stock relevance
	Intermediary	▪ Increased use of intermodal transports to realize alternative routes ▪ Achieve maximum bundling of goods
	Carrier	▪ Analyze cascading effects of delays and distortions (e.g., closure of railway lines) to react fast ▪ Re-route and bypass interrupted sections based on available capacity and product characteristics ▪ Seek to pass on incurred costs if failures are not caused by force majeure

Observation 8: For the New Silk Road, actors used new information sources to receive up-to-date information

Dimension	Actor	Practices
Informational	Shipper, Intermediary, Carrier	▪ Leverage indices (e.g., ERAI Index) to monitor the cost of shipping container cargo via rail as well as current delivery times on the New Silk Road

Managing disruption (ReAct)

Observation 9: During the crisis, rail freight was initially affected by a volume decline, which was quickly made up as rail freight emerged as a number one alternative to road freight, partly due to the systemic importance for retail, as in Switzerland

Dimension	Actor	Practices
Partner	Shipper	- Communicate with an extended portfolio of intermediaries and carriers due to high uncertainty - Especially retail companies shifting to rail freight (e.g., provision of food)
	Intermediary, Carrier	- Attempt to offer a base amount of space and lease additional inventory in order to be able to respond to fluctuations in demand - Intensify customer approach to shift to rail freight during times of low demand (e.g., COVID-19, economic downturn) - Deploy quantity clauses to provide customers with incentives to shift volumes to rail - Proactively introduce clauses (e.g., earthquake) to allow for re-negotiation or termination of contracts - Maximize usage of available equipment (e.g., load rates) during periods of high demand

Managing change (ReThink)

Summary: Disruptions such as the Russia-Ukraine conflict pose significant uncertainty among shippers, leading to shippers rethinking their sources of supply in Russia, consequently affecting the expansion of the New Silk Road. On the other hand, the increasing promotion of sustainable transportation (e.g., the European Green Deal) and a trend toward nearshoring to improve time to market (e.g., Europe's best-cost countries) will accelerate rail freight. However, infrastructure must be built up intensively to meet the politically demanded (e.g., European Green Deal) future requirements for intermodal rail freight. For instance, numerous multimodal terminals are needed in combined transport for transshipment from truck to train, while horizontal handling technologies such as Modalohr and new loading technologies (e.g., Cargobeamer, Nicasa) will complement vertical terminals. The following pages shed light on associated practices to manage change in rail freight.

Observation 10: Actors are looking for ways to improve the use of capacities consistently, particularly by leveraging technology

Dimension	Actor	Practices
Organizational	Shipper	- Shift products from road to the rail where “road flexibility” is not needed - Shift products from sea to rail where price differences dwindle to gain more control over inbound logistics as rail freight from China to Europe reduces capital commitment while capacity utilization is facilitated compared to chartering container ships - Identify “predictive” product categories that require less flexibility (e.g., consumer goods) that can benefit from rail freight in addition to bulk (e.g., retail and consumer goods)
	Intermediary	- Intensify intermodal competencies as modal shifts (e.g., New Silk Road) become more important - Develop concepts to achieve traffic pairing (single wagonload and intermodal, mainly from Europe to China)
	Carrier	- Recruit personnel (e.g., locomotive drivers, dispatchers, maintenance workers) by improving working conditions, providing attractive development opportunities, and leveraging online job exchanges (e.g., SchienenJobs.de) - Build capacity on new transport routes (e.g., Felb service) to bypass bottlenecks (e.g., border Poland-Belarus New Silk Road) - Assess the use of longer freight trains to expand capacity - Automation in operation (driver assistance up to autonomous driving), building wagon intelligence for denser train sequences - Automation of shunting operations (uncoupling robots, fully automatic shunting locomotive, automatic coupling, and uncoupling, automated brake tests) - Automation in handling (e.g., driverless cranes)

Managing change (ReThink)

Observation 11: To gain more attraction, shippers, intermediaries, and carriers are urged to collaboratively build services that are more transparent, reliable, flexible, efficient, and user-friendly

Dimension	Actor	Practices
Partner	Shipper	- Rethink sources of supply in Russia, consequently affecting the expansion of the New Silk Road - Shorten supply chains to improve time to market (e.g., Europe's best cost countries) and accelerate rail freight
	Intermediary	- Continue to rethink routes, e.g., access via southern ports (Italy) instead of northern ports (Netherlands, Germany) (Might) position themselves as intermodal experts or integrators along the New Silk Road - Develop new transport concepts to improve load factors (especially single wagonload)
	Carrier	- Establish know-how concerning sales channels and digital marketplaces to facilitate freight booking - Build partnerships to facilitate intermodal transports (e.g., pre- and on-carriage) - Enhance cooperation among carriers to leverage network effects (transparency through asset and knowledge sharing) - Improve reliability (regular service frequency) and digitization of customs processes (New Silk Road) by cooperating with shippers to solve the chicken-egg deadlock of supply and demand

Observation 12: To improve overall reliability and efficiency, actors rethink their data sharing practices and discuss control tower solutions to improve capacity use and reduce transport costs

Dimension	Actor	Practices
Partner	Shipper	- Engage with LSPs, share objectives and demand figures concerning the envisioned transportation strategy - Seek to optimize cost and service by choosing the correct transport mode
	Intermediary	Create more transparency concerning cargo movements (e.g., forecasts and transportation schedules with shippers)
	Carrier	Increase transparency into market details (e.g., infrastructure disruptions and capacities, available capacities, and shipments)

Observation 13: In the future, intermodal capacity brokers, marketplace solutions, TMS systems, telematics solutions, and digital storefronts by intermediaries by service providers are gaining importance

Dimension	Actor	Practices
Provider	Intermediary, Carrier	- Offer digital storefronts as solutions to promote their own services to the market (e.g., EVplus by DB Cargo) - Use intermodal capacity brokers (e.g., rail flow, modility) and marketplace solutions (e.g., railvis) to simplify organization and gain new sales channels - Leverage TMS systems to create intelligent offers based on existing capacities to simplify processes for the customer - Introduce telematics solutions (e.g., Nexxiot) to increase capacity utilization by building visibility and avoiding empty runs

Expected price level and associated levers for the short- to mid-term outlook



Outlook:

As a result of the price orientation towards road freight (national) or sea freight (international) in the short term and the observed structural drivers promoting an increasing shift to rail transportation, we estimate an elevated price level for rail freight

Actor	Lever	Price
Shipper	Demand: Due to the increasing promotion of intermodal transport and green mobility, shippers continue shifting freight volume to rail freight	
Intermediary (forwarder, operator)	Capacity utilization: Enhanced through (supply-side) digital collaboration platforms, improved planning	
Carrier (rail undertakings)	Cost structure: Rising costs due to taxes and duties, personnel, energy, and rail tracks Infrastructure: Higher railway charges and strengthening the infrastructure through new construction and expansion of the railway track network Modernization: Noise abatement of wagon fleet and digitization of equipment (locomotives and wagons) increases costs Automation: Cost savings through driverless operation, automatic coupling, and automated brake testing in the short to mid term Technology: Reduction in operating and maintenance costs through standardization, connectivity, predictive maintenance, and digital twins (Wagon Intelligence)	
Boundary conditions	Political driver: Governments seek to increase the road transportation. In Germany, from the current 18 percent to at least 25 percent by 2030 (Pro-Rail Alliance, Allianz Pro Schiene) External costs: Per tkm, rail transportation on average produces 80% less CO2 than road freight (one ton transported in one kilometre). In addition, rail transportation causes fewer external costs such as accidents, air pollution, climate change, noise, congestion, well-to-tank emissions, and habitat destruction (European Commission, 2019). In the mid to long term, we expect a pricing of these external cost categories, impacting rail freight due to its orientation towards other transport modes	



Air freight

35%

The share of scheduled belly cargo tonne-kilometers replaced by freighters and preighters between 2019 and 2020 in the Europe-Middle East segment

28%

The global air cargo slump in April 2020

12,3%

The increase in cargo load factors in Europe from 51,8% to 63,1% between 2019 and 2021

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Background of the scenario

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ReStrain: Managing business as usual

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ReAct: Managing disruption

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ReThink: Managing change

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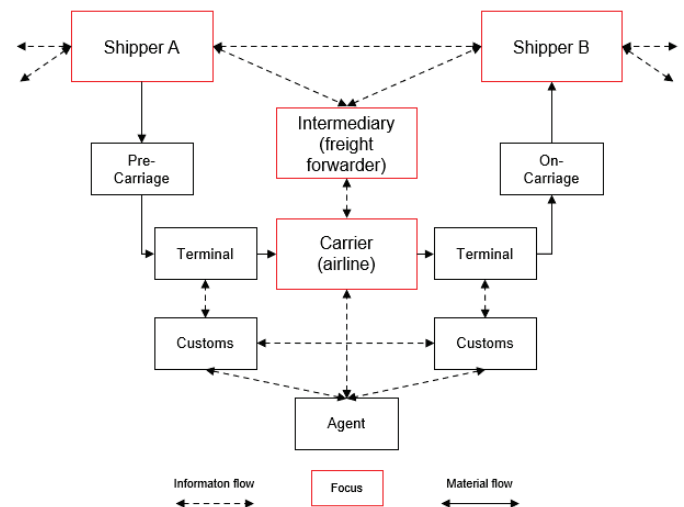
Outlook

Background of the scenario

Air freight represents the transport mode with the shortest transit times and highest transport costs and is therefore characterized by its transport affinity for time-sensitive, high-value goods. Historically, there was capacity underutilization in air freight since carriers expanded to new markets primarily from a passenger point of view. However, in the wake of the COVID-19 crisis, there was a shortage of capacity due to the extensive grounding of passenger airlines, leading to a tenfold increase in spot rates. Within this scenario, we focus our unit of observation on shippers, intermediaries (who generally work as freight forwarders that organize the transportation process), and carriers (passenger airlines, combination carriers, full-cargo carriers, integrated carriers, and charter carriers). For these three actors, we analyze management practices within two business relationships: First, direct business relationships where large shippers directly contract with carriers (i.e., integrated carriers and charter carriers), and second, an indirect relationship where

shippers do not contract with carriers (i.e., passenger airlines, combination carriers, full-cargo carriers) but with intermediaries. Figure 13 illustrates the analyzed actors, relationships, and industry dynamics in air freight.

Figure 13
Key actors in air freight



Industry dynamics

Implications

Relevance

- **Bulk Unitization Program (BUP):** Air freight suffers from an unfavorable ratio of load capacity to deadweight of the aircraft. BUP increased efficiency gains (i.e., combining loosely loaded freight into consolidated shipments)
- **Transport affinity:** Time-sensitive, high-value goods

Business relationships

- **Direct contact:** Shippers directly contract with logistics intermediaries
- **Consolidation:** Forwarders earn money from consolidating airfreight
- **Amazon Air:** Amazon starts building up own fleet (73 freighters)
- **Deals:** Assigned to summer and winter schedules

Rate development

- **Historically, low level of rates:** Global capacity utilization was about 50%, i.e. reason larger passenger aircraft machines and expansion to new markets primarily from a passenger point of view, less attractive from cargo point of view
- **COVID-19:** Partially tenfold increase in spot rates

Competition

- **Fragmented market with no dominant market players:** Direct-customer approach as in sea freight with the partly elimination of the forwarder in air freight has failed due to the relevance of high availability logistics and the requested forwarder's ability to take care of ordering and handling due to the complexity of the air freight logistics process chain

Managing business as usual (ReStrain)

Summary: Managing the business as usual in air freight usually encompasses managing tight margins as high fragmentation and competition put pressure on for LSPs. Shippers and intermediaries usually close and assign deals to summer and winter schedules to generate planning stability concerning freight volumes and prices. Pre-Covid, there was in general overcapacity on most of the trades, which partially led carriers to shift from dedicated freighters to passenger aircraft to generate earnings by cross-subsidizing belly capacity with business class passengers. On the other hand, shippers and intermediaries did focus their international air cargo movements among a restricted group of airports to increase profitability. The following pages shed light on challenges and associated practices to better deal with the business as usual in air freight.

Management stage

Challenges

Business as usual

- **Change in market and air rates:** At first glance, the market and air rates were stable. Yet, due to high competition, logistics service providers faced margin pressure
- **Uncertainty:** For 20 years, rates went down. During seasonal cycles, prices tend to go up. Also, oil price fluctuations and reefer container availability during the fruit season induce volatility. Likewise tendering procedures with young and "cheap" intermediaries and carriers increases the risk of unexpected surcharges (new surcharges such as repositioning, in addition to security, fuel) for shippers

Observation 1: With belly-only airlines, forecasting plays a crucial role but is influenced by many practices, including demand shifts, cargo bookings, and carrier routings

Dimension	Actor	Practices
Organizational	Shipper	▪ Monitor top lanes to identify capacity constraints or critical markets for supply ▪ Monitor shifts in passenger demand and industry changes to anticipate changing cargo patterns
	Intermediary	▪ Consider availability of direct flights, commodity type, and hub consolidation for cargo bookings ▪ Seek to capitalize on belly capacity underutilization ▪ Focus international air cargo movements among a restricted group of airports to increase profitability ▪ Lease warehousing and airport facilities for truck distribution
	Carrier	▪ Shift from dedicated freighters to passenger aircraft to generate earnings by cross-subsidizing belly capacity with business class passengers ▪ Focus on passenger demand when expanding to new trade lanes, cargo as a by-product (passenger airlines) ▪ Transport a significant share of air freight by working with ground handlers (road feeder services) in case of price inefficiency, lack of cargo space, or absence of direct flights ▪ Feed smaller passenger flights into the cargo-only network to increase overall utilization (combination carriers)

Managing business as usual (ReStrain)

Observation 2: In air freight, actors typically consider information sources from established institutions

Dimension	Actor	Practices
Informational	Shipper, Intermediary, Carrier	Gain market insights into freight prices and air cargo traffic growth by monitoring reports (e.g., TIACA, Accenture Seabury), market updates (e.g., IATA) but also economic indicators (e.g., Purchasing Manager Index)

Observation 3: Relationships in air freight encompass a triad of shippers, intermediaries, and airlines

Dimension	Actor	Practices
Partner	Shipper	- Contract fixed prices per schedule (summer, winter) - Use a portfolio of selected forwarders who know their business as well as the specifics of the goods and handle the transportation with the carrier in their interest (end-to-end, including customs clearance) - Consider strategic relationships with freight forwarders vs. flexibility and interchangeability (e.g., using 4PLs)
	Intermediary	- Directly book with the airline or through a general sales agent representing the airline - Consolidate shipments into container loads (ULD)
	Carrier	(Partly) pivot sales from capacity to product by addressing scheduling needs or commodity groups (e.g., pharma, perishables)

Observation 4: The electronic air waybill (e-AWB) has become established and is used by about two-thirds of the IATA airlines. Furthermore, e-freight is an industry-wide initiative comprising shippers, carriers, forwarders, ground handlers, and customs officials to create a paperless end-to-end air cargo transportation process. However, freight booking is (still) a high-friction, one-to-one approach, with carriers predominantly relying on in-person negotiations and the use of emails and phone calls

Dimension	Actor	Practices
Partner	Shipper, Intermediary, Carrier	Exchange directly with (other) shippers, intermediaries, and carriers to generate insights concerning market developments

Observation 5: Regarding providers, IATA Cargo IS represents an established and widely used tool for intermediaries and carriers

Dimension	Actor	Practices
Partner	Shipper, Intermediary, Carrier	Use IATA Cargo IS for benchmarking the market rate (USD/kg) of CASS data with the own purchasing rate of specific lanes in export (only available to submitting airlines and forwarders)

Managing disruption (ReAct)

Summary: Disruption management in air freight encompasses price explosions due to the sudden elimination of belly capacity (e.g., COVID-19 crisis) or demand shocks for air cargo services due to the transportation needs with a high urgency (e.g., PPE equipment). In such cases, shippers move essential supplies by air freight and shift less valuable cargo to other transport modes (e.g., sea, rail). In contrast, intermediaries and carriers move goods to airports, focusing on cargo operations to secure the decentralized capacity of individual countries. The following pages shed light on challenges and associated practices to better deal with the disruption stage in air freight.

Management stage

Challenges

Disruption

- **Past:** Airfreight as the mode of choice if short lead times and small risks were required. Today, shippers pay any price to get goods
- **Availability of loading space:** During COVID-19, prices exploded due to the sudden elimination of belly capacity with airlines withdrawing contracted quantities. At peak times, shippers and forwarders are reporting spot market prices that are a factor of 10 and more above the usual freight rates
- **Closure of airports and restrictions among ground and air crews:** Maintaining operational activities in compliance with hygiene regulations
- **PPE-Effect:** Demand for air cargo services increased due to the transportation need for PPE, medical products, and vaccines, squeezing capacity and bumping up rates
- **Sustainability:** As a small driver, sustainability also calls into question the raison d'être of national as well as continental lanes

Observation 6: With passenger jets grounded and air cargo demand, actors pivot from their "business as usual" strategies to the new airfreight market conditions and extend their reach business relationship

Dimension	Actor	Practices
Organizational	Shipper	▪ Move more (and atypical) shipments to the air market due to continued disruptions in sea freight (ocean-air conversion) ▪ Shift less valuable cargo to other transport modes (sea, rail) ▪ Move essential supplies, especially for price-insensitive customers with low demand or price-dense goods ▪ Extend supply chain lead times due to airport congestions and plan supply chain accordingly ▪ Use air freight resupply as an inventory buffer to compensate for supply-demand inequality, prioritize and move commodities and goods to stores and production lines in case of shortages
	Intermediary	▪ Move goods to airports, which focus on cargo operations, secure capacity decentralized out of individual countries not only from cargo hubs ▪ Move cargo with own assets to reduce delays (e.g., caused by ground handlers), charter aircraft (freighters), and launch dedicated services for customers in specific trade lanes ▪ Expand storage and warehouse capacity to off-airport areas to deal with uncertain carrier capacity and reduce costs ▪ Explore opportunities to use "cargo-only passenger charter" ("freighters") ▪ Explore multimodal solutions (sea-air shipments via Dubai and Singapore)
	Carrier	▪ Reduce passenger services substantially in the face of collapsing demand and breakdown of belly capacity and increase

		freighter to passenger conversion (combination carrier)
		▪ Pivot their focus to cargo, converting passenger aircraft to “freighters” (removing seats or putting load under or over the seat, in the overhead bins) ▪ Reactivate or purchase freighter machines to add capacity ▪ Avoid (congested) airports and pivot to others ▪ Make capacity available via digital platforms ▪ Deploy (more) RFS capacity to hubs that receive increased charter and diverted flights

Observation 7: The COVID-19 crisis accelerated trends to digitize core processes

Dimension	Actor	Practices
Informational	Shipper, Intermediary, Carrier	▪ Digitize air cargo capacity and rates to enable real-time dynamic capacity and pricing, instant quotes, and e-Booking on a specific flight (e.g., Digital Air Cargo) ▪ Consider individual airport statistics, including carrier-level en-planed and deplaned tonnage as well as the number of flights

Observation 8: To secure capacity, cooperation is sought to intensify between actors in air freight

Dimension	Actor	Practices
Partner	Shipper	▪ Perform monthly task force calls about market constraints, capacity developments, and challenges by region ▪ Build close contact with intermediary and carrier to react faster to shifts in marketplaces (e.g., event management plans) ▪ Consider all transport modes in their transportation strategies to meet tight capacity, rate hikes, on-time requirements
	Intermediary	▪ Leverage digital platforms to receive instant pricing in search of capacity ▪ Build carrier partnerships and charter arrangements ▪ Remain cautious about long-term capacity commitments and block space agreement negotiations with airlines during a crisis
	Carrier	▪ Extend reach through digital platforms and marketplaces and provide real-time data and access to shippers ▪ Introduce surcharges on existing contracts (e.g., peak season surcharge) ▪ Charge prices dynamically and strategically via the spot market to optimize revenues

Observation 9: Driven by the COVID-19 crisis, air freight actors intensify their efforts to implement digital tools

Dimension	Actor	Practices
Provider	Shipper	▪ Engage with tools (e.g., shipsta) for rate purchasing and management, tendering of contract rates as a single source of truth
	Intermediary	▪ Initiate own digital storefronts to provide capacity to the market (e.g., Skycapacity by CEVA)
	Carrier	▪ Make more cargo capacity available through digital platforms (e.g., WebCargo) to list schedules prices and enable eBookings, but also to automate pricing and quote

Managing change (ReThink)

Summary: Disruptions such as the COVID-19 crisis highlighted the need for rapid replenishment and quick lead times while questioning the high dependency on belly capacity. As such, shippers rethink the need for air cargo for (expected to be) higher average airfreight rates (“Have” and “Have nots” high-enough product margins). LSPs will introduce cargo-only “freighters” and charter services as a more permanent part of service offerings (short- to midterm) to build density and economies of purchasing scale. In addition, sustainability represents a further structural force for change with the increasing importance of carbon footprints for shippers. As such, carriers must intensify their research efforts in technological developments, for example, by developing sustainable aviation fuels (SAF) to cut CO2 emissions. The following pages shed light on associated practices to manage change in air freight.

Observation 10: Spurred by e-commerce, regionalization trends, reduction of low-cost carrier offerings, and the need for rapid replenishment and quick lead times, the COVID-19 crisis raises the question of whether freighter and freighter bridge the gap or represent the new normal

Dimension	Actor	Practices
Organizational	Shipper	▪ Rethink own strategies (e.g., omnichannel), sourcing lead times, and the resulting selection of belly or freighter carriers ▪ Commit to higher quantities in advance (e.g., higher baseload and advancing “winter volume” in retail) ▪ Consider the cost-benefit trade-off between rising transport costs using air cargo and reduced inventory costs and WACC ▪ Build (more) inventory before peak cargo season in October and nearshore production for critical products ▪ Rethink the need for air cargo for (expected) higher average rates (“Have” and “Have nots” high-enough product margins)
	Intermediary	▪ Put contingency plans in place for variations in volume, including additional warehouse space, extended capacities, and adjusted handling processes to get more capacity with short notice ▪ Include cargo-only “freighters” and charter services as a more permanent part of service offerings (short- to midterm) to build density and economies of purchasing scale ▪ Build a more extensive passenger and complete freighter aircraft network to meet the increasing demand for air cargo
	Carrier	▪ Intensify research efforts in technological developments, e.g., developing sustainable aviation fuels (SAF) to cut CO2 emissions, new aircraft concepts, increasing engine power, improving aerodynamics, and developing new lightweight ULDs ▪ Rethink freighter share, increase load factors, and earn higher yields as e-commerce increases complexity due to freight category diversity and lower shipment density ▪ Rethink P2F conversions and deployments depending on rates, investigate opportunities to boost cargo services ▪ Investigate effects of replacing widebody passenger planes with narrowbodies (dependency on belly space) ▪ Revisit flight economics (network changes, flight schedule) as business lags leisure (passenger airline, combination carrier) ▪ Rethink launching cargo-only agreements to build new business lines and boost secondary gateways (passenger airlines) ▪ Build more competencies to forecast loading space capacity, especially for belly carriers (e.g., passenger booking accuracy) ▪ Rethink network structure (hub and gateway airports) and, as a result, routing patterns (especially integrated carriers)

Managing change (ReThink)

Observation 11: New sources of information such as the “TAC Index” emerge, allowing actors in air cargo to compare contracted rates

Dimension	Actor	Practices
Informational	Shipper, Intermediary, Carrier	- Access airport-to-airport general cargo pricing based on the rates provided by forwarders - Track volatility across significant air cargo trade routes, including transaction-based data of cargo-only carriers

Observation 12: Driven by digitization and competitive dynamics, partnerships in air cargo begin to shift

Dimension	Actor	Practices
Partner	Shipper	- Rethink transport mode and contractual agreements based on trade lane, market demand, and customer needs - Spread volume commitments among partnerships while relying on reliable intermediaries and expanding reach by co-operating with digital forwarders (e.g., flexport) - Communicate demand needs early - Seek longer-term commitments (again) with spot-market activity diminishing in importance - Rethink contractual agreements and contact relationships (CFO, risk managers) by considering Forward Freight Agreements, Index-linked agreements, and freight derivatives based on indices such as the TAC Index - Introduce shipment tracking as a critical prerequisite for building partnerships with intermediaries and carriers
	Intermediary	- Emphasize service offerings, which are hard to commoditize (value-added services), e.g., customs clearance, warehousing, packaging, and informing (e.g., control-tower solutions) - Improve collaboration among shippers and carriers to improve forecasts of demand peaks and better react to crisis - Improve end-to-end visibility and track-and-trace offerings by building interfaces (e.g., BRU cloud Brussels airport)
	Carrier	- Seek (partly) new partnerships as some trades are eroded by improved offerings from rail, truck, and ocean carriers - Introduce dynamic pricing and revenue-management systems based on OD pairs instead of single legs - Build strategic partnerships with ground handlers and road carriers to enhance distribution capabilities - Rethink distribution channels for providing cargo space (insourcing, general sales agents, marketplace)

Managing change (ReThink)

Observation 13: Freight booking remains a high-friction, one-to-one process with carriers still relying on in-person negotiations and the use of emails and phone calls. Driven by initiatives such as "IATA One Record", pushing the digital data exchange standard from document-centric to data- and process-centric air cargo logistics, new providers in air cargo emerge as (potentially) being helpful for prevalent actors

Dimension	Actor	Practices
Provider	Shipper	▪ Leverage logistics platforms to purchase freight rates and generate market intelligence (data across multiple shippers) ▪ Seek end-to-end visibility solutions (efreight, arviem, youredi) with the closest possible to real-time data
	Intermediary	▪ Strategically build, buy, or partner with emerging digital platforms and marketplaces
	Carrier	▪ Leverage marketplaces (Cargo.One, WebCargo) to increase revenue streams by building customer reach and to evolve dynamic pricing strategies ▪ Build own platforms (e.g., Air France KLM myCargo) to automate processes, allow for instant-confirmation e-booking, and provide full transparency of the shipping process

Expected price level and associated levers for the short- to mid-term outlook



Outlook:

In the short and medium term, demand for leisure and travel to see friends and family is predicted to rebound in 2023, while business is expected to trail leisure. Thus, pre-COVID 19 levels and (well needed) belly capacity will not (immediately) return to the market.

Actor	Lever	Price
Shipper	Demand: E-commerce and spending by “stuck-at-home” customers fueled by COVID-19 induces more volume for air freight due to the required speed of deliveries	
	Supply chain shift: Shifting supply chains through production and warehousing capacities leads to cannibalization by other modes of transport	
Intermediary	Load factor: Load factors (volume-density ratio) of 50-60% are not yet exploited properly in air freight and still offer potential for optimization	
Carrier (airline)	Sustainability: Rising energy costs (kerosene is currently exempt from energy tax; in addition, CO2 pricing is creating further cost blocks). Alternatives such as Sustainable Aviation Fuels (SAF) cannot generate reductions in the short to medium term	
	Capacity: Reduced loading space and thus missing belly capacity due to decrease in business flights and tourism	
Boundary conditions	Ground handling personnel: In addition to the loading space capacities, there is a lack of ground personal, which take over the handling, and lead together with infrastructural investments to further costs	

8

Mini cases & Russia-Ukraine

Based on the results presented in the previous chapters, this chapter illustrates practical use cases to demonstrate distinct approaches logistics actors can pursue when managing freight price volatility.

Coop Genossenschaft

The Coop case illustrates a distinct approach to maritime freight procurement that is fundamentally different from that of many other retailers. Coop is a member of the Beneficiary Cargo Owner (BCO) network of XSTAFF GmbH, a purchasing association bundling imports from its participating members.

DB Cargo Switzerland

The DB Cargo Switzerland case illustrates a rail company's approach to building and developing its digital distribution channel in the future to include dynamic pricing capabilities and interfaces to other freight exchanges.

Ek Procurement Group

The Ek Procurement Group (EPG) case illustrates the service offerings of an organization managing purchasing processes from China. The company specializes in achieving supply chain resiliency in China to mitigate the effects of disruptions on logistics markets.

Fygen

The Fygen case illustrates how manufacturing companies can leverage new technology to obtain insights into their suppliers' industrial activity and capacity levels to anticipate bottlenecks and specific supply chain functionality.

Heraeus

The Heraeus case illustrates how new digital business models can be leveraged for intelligent freight procurement decisions, rates, and tender management.

Migros Genossenschafts-Bund

The Migros case illustrates how shippers can use control tower solutions to display relevant information about logistics processes in real-time (e.g., expected delivery times) while quickly responding to supply chain disruptions (e.g., the Suez Canal blockage).





Coop Genossenschaft, Basel

Disrupted supply chain in global maritime transports

The company

The Coop Genossenschaft is the largest retail and wholesale company in Switzerland. It consists of around 2.5 million members and set aside around CHF 30.1 billion in 2020. The group employs more than 90,000 people and operates around 2,300 stores.

For the procurement of goods in maritime containers (FCL), Coop is a part of the BCO network of XSTAFF GmbH. We founded the organization in 2016 together with the Belgian retailer Colruyt for the purpose of bundling our imports from Asia. In the meantime, the steadily growing network, which has over 50 members, benefits from integrated logistics services from a single source.

The problem

Since the outbreak of the COVID-19 crisis two years ago, the container shipping business has faced considerable challenges. Lack of container equipment, port congestions, the blockade of the Suez Canal, significant increases in the volume of sea freight, and bottlenecks in hinterland connections have caused delays in the maritime trade. In addition, there are currently nine carriers that organize their vessel schedules in three alliances. Therefore, the demand for container equipment and storage spaces on the ships is unbroken, and we do not expect the situation to ease in the short term.

The solution

The BCO network organizes its charter. To this end, it plans to use small container ships with a capacity of 2,000 TEU. The congested ports in China and Europe are deliberately not approached to save time and money. The westward route starts with two Chinese loading ports in the Shanghai and Shenzhen areas and ends for the southern European members in Barcelona and Vlissingen for Western and Northern Europe. The necessary containers are pooled for the network via a leasing company and operated in circular motion for two years.

The benefit

In the medium term, we have constant freight rates and do not have to buy additional space at very high costs. Each member has guaranteed monthly departures with its pre-agreed number of containers from two main Chinese ports. In addition, we are strengthening our network and making ourselves somewhat less dependent on the globally operating carriers.



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EPG

Achieving supply-chain resiliency from China

The company

EPG is a procurement services provider that serves global clients and specializes in working with European firms. On behalf of our clients, we manage tasks and areas in their purchasing process from China, from demand optimization and sourcing-strategy definition to negotiation and supplier management and social responsibility. We offer organizations the ability to focus on their core competencies and gain access to our leading external procurement capabilities, improving the overall level of procurement performance and ensuring stronger compliance along their supply chain without the need to make large infrastructure investments.

The problem

An industrial manufacturer from Germany suffered from average margins and limited transparency in the supply market. The company had taken steps to improve supply-chain resilience from China by increasing safety stocks of vulnerable parts and ramping up supplier collaboration, but more work was necessary.

The solution

EPGs approach:

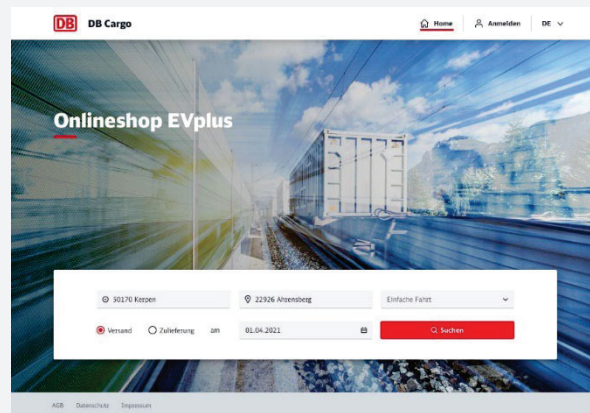
- Increased inventory to allow for backup capacity
- Dual sourcing to reduce outage risk
- Optimized supply chain network as supply/demand continues to evolve
- EPG added our China control tower to provide an up-to-date view across the entire supply chain process
- Flexible contracts across supply, manufacturing, and distribution
- Risk and bottleneck identification
- Design mitigation actions for highest risk and value segments
- Digital tools to increase visibility into multi-tier supplier network across all tiers
- Shift towards more circular production processes (recycle, reuse, remanufacture) to lower costs and create less waste

The benefit

In the case of the given industrial maker from Germany, EPG's assistance and solution implementation made the supply chain resilient to disruption affecting the logistics market and flexible enough to capture new sources of competitive advantage while lowering costs.



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DB Cargo Schweiz GmbH

Onlineshop EVplus

The company

Since 2007, DB Cargo Schweiz GmbH has been operating as a subsidiary of the DB Cargo network. Before the acquisition, DB Cargo Schweiz was founded in 2005 as Brunner Railway Services GmbH and was known for cross-border block train services to and from Switzerland as well as its single-wagonload network in Switzerland. Today, most transports are cross-border as the Swiss economy is also internationally oriented and needs efficient connections to all European countries and sea-ports. Internationally, DB Cargo Switzerland uses all DB Cargo's European network resources. These include, for example, high-performance multi-system locomotives, of which around 100 can be deployed in Switzerland, and around 110,000 modern freight wagons, which are available for all customers transport tasks.



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The problem

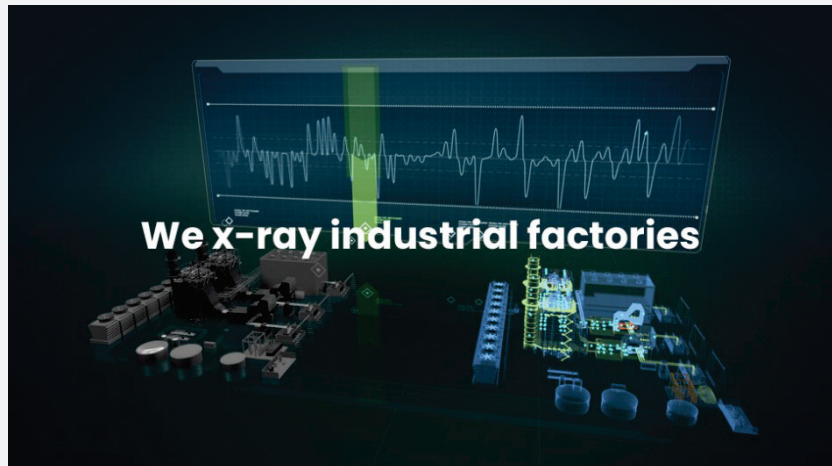
Today empty runs occur due to inconsistencies in the transportation process between the individual train routes due to long-term contracts with customers. Empty runs mean that existing capacity is used expensively and inefficiently. To avoid this problem, it is crucial to use an online shop or other digital distribution channels to find customers. Through these channels, every shipper can book free spaces in the short term to secure capacities or get price discounts. However, it is currently not possible to manage the demand, and we do not know details about the price elasticity.

The solution

We try to offer dynamic prices based on demand volatility in the future. According to the requested day, the system will also provide alternative dates with other prices to nudge the customer to the days with many available spaces. Price changes will depend on the urgency of both sides. If, for example, space is still available a day before the transportation, customers will receive a discount. This mechanism also works vice versa. Although we know that the solution should work in theory, the tool's performance must still be determined.

The benefit

With the help of the tool, we will be able to flatten the demand at the peak to other days and reduce empty spaces to a minimum. Moreover, by dynamizing the price, we can incentivize our customers to utilize our capacities better. As a result, we can act more reliably and cost-efficiently. In this context, an even more significant benefit could arise if we manage to establish interfaces to existing freight exchanges across other modes of transport (e.g., TIMO-COM).



Fygen Operations GmbH

Monitoring the supply chain activity in real time

The company

Fygen Operations GmbH is a Berlin-based intelligence SaaS provider for global manufacturing industries. Our innovative remote data gains insights into real-world industrial activities at a glance.

The problem

The manufacturing industry contributes 35% of the world's GDP. Within the life cycle of manufacturing industries, supply chains are considered a vital element. However, buying companies have hardly any understanding of the capacity levels (i.e., factory activity) of their suppliers. This problem is exacerbated if suppliers are confronted with shortages in delivery during unpredictable downtimes.

The solution

Fygen can x-ray the critical factories of suppliers remotely, provide insight into factory activities, and thus create a precise overview of supply chain capacities. With the novel real-time technologies offered by Fygen, we can answer the following questions:

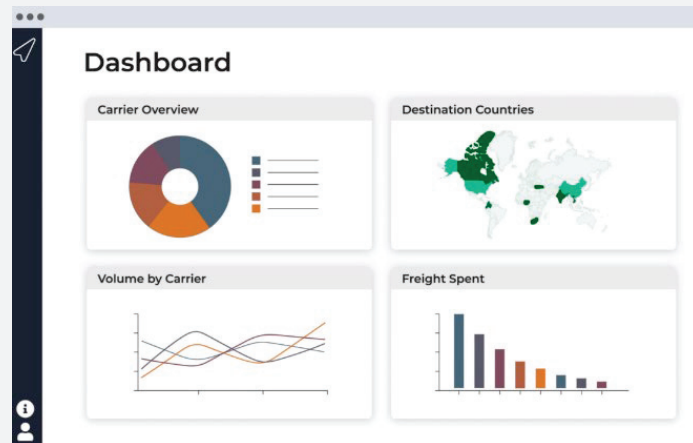
- What is the capacity load of a factory?
- How has the capacity load developed?
- Are there any production downtimes?

The benefit

By using Fygen's SaaS online platform, clients can understand the fitness of their suppliers, identify crisis-related or other unpredictable downtimes much earlier, and act accordingly (e.g., build up new inventories and adjust ordering). As a result, companies can secure their supply chain functionality and reduce their level of exposure in comparison to their competitors.



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Heraeus

Shipsta Flex: Digital and smart purchasing of transport services

The company

Heraeus, a leading international family-owned portfolio company with its headquarters in Hanau, Germany. The company's origins may be traced back to a 1660 family pharmacy. The Heraeus group now comprises companies in the fields of environmental, electronics, health, and industrial applications. Customers benefit from cutting-edge technology and solutions backed by extensive material knowledge and technological leadership. The FORTUNE Global 500 listed group had generated revenues of €31.5 billion in the fiscal year 2020 and employed approximately 14,800 employees.

Being a portfolio company the demand for logistics and transport services are manifold. A wide range of transport modes with versatile service options are within our scope.

Heraeus

Heraeus Holding GmbH
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www.heraeus.com

The problem

The challenge is to digitize the current workflows of today's logistics procurement. Furthermore, creating a digital network between the freight forwarders and LSPs on a shared platform to optimize costs and processes in the supply chain represents a challenge. The COVID-19 crisis has dramatically impacted the logistics market. Freight rates are much more volatile today. Shippers need to be prepared to manage transportation procurement activities with a smart, digitized set up.

The solution

The logistics platform delivers smart procurement decisions by enabling total visibility and data-driven solutions for a state-of-the-art rate- and tender management, buying freight for any transportation modes and equipment via spot and tender events, receiving and comparing bids, generating a rate history with all important dates in one place, gaining insights to ensure cost transparency, aligning with market rates for multiple transport modes, and increasing supply chain performance.

The benefit

- Agility: automates time-consuming processes to act efficiently, no "Excel tsunami"
- Efficiency: web based platform connects with partners and enables an intelligent, data-driven approach
- Meaningful analytics: analyze quotes with combinatorial scenarios and evaluation
- Meaningful reports: visibility into shipping volumes and spend, strategic decision making based on data
- Intelligence: an end-to-end platform that provides a complete overview of the data (single point of truth)
- Global network: one database for all company's logistics locations

SHIPSTA

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www.shipsta.com



Migros-Genossenschafts-Bund

The company

The Migros-Genossenschafts-Bund (MGB) is the largest retail company in Switzerland. The MGB Logistics and Transport division offers customized logistics solutions to both the Migros Group and third-party companies in Switzerland. At seven sites, 80 employees ensure a smooth flow of goods along national and international supply chains.

Migros LTOPEX Tower – The Migros Supply Chain Command Center

The problem

With several thousand products a day, different distribution channels and means of transport, monitoring and, in particular, optimizing complex value chains becomes a major challenge. Those who want to maintain an overview of supply chains need a user-friendly tool that displays relevant information in real time and offers simple analysis options. This allows logistics processes to be displayed transparently and provides knowledge about expected delivery times.

The solution

The Migros LTOPEX Tower displays all relevant information about the supply chain centrally and clearly. Deliveries can be tracked, truck routes monitored, and customers informed in real time. Smart algorithms transform the complex data of the transport chains into concrete information. The visualization of deviations, trends, and KPIs makes it possible to react quickly and make the right decisions immediately. Digital maps with geographical reference points make it possible to visualize our data.

The benefit

The Migros LTOPEX Tower serves as a command center in supply chain management. The monitoring of worldwide transport processes controlled from there even integrates data on global events that could pose a potential risk to the flow of goods. Customers are guaranteed complete transparency. This allows exploiting the Just-in-Time principle while quickly responding to supply chain disruptions like the Suez Canal blockade.

Russia-Ukraine: Uncertainty grows among shippers and logistics service providers

The Russia-Ukraine war, which erupted just prior to the publication of this work, occurred at a critical time for the present study, as it resulted in unexpected challenges and posed new questions for logistics actors. For example, what role do logistics actors play in times of geopolitical crisis? How can practitioners understand the study results

in this new crisis? Consequently, it was logical to respond to current developments, document significant impacts on various logistics markets, and provide recommendations for action. The following section sheds light on these questions.

Impact of the Russia-Ukraine crisis on different transport modes:

Sea freight	Road freight	Rail freight	Air freight
36%	12,000	1.5 M	28%
The increase in dwell times of outbound ships with export cargo in European ports	The number of truck drivers stuck in Ukraine	The number of containers transported by rail from China to Europe in 2021	The increase in flight routes from Germany to Asia

Challenges and consequences:
As a result of the Russia-Ukraine conflict, both governments and businesses have significantly restricted their trade relations with Russia and Russian companies. The war in Ukraine has also led to a disruption of transport routes. These developments have created various transport-specific challenges: In sea freight, specific ports in the Black Sea (e.g., Odessa) are cut off from international trade, with shippers, intermediaries, and carriers seeking to find alternative transport routes via Romania (e.g., port of Constanta). Also, due to transport shifts from the New Silk Road to sea freight, capacity tightened further, and freight prices exploded. In road freight, most drivers originate from Eastern Europe, which further exacerbates the shortage of personnel. It is estimated that about 12,000 drivers were stuck in Ukraine at the beginning of the war and that the number of Ukrainian drivers employed in Poland is much higher. Consequently, cargo space for

national and international transportation will become scarcer, and prices will likely rise. While rail freight traffic notably grew in volume during the COVID-19 crisis due to transport shifts from sea to air, the New Silk Road was particularly affected by increased uncertainty, security concerns, and moral issues of shippers. While some cargo is still processed on import to Europe, exports to China are no longer dispatched, as shippers are increasingly withdrawing their bookings. Although the Middle Corridor could benefit in the short term, other corridors can neither absorb the transport volumes nor provide more efficiency in transport time and costs than sea freight.

Of all transport modes, air freight is the most severely affected by the Russia-Ukraine crisis. In response to the closure of Russian airspace, carriers are forced to initiate detours via the Middle East. These diversions increase the number of flight routes from Germany to Asia by up to 28%

and require more fuel and, therefore, more weight, resulting in capacity losses as less tonnage can be transported, which has led to a significant increase in spot rates (comparable to March 2020).

Assessment of impact on freight prices

The Russia-Ukraine crisis has affected volatility significantly due to rising uncertainty, especially on a local scale but has not yet reached the magnitude necessary to have a global impact with structural ramifications. However, global sanctions on Russia have resulted in the formation of a worldwide block of 37 nations representing 55% of the global GDP, with some of these countries supporting punitive actions against Russia and others supporting both Russia and China. In the short-term, freight prices are expected to increase among all transport modes due to shortages of truck drivers, increasing dwell times, and port congestions. A study by McKinsey (2022) published immediately prior to the outbreak of the Russia-Ukraine crisis argues that freight prices in containerized logistics will return to 2019 levels by Q3 2022 in the best case or remain at a level three times that of 2019 in Q4 2024 in the worst case. Since these calculations did not consider the impact of the Russia-Ukraine crisis, we estimate that freight prices will be significantly higher in the best case and that the probability of the worst case occurring is likely to increase. This will mean that freight price volatility and associated uncertainty among logistics actors are likely to remain high. However, we also observe mid-term drivers counteracting further price increases. For instance, tanker and dry bulk freight is becoming more critical than container cargo during times of geopolitical turmoil. Together with a decreasing impact of COVID-19 on operating activities, consumers shifting their spending from products to services, and shortening trade routes in sea freight, freight prices may recover faster than expected. Until then, it becomes even more important for shippers and LSPs to establish successful crisis management. This includes securing liquidity to ensure business

continuity, monitoring the payment capabilities of customers and service providers, and ensuring rapid decision-making throughout task forces.

Logistics-related trends

The Russia-Ukraine crisis and the resulting political sanctions led to further block formation. With supply chains at risk, the crisis has heightened many shippers' awareness of their dependence on individual transport routes and sourcing regions and highlighted that the economic advantages of globalization could only be realized if there is global political and economic stability. Two trends are increasingly coming to the fore:

Sourcing: Shippers are critically examining the resilience of their supply chains and putting sourcing strategies to the test due to geopolitical risks, potentially causing a structural shift in transportation processes. One issue many shippers will review is the dependency on sourcing regions whose political conformity is not acceptable or justifiable for a particular company. Therefore, aside from economic conditions, it is conceivable that a sourcing country's political stability will be evaluated in future decisions.

New Silk Road and sea freight: Shippers have increasingly used rail freight as an alternative means of transport between Europe and Asia during the COVID-19 crisis. Due to increased uncertainty, security concerns, and moral issues, shippers have shifted cargo volumes back to air and sea freight. In this context, two logistics-related development trends are conceivable. First, the transatlantic region could become increasingly important for the Western world, which would lead to an increase in freight volumes handled at northern ports such as Rotterdam and Hamburg. A second development trend could be a further shortening of transport routes in sea freight by cutting off the Black Sea and transferring transport volumes in the Mediterranean (ports between Athens and Gibraltar).

SECTION B

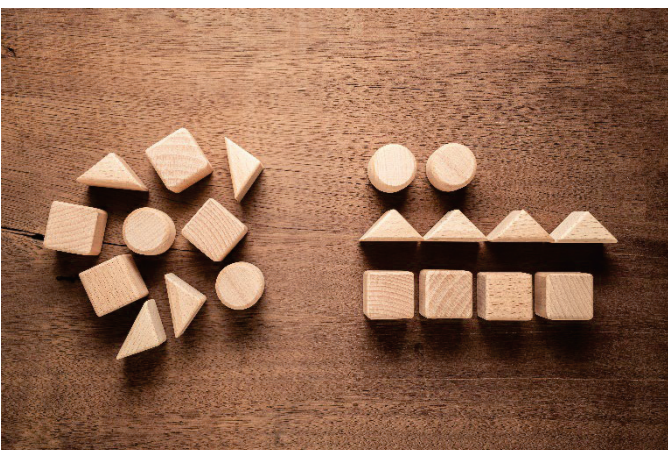
Index and company profiles

Section B presents a classification and meta-list of indices and digital business models in freight. We include a handy and compact summary of the index and company profiles in the appendix.

9

Classification of indices and digital business models in freight

This chapter classifies and presents the tools and indices developed based on our extensive interviews and online research. To this end, we first offer distinct structuring criteria, culminating in two classification schemes for indices and digital business models. After that, we assign each observed index and digital business model to this classification scheme. We subsequently attach a handy and compact summary of the profiles according to the respective classification in the appendix. The resulting profiles provide an overview of the information sources and emerging digital actors available to legacy players in logistics markets. However, since the profiles are based on the authors' research and data analysis of primary (e.g., company websites) and secondary data sources (e.g., Crunchbase, CBinsights), it is not possible to present an evaluation of how these indices and digital business models serve as solution providers to manage freight price volatility in logistics markets within the scope of this study.

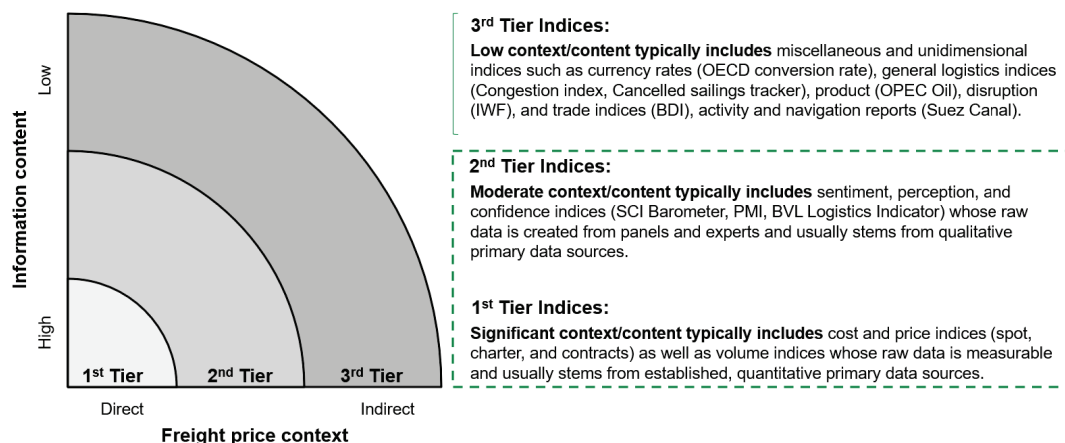


9.1 Indices

In the field of information sources, the interviewed experts stressed the plethora of indices and information sources and noted that these often provide an inadequate and undifferentiated picture of current developments to draw conclusions and recommendations for action. In this vein, the experts identified three critical pain points: low publication frequency, retrospective data publications, and methodological misconceptions. Due to this partial lack of transparency for practitioners, the following chapter presents a systematization of indices and relevant investigation criteria to leverage indices as a decision-supporting instrument in practice.

Figure 14

Classification of indices in the context of freight prices



Tier 1 indices: Indices in this category typically include cost and price indices (spot, charter, contracts) and volume indices whose raw data is measurable and usually stems from established, quantitative primary data sources. Indices within this category provide a significant freight price context and information content.

Tier 2 indices: Indices in this category typically include sentiment, perception, and confidence indices from expert panels whose raw data usually stems from qualitative primary data sources.

Based on our assessment of available indices concerning freight prices, we clustered the available indices based on an onion model into one of the following three segments:

- (1) Tier 1 indices
- (2) Tier 2 indices
- (3) Tier 3 indices

Figure 14 illustrates the classification into three tiers based on the two dimensions of freight price context and information content. In the following, we explain each tier to provide a better understanding of the available index landscape.

Indices within this category provide a moderate freight price context and information content.

Tier 3 indices Indices in this category typically include various and unidimensional indices such as currency rates (e.g., OECD conversion rate), general logistics indices (e.g., congestion index, canceled sailings tracker), product indices (e.g., OPEC Oil), disruption indices (e.g., IWF), trade indices (e.g., Baltic Dry Index), and activity and navigation reports (e.g., Suez Canal). Overall, indices within this category provide low freight price context and limited information content.

Recommendation

Our investigation of the indices resulted in 60 different information sources. For each index, we have created a corresponding profile with key information in the appendix. Based on our classification, practitioners can leverage the identified indices within each tier. Following Resch (2012), the indices examined in this study can be used as methodological-instrumental support by providing decision-critical information in aggregated form for three fields of action:

- **Price planning:** Price planning involves developing a price system that takes into account given and expected market, competitive, and environmental conditions. As such, the identified indices support information retrieval by visualizing the general price development and enhance planning reliability regarding possible price and capacity adjustments. Finally, price planning serves as an objective and accepted basis for price negotiations for determining prices in line with the market.
- **Price control:** Price control involves developing a benchmarking tool or dashboard to monitor market conditions. Thereby, practitioners can leverage the identified indices as an objective and accepted basis for price negotiations to set prices in line with the market.
- **Price steering:** Price steering includes monitoring soft facts as leading indicators that (can) reduce the risk of unexpected volatility in transportation prices. Practitioners can use indices to steer prices (e.g., when LSPs are unexpectedly exposed to large fluctuations in demand and thus loss-making business, or when shippers are at risk of being surcharged). In this sense, the historical development of indices as an objective leading indicator can also help to legitimize suitable countermeasures.

Based on the preceding application areas, we recommend to carefully examine the identified indices in this chapter and, in particular, determine whether a specific index would be of use based on the following criteria: transportation mode, geographical scope, load carrier, and pricing. Based on the given publication frequency of the selected indices, we propose to either collect index data and record it manually or to build a dashboard using Microsoft PowerBI and use APIs with index providers to monitor current market conditions. To obtain a better overview of the market, this process should involve supplementing the index values with proprietary and partner data, such as contracted freight rates, current market capacity, rejected tender rates (as shipper), driver waiting times (road), and demand monitoring. Considering such data will help in increasing market transparency, in gaining a retrospective overview of historical price movements, and thus generating an outlook on future (price) developments.

9.2 Digital business models in freight

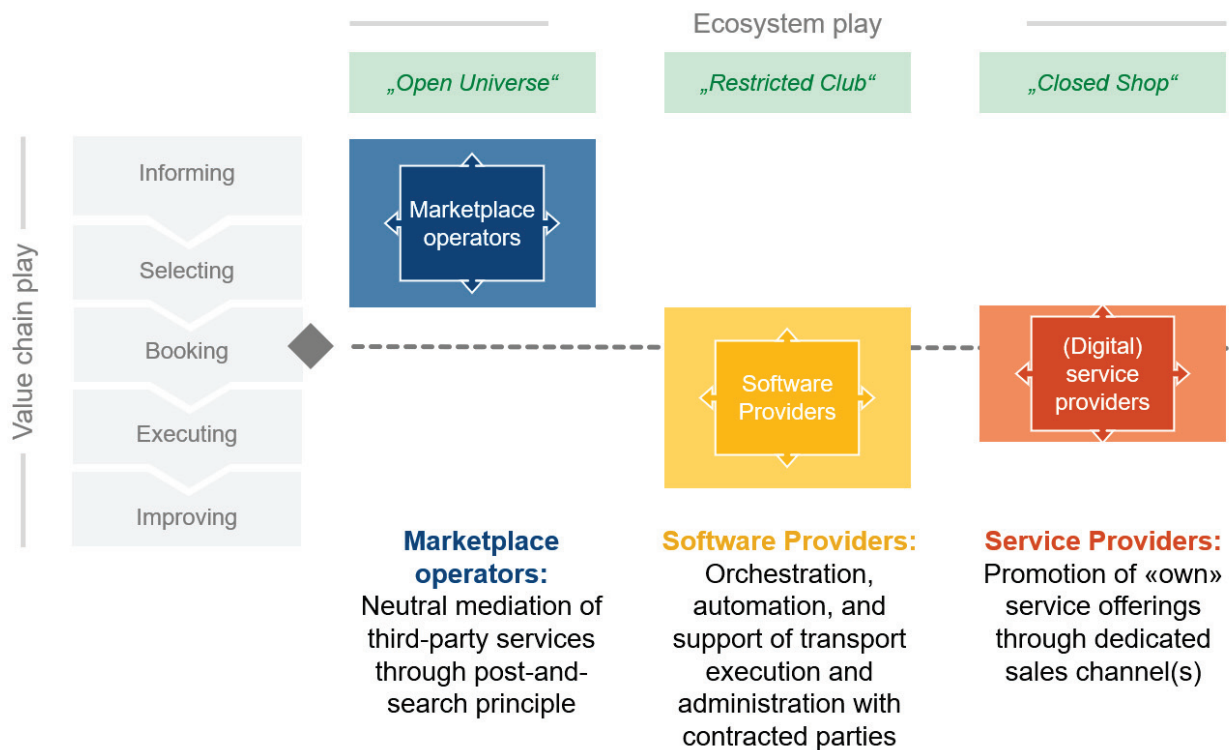
In the field of digital business models of freight, the interviewed experts identified three critical pain points in the field. First, legacy players in logistics markets usually lack knowledge about emerging digital business models. Accordingly, established shippers, carriers, and intermediaries are not fully aware of emerging actors, providers, and related technological advancements. Second, shippers, carriers, and intermediaries do not actively monitor the potential and growth trajectory of new entrants. Third, practitioners lack understanding of the value propositions emerging digital business models possess as the boundaries and solution scope between them are becoming increasingly blurred. For instance, differentiating between a new business model and a legacy company with a “digital surface” is challenging and becomes even more so when attempting

to determine their different functionalities. To clarify this issue, we categorize the landscape of digital business models in freight into nine archetypes building on an existing classification by Zintel et al. (2021). To alleviate practical problems and misunderstandings, we assign each identified digital solution provider to one of these archetypes.

After a short description of the digital business model evolution in freight, we describe each archetype in more detail in this chapter. Figure 15 illustrates the three traditional digital business model families in freight. In the following, we explain each business model in more detail to provide a deeper understanding of their ecosystem and value chain interplay.

Figure 15

Classification of traditional digital business models in freight (Zintel et al., 2021)



1 Marketplace operators provide online marketplaces that connect LSPs and shippers to facilitate the exchange of goods. Historically, marketplaces acted as neutral mediators that focused exclusively on supply and demand matching. As Figure 15 indicates, their value chain play is limited to providing information and, to a lesser extent, assistance in the selection process of logistics providers. Subsequent bookings and other value-generating functions take place independently of the marketplace.

2 Software providers focus on supplying users with software that enables them to manage transactions through a defined portfolio of well-selected (contract) partners. Software providers typically assist LSPs in their transport operations and critical segments of the freight value chain. Historically, shippers placed freight bookings exclusively through a limited group of partners connected via separate electronic data interchange (EDI) connections.

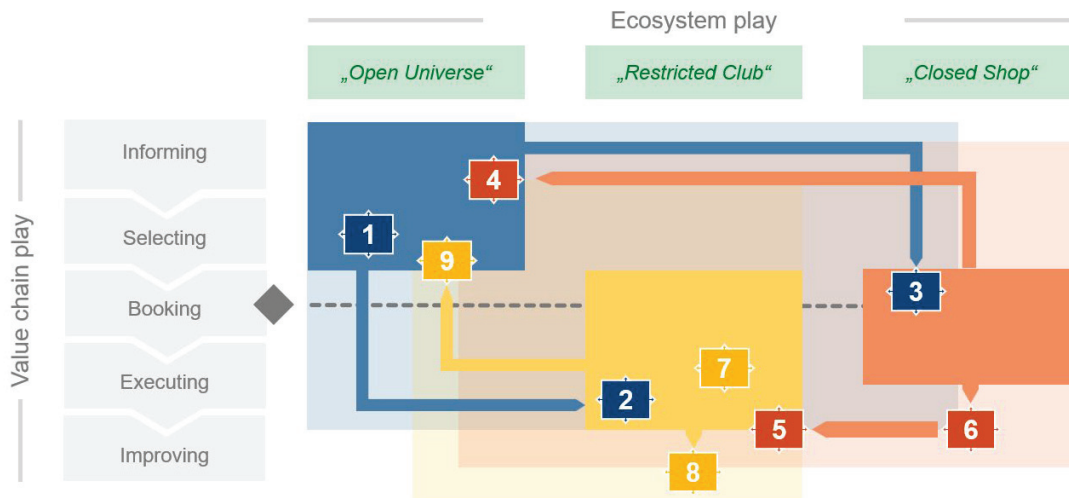
3 (Digital) service providers are primarily concerned with the packaging, configuration, and distribution of their transport offerings. As a result, they have access to their own production means or a selected carrier base. This form of digital business strategy is very similar to that of traditional LSPs and can be interpreted as to its digital counterpart. Digital service providers can be classified along the value chain from cargo booking to delivery, including added services such as tracking and tracing of goods.

In contrast to this traditional picture, the various digital business models are increasingly evolving in terms of their functional scope. As Zintel et al. (2021) note, the reality of digital business models in freight transport today is much more complex. In this respect, three trends that are shaping digital business models can be derived: First, the digital ecosystem is increasingly converging and thus blurring the boundaries between the traditional three business models. Accordingly, hybrid business models seeking to combine the functionalities of the individual business model families to generate added value have emerged. Second, the value chain capabilities of the individual business models are continuously increasing. For instance, marketplaces are no longer limited to a mere search platform but also facilitate LSPs' active selection and booking. Third, technology is constantly advancing in critical areas such as data and analytics (e.g., AI-based spot prices), altering the range of services provided by LSPs.

The changing characteristics of digital enterprises have led to the three previously identified business model families being divided into nine different archetypes, which are briefly explained below. Figure 16 illustrates these distinct value chain and ecosystem movements and the overlap of digital business models in today's landscape. In the following, we explain each archetype to allow the reader to better understand its functionality.

Figure 16

Emergence of nine digital business models in freight (Zintel et al., 2021)



Based on Figure 16, Zintel et al. (2021) distinguish between nine archetypes of digital business models in freight:

1 Matching marketplaces are the most traditional type of marketplaces. They act as a neutral intermediary, assisting third parties in matching capacity and loads to demand. They have a limited value chain scope and often focus on supporting the information and selection process before a booking.

2 Managed marketplaces support most value chain stages, ranging from selecting and booking to paying and optimizing future transactions using comprehensive analytics. Rather than being passive observers, as is the case for matching marketplaces, managed marketplaces actively participate in transactions by evaluating, rating, and prioritizing partners and offers.

3 Hybrid marketplaces span all three business model families and are increasingly gaining market size among digital marketplace business models. In contrast to matching and managed marketplaces, hybrid marketplaces usually provide logistics services through long-term cooperation or by using their own production means.

4 Hybrid forwarders exist between the business model families. They operate as logistics services providers on the

market but leverage marketplace capabilities to contract with carriers and acquire capacity in the background. Therefore, hybrid forwarders are usually considered asset-light.

5 Digital forwarders resemble the business model of traditional freight forwarders by offering competitive prices for the end-to-end logistics of complicated transport chains. In addition, digital freight forwarders span the value chain by developing software provider capabilities. For instance, digital freight forwarders replace disposition processes and use analytics to enable intelligent routing and network optimization. In terms of logistics assets, digital forwarders leverage long-term partnerships or their own production means.

6 Digital storefronts are online sales channels of LSPs dedicated to promoting their services and offering opportunities to facilitate shippers' booking processes. Digital storefronts allow shippers to receive quotes and price conditions for transportation in real time.

7 Visibility managers assist logistics actors by providing visibility into transportation processes along the value chain. Accordingly, visibility managers focus on the execution process of transportation providing information on cargo movements and allowing for route optimization.

8 Transport managers or transportation management systems (TMSs) focus on improving logistics management by automating processes such as billing and invoicing. To optimize freight procurement, TMS solutions build interfaces between shippers, carriers, and freight forwarders and provide logistics actors with a single source of truth.

9 Hybrid managers include TMS functionalities but are not limited to these. In addition, hybrid managers possess their own marketplace capabilities, allowing shippers to submit freight bids or spot shipment requests to the marketplace

to compare freight rates not covered by existing provider agreements.

Figure 17 summarizes the value chain and ecosystem play, presents brief assessments of the individual digital business models in freight, and identifies possible future development paths in terms of market share. Based on this classification, we assign each identified digital solution provider to one of these archetypes. To this end, we include a handy and compact summary of the company profiles in the appendix.

Figure 17

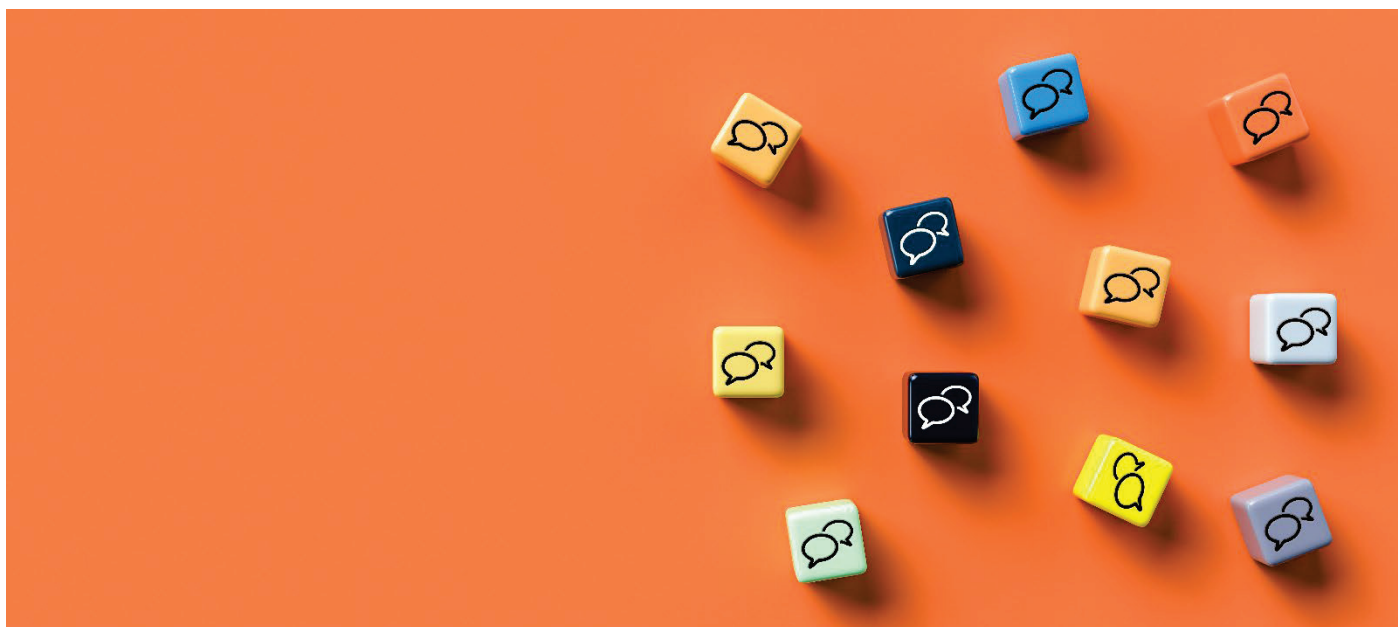
Breakdown of the nine digital business models in freight (adapted from Zintel et al., 2021)

1 Matching marketplaces ▪ Value chain play: Neutral platform for informing, and selecting (matching function) ▪ Ecosystem play: Open Universe, i.e., direct interaction through offline channels Quick assessment: 🚫 Market share + Simple platform, neutral market position + "Offline deal-closing" opportunity - Narrow value chain scope	2 Managed marketplaces ▪ Value chain play: Expand downward to offer end-to-end transactions (booking and execution) ▪ Ecosystem play: Expand to a restricted club (e.g., through ranking, rating, prioritizing partners) Quick assessment: 🟢 Market share + Broad or full transaction support + Guarantee of defined quality level - Losing "offline deal-closing" opportunity	3 Hybrid marketplaces ▪ Value chain play: Possess traits of managed marketplaces ▪ Ecosystem play: Incorporate service offerings (long-term carriers, own production means) Quick assessment: 🟢 Market share + Broad or full transaction support + Additional services and guarantees - Losing neutral market positioning
4 Hybrid forwarders ▪ Value chain play: Expand upwards and develop marketplace capabilities ▪ Ecosystem play: Marketplace environment (backend) to procure freight capacities Quick assessment: 🟢 Market share + Powerful marketplace procurement + Forwarder-like guarantees to clients - Only digital broker: no assets	5 Digital forwarders ▪ Value chain play: Expand downward and become end-to-end operators for the entire value chain ▪ Ecosystem play: "Restricted" long-term carrier partnerships and own production means (assets) Quick assessment: 🟢 Market share + Digital (transparency, documentation) + Full-service portfolio - Miss "global networks", work with agents	6 Digital storefronts ▪ Value chain play: Platform to quote, book, and track & trace shipments ▪ Ecosystem play: "Closed" online sales channels to promote own services to the market Quick assessment: 🚫 Market share + Monitor shipments + Experience in "global networks" - Closed solution (limited functionality)
7 Visibility managers ▪ Value chain play: Focus on execution (network planning, optimization, carrier equipment) ▪ Ecosystem play: "Restricted" standalone offerings Quick assessment: ➡ Market share + Improve execution process (transparency) + Predictive ETAs - Narrow, standalone offerings	8 Transport managers ▪ Value chain play: Support and automate (billing, invoicing, optimization (transport route)) ▪ Ecosystem play: "Restricted" but integration with different players (shipper, carrier, forwarder) Quick assessment: ➡ Market share + Full value chain play + Neutral orchestrator position - No own "service offerings"	9 Hybrid managers ▪ Value chain play: Expand upwards to build marketplace competencies ▪ Ecosystem play: "Open": Place freight tenders or spot shipment requests on the marketplace Quick assessment: 🟢 Market share + Full value chain play + Coverage outside of existing providers - Loss of "neutral" orchestrator position

10

Discussion

While the results presented in the preceding chapters contribute to providing answers to the previously defined research questions and thus to a better understanding of freight price volatility (management), a concluding discussion is necessary to put the findings into perspective. Therefore, this chapter critically evaluates the study results by illuminating the contributions (i.e., the acquisition of knowledge) and limitations (i.e., boundaries from the derived expertise) of the present study to inform future research.



10.1 Contribution

Concerning the overall contribution of this study, one of the lessons learned from discussing the volatility sources and analyzing management practices to mitigate freight price volatility is that each logistics scenario has different characteristics; however, there are a handful of patterns that repeat with variations. In addition, the analysis of indices and digital business models in freight reveals that a variety of different information sources and solution providers can be identified in logistics markets. By illuminating the challenges, practices, and tools to manage freight price volatility, the contribution of this study is threefold:

Contribution 1: Understanding challenges (RQ1)

First, this study provides a comprehensive conceptualization of sources and dimensions of freight price volatility to explore the underlying phenomenon. The four dimensions and 35 sources of volatility identified within the group exercise can provide practitioners with a better understanding of the complexity of freight price volatility and researchers with a foundational work based on which to identify cause-effect relationships.

10.2 Limitations

Although this work offers important insights, the study was exploratory by design and is not without limitations. Thus, assumptions, as well as subjective assessments, were needed to answer the research questions. In the following, this study's content- and methodology-related limitations are presented, starting with the derived volatility sources in Chapter 5.

Limitation 1: Understanding challenges (RQ1)

First, the elaborated dimensions and sources of volatility presented in Chapter 5 are not static but variable over time and depend on technological breakthroughs or behavioral changes between logistics actors. The time constraint stems from the classification representing a momentary snapshot of the individual volatility sources. Therefore, the conceptualization should be revisited continuously over an extended period to capture permanently

Contribution 2: Understanding practices (RQ2)

Second, based on a holistic framework for identifying and investigating strategies for dealing with freight price volatility, the four analyzed logistics scenarios provide contextualized insights into good practices. Drawing on an extensive expert interview series, this study provides a clear picture regarding the application of practices according to the management dimension, management stage, and actor perspective. Using our practitioner's guide, shippers, intermediaries, and carriers can implement the identified practices within their specific logistics scenarios and address existing pain points.

Contribution 3: Understanding tools (RQ3)

Third, the classification and analysis of indices and digital business models in freight make a substantial contribution to better understanding tools available on the market and their individual value propositions for shippers, intermediaries, and carriers. In this vein, the profiles in the appendix provide a clear picture for practitioners concerning the heterogeneity and scope of solutions.

changing structures. In addition, the derived conceptualization could be supplemented or revised by other scientific literature.

Limitation 2: Understanding practices (RQ2)

Second, the research design is subject to limitations regarding the conducted expert interviews and the development of practices within each scenario. For example, while the expert selection focused on an even distribution of interview partners among shippers, intermediaries, and carriers, this was not always achieved. Consequently, the employed interview format could have benefitted from a more comprehensive sample of participants to allow for enhanced robustness and a deeper understanding of contextual factors. We sought to fill this gap by processing and discussing the interview results within the consortium to ensure that the opinions of individual

actors are included in the study and that different experts validate the interview results.

Since we mainly conducted this study during the COVID-19 crisis, several of the described practices must be considered in light of this crisis and cannot easily be translated to other disruptions. Based on this constraint regarding the methodological approach, the identified good practices within each logistics scenario in Chapter 7 lack specific information about each actor's situation, which is why assumptions were needed to reduce complexity. Thereby, the applied "high-level approach" ensures the same overall level of analysis across all four logistics scenarios and provides the flexibility necessary for the individual implementation of practices. However, although we distinguish between different actor perspectives (shipper, intermediary, carrier), additional effects such as company-specific strengths could not be considered.

Limitation 3: Understanding tools (RQ3)

Third, objectification regarding the classification of the identified indices and digital business models in freight was only partially successful. Since the classification of each company was primarily based on expert interviews and extensive online research, primary data was only partially collected. In this context, further analysis could improve the validity of the classified indices and companies by integrating additional sources of evidence to enable data triangulation. As such, a more comprehensive review and discussion with industry experts could have further improved the methodological validation; however, such a review and discussion would have exceeded the scope of the study. Finally, a conclusive assessment of the performance and added value of the individual index and solution providers concerning the volatility of freight prices was not feasible. Depending on the company, the assessment must also be viewed and requires further implementation knowledge, which was not investigated in this consortium study.

11

Conclusion

As outlined in the previous chapters, this study provides significant insights for research and practice by collecting, structuring, and analyzing challenges, practices, and tools with which to address freight price volatility in logistics markets by focusing on the perspectives of shippers, intermediaries, and carriers.

Challenges

A fundamental finding based on the results of this study is that there are numerous sources of volatility that complicate freight price forecasting. By structuring the volatility antecedents into four dimensions and 35 underpinning sources, this study provides a better understanding of the factors determining freight prices. Practitioners need to assess the relevance of these sources of volatility to their situation to identify the specific impact of each volatility source on the development of freight rates.

Practices

In addition to the increased clarity regarding volatility sources, identifying different measures to deal with volatility within the different logistics scenarios represents substantial practical value. The study results indicate that practitioners can implement a myriad of practices intra-organizationally, but especially collaboratively with partners in the logistics chain. Practitioners must determine and adjust the effectiveness of these individual measures based on their specific context. For this purpose, the practitioner's guide in Chapter 4 provides an instrument for implementing the study contents. The management framework presented in Chapter 6 illustrates that managing volatility requires different actors and dimensions of practices. In this context, structuring volatility management in three management

stages not only enables a detailed analysis of measures in "business as usual" or during a "disruption", but also opens the perspective to "Rethink" established practices.

Tools

Lastly, the two classification schemes for indices and digital business models in freight provide transparency for practitioners regarding available information sources and solution providers in logistics markets. In this vein, the resulting list of profiles in the appendix provides an overview of information sources and emerging digital players available to shippers, intermediaries, and carriers in logistics markets. On the one hand, practitioners can leverage the derived list of indices as a decision support instrument for market-driven price planning, management, and control. On the other hand, the digital business models provide practitioners with an overview of potential solutions on the market and create a stimulus for pursuing their own digitization efforts.

Conclusion

To conclude, this study serves as a starting point for further (quantitative) research concerning the sources and associated practices in dealing with freight price volatility. While this study recommends a range of different practices, information sources, and tools, many of the results require quantitative confirmation before practitioners can use them to make implementation decisions. Still, this study adds to research on freight price volatility by offering a uniform classification of volatility sources, management practices, indices, and digital tools, thus providing helpful guidance for practitioners.

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Appendix

A1 Interview guideline

Interview series on "Managing Volatility in Logistics Markets"

Interview guideline prepared by Laurin Zemmrich, as of 22.09.2021

Aim of the interview

- Based on our framework, which **capabilities** (informational, organizational, partner, provider) can be used in logistics to deal with freight price volatility?
- Which of these **capabilities** can be located and used depending on the volatility stage (ReStrain, ReAct, ReThink) and logistics scenario?
- How can the **capabilities** be used by different logistics actors (shipper, intermediary, carrier)?

1. Introductory question

- Personal introduction (name, function, role) in the company
- What has been your experience with freight price volatility so far?
- **Objective:** Derive and define the volatility scenario(s) to be investigated (air, sea, road, rail)

2. Interview questions based on research questions

- Today we talk about practices for managing volatility in freight prices in three clusters (ReStrain, ReAct, ReThink)
- **Goal:** Common understanding of the interview content and objectives

3. Management cluster 1 - ReStrain

- How can companies prepare against (known) triggers for freight price volatility?
- Which **sources of information and indices** have proven useful?
- Which **organizational management components, decisions, and structures** have proven successful?
- Which **strategies in dealing with SC partners** have proven successful?
- Which **tools and solution providers** have proven successful?

4. Management cluster 2 - ReAct

- How should companies behave when (unexpected) disruptions occur?
- Which **sources of information and indices** have proven useful?
- Which **organizational management components, decisions, and structures** have proven effective?
- Which **strategies in dealing with SC partners** have proven successful?
- Which **tools and solution providers** have proven successful?

5. Management cluster 3 - ReThink

- How can logistics companies best recover from disruptions and reflexively adapt to new market conditions?
- Which **information sources and indices** have proven to be helpful?
- Which **organizational management components, decisions, and structures** have proven successful?
- Which **strategies in dealing with SC partners** have proven successful?
- Which **tools and solution providers** have proven successful?

A2 Overview expert interviews

ID	Role	Type	Location	Duration (min)
Expert 1	Head of International Road Haulage	Association	Germany	71
Expert 2	Co-Founder and Managing Director	Service Provider	Germany	69
Expert 3	Coordinating Manager Central Logistics	Shipper	Germany	48
Expert 4	Sales and Logistics Advisor	Intermediary	Switzerland	53
Expert 5	CEO	Intermediary	Germany	51
Expert 6	Deputy Managing Director	Carrier	Germany	50
Expert 7	Director Controlling	Intermediary	Germany	69
Expert 8	Vice President Business Development	Carrier	Germany	56
Expert 9	Head Specialist Department of Logistics	Shipper	Switzerland	53
Expert 10	Logistics Coordinator	Shipper	Germany	58
Expert 11	Head of Distribution	Intermediary	Switzerland	56
Expert 12	Expert for Logistics Solutions and Distribution	Service Provider	Germany	60
Expert 13	Senior Procurement Partnering Manager	Shipper	Switzerland	49
Expert 14	Commercial Director	Shipper	Germany	72
Expert 15	CEO	Carrier	Germany	47
Expert 16	Head of Transport	Service Provider	Switzerland	55
Expert 17	Senior Advisor	Carrier	Switzerland	55
Expert 18	Managing Director	Intermediary	Germany	69
Expert 19	Head of Logistic Engineering	Service Provider	Switzerland	65
Expert 20	Managing Director	Intermediary	Germany	53
Expert 21	CEO	Carrier	Germany	60
Expert 22	Senior Manager Industry Solutions	Service Provider	Germany	51
Expert 23	Assistant to Managing Director	Shipper	Germany	51
Expert 24	Strategy & Innovating Director	Intermediary	Switzerland	71
Expert 25	CEO	Intermediary	Austria	56
Expert 26	Head of International Road Haulage	Association	Germany	61
Expert 27	CEO	Service Provider	Germany	67
Expert 28	Head of Contract Logistics/SCM	Intermediary	Switzerland	73
Expert 29	Head of Business Design and Regulation	Intermediary	Switzerland	71
Expert 30	Business Development Director	Service Provider	Switzerland	74
Expert 31	Head of Distribution	Carrier	Switzerland	72
Expert 32	CEO	Carrier	Switzerland	59
Expert 33	Managing Director	Shipper	Switzerland	46
Expert 34	Group Category Manager Logistics	Shipper	Germany	55
Expert 35	CEO	Service Provider	Germany	50
Expert 36	Division Manager International Transports	Shipper	Switzerland	52
Expert 37	Leader SCM & Operations	Shipper	Switzerland	52
Expert 38	Director Supply Chain Management	Shipper	Germany	67
Expert 39	Managing Director	Service Provider	Germany	70
Expert 40	Deputy Head of Transport	Shipper	Switzerland	75
Expert 41	CEO	Intermediary	Switzerland	46
Expert 42	Head of Procurement	Shipper	Germany	64
Expert 43	CEO	Intermediary	Switzerland	45
Expert 44	Managing Director	Intermediary	Germany	40

COMPANY OVERVIEW

Company (website)	Archetype	Air	Rail	Road	Sea	Geographical Scope	Pricing and costs
<u>123cargo</u> https://www.123cargo.eu/	Matching marketplace			✓		Regional (Central Europe, Eastern Europe)	180 EUR / 3 months; 300 EUR / 6 months; 480 EUR / 12 months
<u>3Gtms TMS</u> https://www.3gtms.com/	Transport manager	✓	✓	✓	✓	Global	Free
<u>3T Logistics & Technology Group TMS</u> https://www.3t-ltg.com/	Transport manager	✓		✓	✓	Global	Free
<u>AEB Shipping Management Software</u> https://www.aeb.com/	Transport manager	✓		✓	✓	Regional (Europe, North America)	102 - 2048 EUR / month
<u>Agility Shipa Freight</u> https://www.agility.com/	Digital forwarder	✓			✓	Global	Transaction-based pricing (contact for pricing)
<u>Air France myCargo</u> https://www.afklcargo.com/	Digital storefront	✓				Global	Transaction-based pricing (contact for pricing)
<u>Allotrac</u> https://www.allotrac.com.au/	Transport manager			✓		Global	Transaction-based pricing (contact for pricing)
<u>Alpega TMS</u> https://www.alpegagroup.com/	Transport manager	✓	✓	✓	✓	Global	Transaction-based pricing (contact for pricing)
<u>AnyLogistix</u> https://www.anylogistix.com/	Visibility manager	✓	✓	✓	✓	Global	18.000 - 55.000 USD / year
<u>Asia logistics</u> https://asia-logistics.de/	Digital forwarder	✓	✓		✓	Global	Transaction-based pricing (contact for pricing)
<u>Beacon</u> https://beacon.com/	Visibility manager	✓		✓	✓	Global	Contact for pricing
<u>BigMile</u> https://bigmile.eu/	Visibility manager	✓	✓	✓	✓	Global (focus Europe)	Contact for pricing
<u>Blackbuck</u> https://www.blackbuck.com/	Hybrid forwarder			✓		Regional (Europe)	Contact for pricing
<u>BlueYonder TMS</u> https://blueyonder.com/	Transport manager	✓	✓	✓	✓	Global	Contact for pricing

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Blujay TM https://www.blujaysolutions.com/	Transport manager	✓	✓	✓	✓	Global	Contact for pricing
Blume global https://www.blumeglobal.com/	Hybrid forwarder	✓	✓	✓	✓	Global	Contact for pricing
Bollore https://www.bollore-logistics.com/	Digital forwarder	✓	✓	✓	✓	Global	Transaction-based pricing (contact for pricing)
Box24 https://www.box24.de/	Matching marketplace			✓		Regional (Europe)	19,95 - 49,95 EUR / month
Boxnbiz https://www.boxnbiz.com/	Digital forwarder	✓			✓	National (Germany)	Contact for pricing
BOXXPort.com https://www.boxxport.com/	Matching marketplace				✓	Global	Contact for pricing
BuyCo https://buyco.co/	Visibility manager				✓	Global	Contact for pricing
C.H. Robinson Navisphere Vision https://www.chrobinson.com/	Hybrid forwarder	✓	✓	✓	✓	Global	Contact for pricing
Cargo.one https://www.cargo.one/	Managed marketplace	✓				Global	Free
Cargoboard (CargoLine) https://cargoboard.com/	Digital storefront	✓		✓	✓	Regional (Europe)	Contact for pricing
CargoBooking https://cargobooking.aero/	Managed marketplace	✓				Global	Contact for pricing
Cargoclix https://start.cargoclix.com/	Managed marketplace	✓	✓	✓	✓	Global	Slot: 0,5 EUR / booking; Terminal: from 99 EUR / month; ETA: from 0,5 EUR / time slot
Cargorexchange https://cargorexchange.in/	Hybrid forwarder			✓		Global	Contact for pricing
Cargofive https://cargofive.com/	Hybrid manager				✓	Regional (Southern Europe)	Starter Plan: EUR 208 / month; Pro Plan: EUR 319 / month; Plus, Plan: EUR 415 / month; with 15 days free trial
Cargomatic https://cargomatic.com/	Digital forwarder			✓		National (USA)	Contact for pricing
Cargonexx https://www.cargonexx.com/	Hybrid forwarder			✓		Regional (Europe)	Percentage of transaction
Cargopedia https://cargopedia.net/	Matching marketplace			✓		Regional (Eastern Europe)	Standard: 41 EUR / 6 months, 61 EUR / 12 months; Premium: 53 EUR / 6 months, 79 EUR / 12 month; Free: default subscription but with limited access
Cargowise https://www.cargowise.com/	Transport manager	✓	✓	✓	✓	Global	Contact for pricing

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<u>Centersource Technologies</u> https://www.centersource.io/	Hybrid manager	✓	✓	✓	✓	Global	Contact for pricing
<u>MyCEVA</u> https://www.cevalogistics.com/en/myceva	Digital storefront				✓	Global	Contact for pricing
<u>CMA CGM</u> https://www.cma-cgm.com/	Digital storefront	✓			✓	Global	Contact for pricing
<u>Connect 4.0</u> https://www.dbschenker.com/de-de/connect/connect-4-0	Digital storefront	✓	✓	✓	✓	Global	Contact for pricing
<u>Convoy</u> https://convoy.com/	Hybrid forwarder			✓		National (USA)	Pay as you go: Free to get started - pay only when loads are successfully booked
<u>DAT</u> https://www.dat.com/	Managed marketplace			✓		National (USA)	Contact for pricing
<u>Descartes (Macropoint)</u> https://www.macropoint.com/	Hybrid manager	✓	✓	✓	✓	National (USA)	Contact for pricing
<u>Descartes TMS</u> https://www.descartes.com/solutions/transportation-management/tms	Transport manager	✓		✓	✓	Global	Contact for pricing
<u>Digital Freight Ltd</u> https://digitalfreight.co.uk/	Digital forwarder	✓		✓	✓	Global	Contact for pricing
<u>Dorae</u> https://www.dorae.com/	Visibility manager	✓	✓	✓	✓	Global	Contact for pricing
<u>Drive4Schenker</u> https://www.dbschenker.com/global/drive4schenker	Hybrid marketplace			✓		Regional (Europe)	Registration required
<u>E2 open</u> https://www.e2open.com/	Transport manager	✓	✓	✓	✓	Global	Contact for pricing
<u>Elemica Eyefreight TMS</u> https://www.elemica.com/solutions/move/eyefreight-tms	Transport manager	✓	✓	✓	✓	Global	Contact for pricing
<u>Emerge</u> https://www.emergemarket.com/	Managed marketplace			✓		National (USA)	Contact for pricing
<u>Everstream Analytics (former DHL Resilience360)</u> https://www.everstream.ai/	Visibility manager	✓	✓	✓	✓	Global	Contact for pricing
<u>Everysens</u> https://en.eversens.com/	Visibility manager		✓	✓		Global	Contact for pricing
<u>Fiduz TMS</u> https://www.dbh.de/fiduz/	Transport manager	✓		✓	✓	Global (focus Europe)	Contact for pricing
<u>Flexport</u> https://de.flexport.com/	Digital forwarder	✓		✓	✓	Global	Transaction-based pricing (contact for pricing)

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Forto https://forto.com/	Visibility manager	✓	✓	✓	✓	Global	Contact for pricing
Fourkites https://www.fourkites.com/	Visibility manager	✓	✓	✓	✓	Global	Contact for pricing - quotation based
Freidesk https://freidesk.com/	Managed marketplace	✓	✓	✓	✓	Regional (Europe)	Contact for pricing
Freight Ship Logistics https://freightshiplogistics.com/	Digital forwarder			✓		National (USA)	Contact for pricing
Freightchain https://freightchain.world/	Digital forwarder	✓				Global	Contact for pricing
Freightify https://www.freightify.com/	Managed marketplace	✓	✓	✓	✓	Global	Contact for pricing
Freightos https://www.freightos.com/	Managed marketplace	✓		✓	✓	Global	49 USD / month / user; percentage of secured order
Freightpop https://www.freightpop.com/	Hybrid manager	✓	✓	✓	✓	Global	Contact for pricing
Freightquote https://www.freightquote.com/	Hybrid manager			✓		Regional (North America)	Contact for pricing
GlobalTranz TMS https://www.globaltranz.com/technology/shipper-tms/	Transport manager			✓		Regional (North America)	Contact for pricing
Hapag Lloyd Live https://www.hapag-lloyd.com/de/services-information/cargo-fleet/reefer/hapag-lloyd-live.html	Visibility manager				✓	Global	Contact for pricing - quotation based
IContainers https://www.icontainers.com/	Managed marketplace				✓	Global	Contact for pricing - quotation based
IMPARGO https://impargo.de/	Hybrid manager			✓		Regional (Europe)	19,90 - 59,90 EUR / month
Infor Nexus TMS https://www.infor.com/solutions/scm/infor-nexus	Transport manager	✓	✓	✓	✓	Global	Contact for pricing
InstaFreight https://www.instaflight.de/	Digital forwarder			✓		Regional (Europe)	Percentage of transaction
ItsMyCargo https://www.itsmycargo.com/	Managed marketplace	✓	✓	✓	✓	Global	Contact for pricing
Kardinal https://kardinal.ai/	Visibility manager			✓		National (France)	Contact for pricing
Koho https://www.gokoho.com/	Managed marketplace			✓		National (USA)	Contact for pricing

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Kontainers https://kontainers.com/	Managed marketplace			✓	✓	Global	100.000 USD to have your own branded platform and 10.000 USD / month to run and maintain
Kuebix TMS https://www.kuebix.com/	Transport manager	✓	✓	✓	✓	Global (focus on North America)	Contact for pricing
Kühne+Nagel myKN https://mykn.kuehne-nagel.com/	Digital storefront	✓			✓	Global	Free registration
LKW Online https://www.lkwonline.de/	Matching marketplace			✓		National (Germany)	9,80 - 29,80 EUR / month
Loads Today (LKW Walter) https://www.lkw-walter.com/int/en/carrier/loads-today-freight-exchange	Hybrid marketplace			✓		Regional (Europe)	Free App with registration
Loadsmart https://loadsmart.com/	Digital forwarder	✓	✓	✓	✓	Regional (North America)	Contact for pricing
LogisEye https://www.logiseye.com/	Managed marketplace	✓	✓	✓	✓	Global	99 - 199 USD + transaction fee; free trail for 60 days
Logistics.cloud https://www.logistics.cloud/	Visibility manager	✓	✓	✓	✓	Global	Basic: free; Solution Partner: 29 EUR; Business: 49 EUR; Premium: 149 EUR
Maersk Spot https://www.maersk.com/transportation-services/maersk-spot	Digital storefront			✓	✓	Global (focus on US trade)	Contact for pricing
Magaya https://www.magaya.com/digital-freight-platform	Hybrid manager	✓		✓	✓	Global	Contact for pricing
Manbang Group https://supchina.com/company-profiles/manbang-group	Hybrid forwarder			✓		National (China)	Contact for pricing
Manhattan Associates TMS https://www.manh.com/products/manhattan-active-transportation-management	Transport manager			✓		Global (focus on America)	Contact for pricing
Marine Traffic https://www.marinetraffic.com/	Visibility manager				✓	Global	Standard: 15 USD / month; Professional: 54 USD / month; Professional Plus: 109 USD / month
MercuryGate TMS https://mercurygate.com/tms-solutions/transportation-management-system/	Hybrid manager	✓	✓	✓	✓	Global	Contact for pricing
Mothership https://www.mothership.com/	Digital forwarder			✓		National (USA)	Percentage of transaction
MPO TMS https://www.mpo.com/transportation-management	Transport manager	✓			✓	Global	Contact for pricing
MXV https://mxv.trade/	Managed marketplace	✓		✓	✓	Global	Contact for pricing
MyDHLi https://www.mydhl.com/global-en/home.html	Digital storefront	✓	✓	✓	✓	Global	Contact for pricing

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NShift https://nshift.com/	Hybrid manager	✓	✓	✓	✓	Global	Contact for pricing
Nuvocargo https://www.nuvocargo.com/	Digital forwarder			✓		Regional (America)	Contact for pricing
Nyshex https://nyshex.com/	Managed marketplace				✓	Regional (Europe, North America)	Percentage of transaction
One Network TMS https://www.onenetwork.com/supply-chain-management-solutions/intelligent-logistics/transportation-management-systems-tms	Transport manager				✓	Global	Contact for pricing
Ontruck https://www.ontruck.com/	Digital forwarder			✓		Regional (Europe)	Contact for pricing
Oracle TMS https://www.oracle.com/scm/logistics/transportation-management	Transport manager	✓	✓	✓	✓	Global	Contact for pricing
Overhaul https://over-haul.com/	Visibility manager	✓	✓	✓	✓	Global	Contact for pricing
Pamyra https://www.pamyra.de/	Managed marketplace			✓		Regional (Europe)	Maximum two branches: 1299 EUR / month; single deployment fee: 2500 EUR; transaction fee: 0,95 EUR; unlimited branches: on request
Project44 https://www.project44.com/	Visibility manager	✓	✓	✓	✓	Global	Contact for pricing
PSI TMS Integration https://www.psilogistics.com/loesungen/transport-management/tms-integration	Transport manager	✓	✓	✓	✓	Global	Contact for pricing
Quicargo https://quicargo.com/	Hybrid manager			✓		Regional (Europe)	Contact for pricing
Raaltrans https://www.raal.cz/en/	Matching marketplace			✓		Regional (Europe)	55 - 570 EUR / month
RIO https://rio.cloud/	Transport manager			✓		Regional (Europe)	Contact for pricing
Riskmethods https://www.riskmethods.net/	Visibility manager	✓	✓	✓	✓	Global	Contact for pricing
Saloodo https://www.saloodo.com/	Hybrid marketplace			✓		Global	Contact for pricing
SAP TMS https://www.sap.com/products/transportation-logistics.html	Transport manager	✓	✓	✓	✓	Global	Contact for pricing
Seaexplorer https://seaexplorer.com/	Digital storefront				✓	Global	Free (registration required)
SeaRates https://www.searates.com/	Matching marketplace				✓	Global	Contact for pricing - quotation based

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<u>Searoutes</u> https://searoutes.com/	Visibility manager			✓	✓	Global	starting at 249 EUR / month
<u>Sendify</u> https://www.sendify.de/	Digital forwarder	✓	✓	✓	✓	Global	Free registration
<u>Sennder</u> https://www.sennder.com/	Hybrid forwarder			✓		Regional (Europe)	Contact for pricing
<u>Seven Senders</u> https://sevensenders.com/	Digital forwarder			✓		Regional (Europe)	Contact for pricing
<u>Shipnext</u> https://shipnext.com/	Managed marketplace				✓	Global	799 - 999 USD / year
<u>Shippeo</u> https://www.shippeo.com/	Visibility manager	✓	✓	✓	✓	Global	Contact for pricing
<u>Shipserv</u> https://www.shipserv.com/	Managed marketplace			✓	✓	Global	Contact for pricing
<u>Shipsta</u> https://www.shipsta.com/	Hybrid manager	✓		✓	✓	Global	Contact for pricing
<u>ShipstaGo</u> https://www.shipstago.com/	Managed marketplace	✓		✓	✓	Global	Essential: Free; Advanced: 145 EUR / month; Enterprice: Upon request
<u>Shipwaves</u> https://www.shipwaves.com/	Digital forwarder	✓	✓	✓	✓	Global	Contact for pricing
<u>Shipwell</u> https://shipwell.com/	Hybrid manager			✓		Regional (North America)	Commission based
<u>Shypple</u> https://www.shypple.com/	Digital forwarder	✓	✓		✓	Global	Contact for pricing
<u>Skyspace</u> https://www.skyspacecargo.com/	Digital forwarder	✓		✓		Global	Free registration
<u>Sonar Freightwaves</u> https://sonar.freightwaves.com/	Visibility manager	✓	✓	✓	✓	Global	Contact for pricing
<u>Teleroute</u> https://teleroute.com/	Managed marketplace			✓		Regional (Western Europe)	Contact for pricing
<u>Tendereasy</u> https://www.tendereasy.com/	Hybrid manager	✓		✓	✓	Global	Contact for pricing
<u>Timocom</u> https://www.timocom.de/smart-logistics-system/frachtenbörse	Managed marketplace		✓	✓		Regional (Europe)	Contact for pricing
<u>TMC TMS</u> https://www.mytmc.com/	Hybrid manager	✓	✓	✓	✓	Global	Contact for pricing

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Traigo (VTG AG)	Hybrid marketplace		✓			Regional (Europe)	Free
Trans.eu	Managed marketplace			✓		Regional (Eastern Europe)	Contact for pricing
Transfix	Hybrid manager			✓		National (USA)	Contact for pricing
Transplace TMS	Hybrid manager	✓	✓	✓	✓	Global	Contact for pricing - quotation based
Transpobank	Matching marketplace			✓		National (Italy)	Contact for pricing - subscription based
Transporeon (Sixfold)	Visibility manager	✓	✓	✓	✓	Regional (Europe)	Contact for pricing
Transporeon (Ticontract)	Hybrid manager	✓	✓	✓	✓	Global	Contact for pricing
Trimble	Hybrid manager			✓		Global	Contact for pricing
Truckstop	Managed marketplace			✓		Regional (North America)	39 - 149 USD / month
Turvo	Hybrid manager	✓	✓	✓	✓	Global	Contact for pricing
Twill (Maersk)	Digital storefront		✓	✓	✓	Global	Free registration
Uber Freight	Hybrid forwarder			✓		Regional (North America)	Free registration
Upplly	Managed marketplace			✓		National (France)	Access: 1.188 EUR / year; Advanced: 2.988 EUR / year; Enterprise: 11.400 / year
VesselFinder	Visibility manager				✓	Global	Satellite: 116 USD / month; Premium: 99 USD / year
Wabco (Traxee)	Transport manager			✓		Regional (Africa, Europe, Middle-East)	From 20 EUR per vehicle / month
Wakeo	Visibility manager	✓	✓	✓	✓	Global	Contact for pricing
WebCargo	Managed marketplace	✓				Global	Contact for pricing
Wtransnet	Managed marketplace			✓	✓	Regional (Europe)	Contact for pricing

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Zencargo https://www.zencargo.com/	Digital forwarder	✓	✓	✓	✓	Global	Contact for pricing
Zuum https://zuumapp.com/	Hybrid manager			✓		Global	Business: 6 USD / shipment (50 shipments or more); Enterprise: 5 USD / shipment (100 shipments or more)

INDEX OVERVIEW

Index (website)	Archetype	Air	Rail	Road	Sea	Geographical Scope	Pricing and costs
Activity reports from Panama Canal https://pancanal.com/en/statistics/	3rd tier index				✓	Routes through Panama Canal	Free
ASTAG Road Transport Index https://www.astag.ch/wissen/betriebswirtschaft/index	1st tier index			✓		National (Switzerland)	Free
Baltic Air Freight Indices (BAI) https://www.balticexchange.com/en/data-services/market-information0/air-freight-services.html	1st tier index	✓				Global	Single user subscription starts at CHF 5.500 but includes further indices and assessments
Baltic Dry Index (BDI) https://www.balticexchange.com/en/data-services/market-information0/dry-services.html	3rd tier index				✓	Global	Single user subscription starts at CHF 5.500 but includes further indices and assessments
Belt and Road Cargo Trade Value Index (BRTVI) https://en.sse.net.cn/indices/brcvnew2.jsp	3rd tier index				✓	Global (CN to world)	Free
Belt and Road Cargo Trade Volume Index (BRCVI) https://en.sse.net.cn/indices/brcvnew2.jsp	3rd tier index				✓	Global (CN to world)	Free
BME Marktinformati-onen https://www.bme.de/services/benchmarking/marktinformati-onen	1st tier index			✓		National (Germany) and International (from/to Germany)	EUR 680 (one time), EUR 1480 (yearly)
Bunkerworld Index (BWI) https://www.bunkerworld.com/prices/bunkerworldindex	3rd tier index				✓	Global	Free, membership required to see the full price history
BVL Logistics Indicator (LI) https://www.bvl.de/en/service/facts-figures/logistics-indicator	2nd tier index					National (Germany)	Free
Cancelled Sailings Tracker https://www.drewry.co.uk/supply-chain-advisors/supply-chain-expertise/cancelled-sailings-tracker	3rd tier index				✓	Global	Free
Cass Freight Index https://www.cassinfo.com/freight-audit-payment/cass-transportation-indexes/cass-freight-index	1st tier index		✓	✓		Regional (North America)	Subscription required
China Containerized Freight Index https://en.sse.net.cn/indices/ccfinew.jsp	1st tier index				✓	Global (routes from China)	Free, subscription required for one-day time lag from the latest publish day; CHF 2.160; CHF 3450 together with SCFI
China Logistics Prosperity Index (CLPI) https://www.fbicgroup.com/research_categories/logistics	2nd tier index					Logistics sector in China	Free
Clarkson's ClarkSea Time Charter Index https://sin.clarksons.net/	1st tier index				✓	Global	Free
Destatis Lkw-Maut-Fahrleistungsindex https://www.destatis.de/DE/Service/EXDAT/Datensaetze/lkw-maut-artikel.html	3rd tier index			✓		National (Germany)	Free
Dieselpreisinformationen (BGL DP) https://www.bgl-ev.de/web/der_bgl/informationen/dieselpreisinformationen.htm	3rd tier index					National (Germany)	Free
DSLVL Cost Index https://www.dslv.org/dslv/web.nsf/gfx/0371547A46775409C125875E00335A9/%24file/Abschlussbericht_DSLV_Kostenindex_1_Halbjahr_2021.pdf	1st tier index			✓		National (Germany)	Free
Erzeugerpreisindex Destatis https://www.destatis.de/DE/Themen/Wirtschaft/Preise/Erzeugerpreisindex-Dienstleistungen/_inhalt.html	1st tier index			✓		National (Germany) and International (from/to Germany)	Free
Eurasian Rail Alliance Index https://index1520.com/en	1st tier index	✓				Regional (China to Europe, Europe to China)	Free

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<u>European Freight Forwarding Index (EFFI)</u> https://www.acea.auto/files/SAG_15_European_Freight_Transport_Statistics.pdf	2nd tier index	✓		✓	✓	Regional (Europe)	Free
<u>Freightos Baltic Global Container Index</u> https://fbx.freightos.com/	1st tier index				✓	Global	Free
<u>Hamburger Logistikbarometer</u> https://www.hk24.de/produktmarken/beratung-service/konjunktur-statistik/hamburger-logistikbarometer/3464156	2nd tier index	✓		✓	✓	Regional (Germany)	Free
<u>HARPEX Index</u> https://www.harperpetersen.com/harpex	1st tier index				✓	Global	Free
<u>Howe Robinson Container Index (HRCI)</u> https://www.howerobinson.com/departments/consultancy-research	1st tier index				✓	Global	Free
<u>IATA CargoIS</u> https://www.iata.org/en/services/statistics/intelligence/cargo-is	1st tier index	✓				Global	Free
<u>IFO Institut</u> https://www.ifo.de/umfrage/ifo-geschaeftsklimaindex	3rd tier index			✓		National (Germany)	Free
<u>IMF Supply Chain Disruptions Index</u> https://www.imf.org/en/Publications/WEO/Issues/2021/10/12/world-economic-outlook-october-2021	3rd tier index					Global	Free
<u>Jet Fuel Price Monitor (JFPM)</u> https://www.iata.org/en/publications/economics/fuel-monitor	3rd tier index	✓				Global	Free
<u>Kiel Trade Indicator</u> https://www.ifw-kiel.de/topics/international-trade/kiel-trade-indicator	3rd tier index				✓	Global	Free
<u>Kosten-Entwicklungsrechner BGL</u> https://www.bgl-ev.de/web/der_bgl/informationen/branchenkostenentwicklung.htm	1st tier index			✓		National (Germany)	Free
<u>Logistics Manager's Index (LMI)</u> https://cscmp.org/CSCMP/Develop/Reports_and_Surveys/Logistics_Managers_Index/CSCMP/Develop/Reports_and_Surveys/Logistics_Managers_Index	2nd tier index					National (USA)	Free, subscription required
<u>Logistics Performance Index (LPI)</u> https://lpi.worldbank.org/international/global	2nd tier index					Global	Free
<u>Maritime Silk Road Freight Index (SRFI)</u> https://en.sse.net.cn/indices/srfnew2.jsp	1st tier index				✓	Global (routes from and to China)	Free
<u>Monthly Oil Market Review</u> https://www.opec.org/opec_web/en/publications/338.htm	3rd tier index					Global	Free
<u>Navigation statistics Suez Canal</u> https://www.suezcanal.gov.eg/English/Navigation/Pages/NavigationStatistics.aspx	3rd tier index				✓	Global (routes through the Suez Canal)	Free
<u>(New) Contex Index</u> https://www.vhbs.de/index.php?id=5	1st tier index				✓	Global	Free (subscription fee for the complete data history)
<u>Ningbo Containerized Freight Index</u> http://www.msri.cn/xyEnIndexView	1st tier index				✓	Global (routes departing from Ningbo-Zhoushan, CN)	Free
<u>NRW Logistikindex (NRWL)</u> https://www.logit-club.de/aktuelles/logistikindex	2nd tier index					Regional (Germany)	Free
<u>OECD: Composite leading indicators</u> https://data.oecd.org/leadind/composite-leading-indicator-cli.htm	3rd tier index					Global	Free
<u>Port Throughput Indices</u> https://www.drewry.co.uk/maritime-research/maritime-research-related-content/port-throughput-indices	3rd tier index				✓	Global	Free
<u>Purchasing Manager Index (PMI)</u> https://www.ismworld.org/supply-management-news-and-reports/reports/ism-report-on-business	2nd tier index					Global	Free
<u>RWI/ISL Container Throughput Index</u> https://www.isl.org/en/containerindex	3rd tier index				✓	Global	Free

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<u>SCI Barometer (SCI)</u> https://www.sci.de/daten-trends/sci-logistikbarometer	2nd tier index					National (Germany)	Free
<u>SCI Railindex</u> https://www.sci.de/daten-trends/sci-railindex	2nd tier index		✓			Global	Free
<u>Seaexplorer disruption indicator</u> https://newsroom.kuehne-nagel.com/new-kuehnenagel-sea-freight-disruption-indicator-points-to-persistent-supply-chain-challenges	3rd tier index				✓	Global	Available for registered users for seaexplorer (conduct for pricing)
<u>Shanghai Containerized Freight Index (SCFI)</u> https://en.sse.net.cn/indices/scfinew.jsp	1st tier index				✓	Global (routes from Shanghai, CN)	Free subscription with one day time lag, subscription fee: CHF 2160; CHF 3450 together with CCFI
<u>Shanghai Shipping Prosperity Index (CSPI)</u> http://sisi.gstta.org/index.php?c=article&a=type&tid=40	2nd tier index				✓	National (China)	Free
<u>Shipping Confidence Survey (SCS)</u> https://www.bdo.co.uk/en-gb/insights/industries/shipping-and-transport/shipping-confidence-survey-sept-2019	2nd tier index				✓	Global	Free
<u>Stifel/TI Logistics Conference Index (LCI)</u> https://www.ti-insight.com/research-papers/lcindex	2nd tier index				✓	Global	Subscription required
<u>Tac Index</u> https://www.tacindex.com/tac-freight	1st tier index	✓				Global	Free for reight forwarders who supply data; individual route subscription: USD 5.000 p.a.; global route subscription: USD 80.000 p.a.
<u>TIMOCOM transport barometer</u> https://www.timocom.co.uk/services/transport-barometer	1st tier index			✓		Regional (Europe)	Free
<u>TransEco Road Freight Cost Indices (TRFCI)</u> https://transeco.pl.com/trfci	1st tier index			✓		National (Australia)	Subscription required (fee: USD 853 p.a.)
<u>Transporeon Insights</u> https://www.transporeon.com/en/products/insights	1st tier index			✓		Regional (Europe)	Subscription required
<u>Transportindex Statistisches Bundesamt</u> https://www.destatis.de/DE/Service/EXDAT/Datensaeetze/transportindex.html	1st tier index	✓	✓	✓	✓	National (Germany)	Free
<u>UK Logistics Confidence Index</u> https://www.barclayscorporate.com/insights/industry-expertise/uk-logistics-confidence-index	2nd tier index			✓		National (UK)	Free
<u>VR Index - Transportpreise im Strassengüterverkehr (VRI)</u> https://www.verkehrsrundschau.de/transportpreise	1st tier index			✓		National (Germany)	Subscription fee starting at EUR 229,30 p.a.
<u>WKO-Transportkostenindex</u> https://www.wko.at/branchen/transport-verkehr/gueterbefoerderungsgewerbe/transportkostenindex.html	1st tier index				✓	National (Austria)	Free
<u>World Container Index</u> https://www.drewry.co.uk/supply-chain-advisors/supply-chain-expertise/world-container-index-assessed-by-drewry	1st tier index				✓	Global	Free, further benchmarking services require a subscription fee
<u>Xeneta Shipping Index (XSI)</u> https://xsi.xeneta.com/	1st tier index				✓	Global	Free, real-time rates via subscription (fee: n.a.)
<u>ZEW/Prognos Transport market barometer (TMB)</u> https://www.zew.de/	2nd tier index	✓	✓	✓	✓	National (Germany)	Free

