

Impacts of the COVID-19 crisis on Inland Navigation

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Impacts of the COVID-19 crisis on Inland Navigation

Purpose: *The goal of this paper is to provide initial insights into the impacts of the COVID-19 crisis on inland navigation on both freight and passenger transport. It creates a starting point for further research and supports practitioners to prepare for future crisis situations.*

Methodology: *After a review of the literature, we prepared an interview guideline and conducted ten interviews with experts from the inland waterway transport (IWT) sector (i.e. freight and passenger transport). The interviews were coded and analysed using MAXQDA software. After the content analysis following the approach of Mayring (2014) we discussed the results and derived future research needs.*

Findings: *The COVID-19 crisis has both, positive and negative impacts on inland navigation. The inland navigation sector was affected by a reduction of transport volumes, the suspension of the passenger transport and requirements for crew changes or arbitrary regulations. A positive impact is that IWT is perceived as a reliable transport mode and customer bonding increased.*

Originality: *This paper shows initial impacts of the COVID-19 crisis for the inland navigation sector for freight and passenger transport. It provides future research needs which serve as a starting point to conduct in-depth analysis of individual impacts of the crisis.*

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1 Introduction

Crises disrupt entire societies and are often accompanied by worldwide impacts (Farazmand, 2018). In general, crises lead to negative impacts such as a reduction in economic performance (i.e., GDP). The transport sector is usually hit by crises, as it correlates with GDP (Moschovou & Tyrinopoulos, 2018). Transportation is essential for supplying the population with their daily needs, such as food or medicine (Gray, 2020). Panic buying, which caused a worldwide stir at the beginning of the COVID-19 crisis, emphasized the importance of functioning supply chains and transport systems (Islam et al., 2021). Transport systems enable and support a wide range of activities, such as commuting to work, supplying households and businesses with energy and transporting goods to production sites or distribution centres. Therefore, they are essential for a functioning economy (Rodrigue et al., 2013).

Freight and passenger transport are carried out by different transport modes, such as railway, road or inland waterways. IWT is an environmentally friendly transport mode (Fastenbauer et al., 2019) that must be promoted more, according to the European Green Deal. According to the goals of the European Green Deal, the modal share of IWT in Europe should see a 50% increase by 2050 (COM(2019) 640 final, 2019). To achieve an increase of the modal share, it is important to demonstrate the reliability and crisis resilience of the transport mode. In our paper we will focus both on impacts and on strengths and weaknesses of IWT during the COVID-19 crisis, as this knowledge about strengths and weaknesses is essential to increase crisis resilience (Borca et al., 2021).

The goal of this paper is to provide initial insights into the impacts of the COVID-19 crisis on inland navigation for both freight and passenger transport. The research question guiding this paper is: RQ (1): How did the COVID-19 crisis impact freight and passenger transport using inland waterways?

The paper is structured as follows: after the introductory part, a theoretical framework is provided. Section 3 continues with the methodological approach of this paper, followed by results and discussion in section 4. The last section 5 will provide conclusions, theoretical and managerial contributions as well as the limitations of this paper.

2 Theoretical background

Borio (2020) describes the COVID-19 crisis using three words: uncertain, global and exogenous, meaning that it has not evolved due to previous financial imbalances. According to the definition by Sawada et al. (2011) the COVID-19 crisis is a natural crisis, meaning that its appearance did not involve any human action. As the COVID-19 crisis evolved due to the virus spreading it affected the majority of the world (Bambra et al., 2020; Borio, 2020; Moreira & Hick, 2021). Furthermore, several uncertainties, such as the speed of disease transmission or the incubation period, accompanied the beginning of the COVID-19 crisis (Kimhi et al., 2020). In order to protect peoples' lives from the virus, rapid initial actions were essential (Moreira & Hick, 2021). These actions differed between regions with measures being more or less strict (Bambra et al., 2020). Actions which were taken during a crisis are called a crisis response and represent a major part of a typical crisis management cycle (Fakhruddin et al., 2020).

Crisis management is generally carried out in four phases: (1) mitigation and prevention (2) preparation (3) response and (4) recovery (Fakhruddin et al., 2020; Spiekermann et al., 2015). The (1) mitigation and prevention phase is characterized by trying to avoid the occurrence of a crisis (prevention) and by taking measures, which help to minimize highly negative impacts of a crisis, before it occurred (mitigation). In the (2) preparation phase disaster plans are prepared to plan and optimize available resources and to agree on international collaboration. When the event occurs the (3) response phase starts and is considered the most important phase, which highly correlates with the other three phases. In the response phase actions take place to tackle the crisis in a coordinated way. The (4) recovery phase plays an important role, summarizing information from the entities involved which is used to help improve the preparation and response in future crises (Coccolini et al., 2020). If the response to a crisis (3) is inappropriate or important resources are missing, a natural crisis can lead to financial or social crises (Bambra et al., 2020).

Several uncertainties, the global spread of the virus, as well as the exogeneity of this crisis (Borio, 2020), are the reasons for the high degree of unpreparedness demonstrated by the bodies involved (Coccolini et al., 2020). This unpreparedness caused a shift in the crisis management cycle: The cycle began with (3) response, followed by (4) recovery (1)

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mitigation and (2) preparation (Fakhruddin et al., 2020). As the COVID-19 crisis emerged due to a virus spreading which occurred in several waves and regions, the (3) response and (4) recovery phases are mainly not linear, as with other natural crisis e.g. caused by flooding (Fakhruddin et al., 2020). Responding to an event without being prepared for it often leads to uncoordinated actions. Therefore, a more integrated approach is needed for future crises (Fakhruddin et al., 2020). To increase the understanding of the response and impacts of the COVID-19 crisis, we will compare our results to the (shifted) crisis management cycle and confirm or reject it from the IWT sector's point of view.

3 Methodology

To investigate the impacts of the COVID-19 crisis for IWT we used a qualitative research approach. Through this approach the information about specific societal problems in order to reveal impacts which can barely be measured quantitatively and to include the personal opinions of the experts, can be obtained. Therefore, we conducted problem-centred and semi-structured expert interviews according to Mayring (2014) for collecting the information. Problem-centred interviews are open, so the interviewed person is able to answer without selecting from given answer alternatives, allowing us to obtain a personal viewpoint about the problem in focus. Furthermore, the interviews are semi-structured, which means that an interview guideline exists, which facilitates the focus on the problem (Mayring, 2014). Figure 1 summarizes the methodological approach of Mayring (2014) used in this paper.



Figure 1: Methodological approach of this paper (according to Mayring (2014))

The interview guideline was categorized by time in the past, present and future. We developed the interview guideline in a team of researchers together with experts from the IWT industry. The interviews were carried out between October and December 2020 with Austrian, German and French experts in inland navigation. As we aimed to obtain information about the impacts of the COVID-19 crisis on passenger and freight transport, we choose interview partners from both sectors. We conducted in total ten interviews, five with experts from the freight transport sector and five with experts from the passenger transport sector. The interviews were carried out virtually using MS Teams or by phone.

The interviews were recorded and afterwards transcribed. For the evaluation of the interviews, we used the MAXQDA software, which allows us to code the transcripts. MAXQDA enables the download of the coded, summarized information from the transcripts into a MS Excel file. This MS Excel file facilitates the qualitative content analysis based on Mayring (2014). For the content analysis, a summative approach was applied. This is useful e.g., for making comparisons or deriving essential statements. The evaluation of the content required a category system. The interview guideline was structured according to categories allowing us to synthesize the essential aspects of the expert interviews. We used these categories for the category system of the content analysis and to structure the Results & Discussion section of this paper.

4 Results and Discussion

The results are clustered in four subsections: the first describes the interviewed experts and the remaining three subsections were defined according to the category system of the content analysis in the past, present and future of the COVID-19 crisis.

4.1 Interviewed experts

We interviewed five experts from the freight and five experts from the passenger transport sector of IWT. Table 1 summarizes the experts, the sector, the size and location of the company.

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Table 1: Overview of interviewed experts

<i>expert</i>	<i>sector</i>	<i>company size</i>	<i>company location</i>
<i>EFT #1</i>	<i>logistics service provider</i>	<i>small</i>	<i>Upper Austria</i>
<i>EFT #2</i>	<i>logistics service provider</i>	<i>small</i>	<i>Lower Austria</i>
<i>EFT #3</i>	<i>port operator</i>	<i>medium</i>	<i>Lower Austria</i>
<i>EFT #4</i>	<i>steel production</i>	<i>large</i>	<i>Upper Austria</i>
<i>EFT #5</i>	<i>compound feed production</i>	<i>medium</i>	<i>Upper Austria</i>
<i>EPT #1</i>	<i>Excursion traffic</i>	<i>small</i>	<i>Vienna</i>
<i>EPT #2</i>	<i>Excursion traffic</i>	<i>medium</i>	<i>Vienna</i>
<i>EPT #3</i>	<i>Excursion traffic</i>	<i>medium</i>	<i>Upper Austria</i>
<i>EPT #4</i>	<i>Cruise ship navigation</i>	<i>large</i>	<i>France</i>
<i>EPT #5</i>	<i>Danube Tourist Commission</i>	<i>small</i>	<i>Vienna</i>

EPT = Expert passenger transport;

EFT = Expert freight transport

Two of the freight experts are managers of logistics service providers which are specialized in IWT, working for small companies in Upper and Lower Austria. Two interviewees are managers of production companies which use IWT regularly for transportation: One expert is a logistics manager of a large steel production plant, the other is a procurement manager of a medium-sized compound feed producer and both are located in Upper Austria. The fifth expert is the manager of a medium-sized Danube ports operator, located in Lower Austria.

Three of the passenger transport experts are employed at companies which organize excursion trips for passengers on the Danube in Austria, Germany and Slovakia. One company is small, the other two are medium-sized, all three are located in Austria. One expert is a captain at a large French river cruising company and responsible for the Danube area. The fifth interviewed expert has been working for the Danube Tourist Commission located in Vienna, which is well informed about the development of passenger transport on the Danube in general and particularly during the COVID-19 crisis.

4.2 The past: before the beginning of the crisis until summer 2020

This subsection contains questions about general preparation for crises, about the first impacts of the crisis and about a modal shift to or from IWT.

Before the COVID-19 crisis

Besides one freight expert, the four freight experts and all passenger transport experts agreed that the preparation for a crisis such as the COVID-19 crisis is not possible at all or only possible to a very limited extent. Contingency plans are generally considered as helpful up to a certain point. In fact, experiences must be gained to be able to prepare for future crises caused by a virus spreading. Five out of ten experts evaluated their own level of preparedness for the COVID-19 crisis as medium up to high. They argued that, almost everything that could be done to prepare for such a large, unknown crisis was done.

Measures to be prepared for crises range from a plan for pandemics (EFT #4), having a broad range of customers to ensure independence and avoid dependencies on a single customer (EFT #3). Another measure is to build monetary reserves to bridge the crisis to a certain extent (EPT #1 and #2). The other experts, two from logistics service providers and three from passenger shipping companies claimed that preparation for the COVID-19 crisis was impossible taking in account their sector.

Regarding the extent to which companies were prepared for crises in general, a difference can be observed between shippers and freight/passenger transport companies: Shippers are basically prepared for different crises (e.g. by having crises plans or even designated teams) (EFT #4 and 5). In contrast logistics service providers (EFT #1 and 2) and passenger shipping companies (EPT #1-4) are primarily prepared for shorter-term unwelcome events, which appear at short notice, e.g. high or low water. Transport companies use so-called contingency to prepare for these unwelcome events. These plans include things such as possible route or programme changes in case a route cannot be operated due to disruptions.

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Beginning of the COVID-19 crisis

Freight transport

The first impacts of the crisis hit the IWT sector in March 2020 with the general worldwide impact of a decline in global GDP. Besides the general decline in the demand for goods, the demand for certain areas increased. Two of the five experts reported positive impacts at the beginning of the crisis due to a higher demand for certain transports and services (EFT #1 and 3). In particular, RoRo (Roll-on/Roll-off) services (i.e. services which transport motorized vehicles e.g. cars and trucks by IWT) offered on the Danube were increasingly requested to avoid the border waiting times across Eastern Europe. Instead of travelling by truck to Romania or Bulgaria, the trucks were transported by vessel to a Romanian or Bulgarian port and from there travelled to the final destination (EFT #1)

Ports reported positive impacts from an increase in the demand for storage space at ports and thus, a shift to IWT. The COVID-19 crisis had increased the frequency of panic buying by companies leading to a shortage of storage space. Therefore, companies needed to rent additional storage space. Some companies which rented additional storage space at ports decided to transport goods by inland vessels, generating a higher demand for inland navigation (EFT #3).

In the steel industry, the demand for IWT declined at the beginning of the crisis. The decline was due to the weak order situation from the automotive industry. Some car manufacturers plants in Europe were closed for a few weeks leading to a reduction in steel demand. (EFT #4) Panic buying had a negative impact on inland navigation, as raw materials were needed in a timely fashion for the production of goods. Therefore, instead of using the inland waterway vessel as usual, trucks were used for transport due to the higher transport speed (EFT #5). In general, IWT was perceived as a reliable transport mode, primarily because of its high availability (EFT #4 and 5).

The logistics service provider EFT #2 confirmed that there were generally less inland waterway transports at the beginning of the crisis. On the one hand the decline in IWT was due to a reduction in transport demand, and on the other hand it was due to arbitrary regulations. At the beginning of the crisis, there were different regulations per country

leading to waiting times at borders. Besides national regulations, port operators, decided on their own regulations, with some ports reducing to one shift or to limit ship handling to daylight hours (EFT #2).

A major problem for both, freight and passenger transport was the change of crews. Usually, crews are changed every two weeks. At the beginning of the crisis, there were cases where crews remained on the vessel for two months because it seemed impossible to change crews due to the quarantine guidelines (EFT #2)

Passenger Transport

While freight transport suffered from lower transport demand, passenger shipping was affected much worse at the beginning of the crisis. Due to a decision by the federal government, passenger shipping was suspended for about three months. The official suspension of passenger shipping had varying degrees of influence on passenger shipping companies. EPT #3 reported, for example, that shipping was seasonally suspended over the winter before the crisis began, meaning that the official suspension of shipping in March 2020 hit them even harder, as the new season was supposed to start that very month.

Even if the passenger shipping industry was hit hard by the sharp decline of passengers, they recorded a few positive impacts. The positive impacts vary from an increase in experience for a future crisis (EPT #2), time to optimise internal processes (EPT #3) and retrofit the vessels with special filters (EPT #1). EPT #1 mentioned that the crisis was used to strengthen customer loyalty through the installation of special ozone filters, which continuously decontaminate all surfaces.

Passenger shipping companies reported that there were limitations in place, once passenger transport was allowed again. EPT #5, for example, reported limitations on the number of passengers and crew, in some cases only 50% of the maximum number of passengers and 50% of the crew were allowed on a vessel. Moreover, passenger shipping companies were increasingly forced to change routes or programmes, e.g. vessels were not allowed to berth with passengers in Budapest for a while. Due to the limitations, necessary programme changes and frequent cancellations by customers, some companies were forced to end the season prematurely because of a lack of profitability (EPT #4). The

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absence of foreign tourists is another major challenge for IWT. Moreover, customers are more careful with their money, and thus less willing to participate in an excursion or a river cruise, which is often pricey (EPT #1).

Passenger transport report negative impacts on crew and staff. On the one hand, a large number of the crew were released or put on short-time work and thus made insecure; on the other hand, the existing crew had to adhere to strict hygiene and quarantine measures. EPT #4 reported, that the crew had to be in quarantine on board ten days before the start of the cruise. EPT #3 had to stay in close contact with the released staff, because they were very uncertain about the future and partly lost faith in the company. Table 2 provides an overview of the impacts for freight and passenger transport of the COVID-19 crisis on IWT.

Table 2: Impacts of the COVID-19 crisis on inland navigation

	positive impacts	negative impacts
<i>Freight transport</i>	<ul style="list-style-type: none"> • <i>in some cases modal shift towards IWT noticeable</i> • <i>IWT is perceived as reliable</i> 	<ul style="list-style-type: none"> • <i>decreased transport volume</i> • <i>problems with crew changes</i> • <i>different national regulations</i> • <i>different regulations by stakeholder group (e.g., port operators)</i>
<i>Passenger transport</i>	<ul style="list-style-type: none"> • <i>internal processes can be revised</i> • <i>gain of know-how for a future crisis</i> • <i>increased customer bonding</i> 	<ul style="list-style-type: none"> • <i>suspension of passenger transport by federal government in Austria</i> • <i>limitations of passengers and crew</i> • <i>route and programme changes</i> • <i>absence of foreign tourists</i> • <i>inland tourists are not willing to spend money on excursions</i> • <i>many staff released or put on short-time work</i> • <i>hard quarantine measures for remaining crew</i>

The results of the expert interviews showed a high degree of correlation with the literature we discussed in the introduction. Preparation for this crisis was hardly possible (Coccolini, et al., 2020; Fakhruddin, Blanchard and Ragupathy, 2020), which most of the experts confirmed. This unpreparedness, paired with many uncertainties (Bambra, et al., 2020) and the need for rapid action (Moreira and Hick, 2021) led to the uncoordinated behaviour of responsible parties, as confirmed by EFT #2. Bambra, et al.(2020) mentioned that the measures differed between regions, which was supported by EFT #1, EFT#5 and EFT #2. The literature and the experts confirm the research of Fakhruddin, Blanchard and Ragupathy

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(2020), which stated that the crisis management cycle was shifted in this crisis and therefore began with the response phase instead of the mitigation and preparation phase. Fakhruddin, Blanchard and Ragupathy (2020) pleaded for a more integrated approach in future crisis preparation, which would lead to a more coordinated response, both nationally and internationally. EFT #2 confirmed that, claiming that clear regulations eased the work a lot and are therefore essential.

Besides the negative impact, the COVID-19 crisis also had positive impacts on freight and passenger transport. It is encouraging that this crisis has partly led to a modal shift towards inland navigation, which is indispensable in reaching the goals of the European Green Deal. One of the goals of the European Green Deal is for the European Union to become climate-neutral by 2050 and in order to achieve this, it is essential to create a modal shift from road to the more sustainable transport modes of rail and IWT. Passenger transport was undoubtedly hit harder by the crisis than freight transport, since cruises were suspended completely for a few months. As passenger shipping has experienced a strong boom in recent years (CCNR, 2019), there was an opportunity for the companies to build up financial reserves to survive the crisis, which all experts from passenger shipping agreed with.

4.3 The present: autumn 2020

The present discusses the change of the impact from the beginning of the crisis regarding its intensity and whether any new effects became visible as the crisis progressed.

The development of impacts in freight transport varies greatly. EFT #4 found that the demand for steel products in certain segments has developed from very low to very high leading to an increase in the demand for IWT. The increased demand due to panic buying has decreased again and in the meantime, the demand has stabilized (EFT #5). The situation with storage capacities in warehouses has not changed since the beginning of the crisis; warehouse storage is still running at full capacity (EFT #3).

Logistics service providers are less optimistic about developments, in particular reaching pre-crisis transport volumes. EFT #1, who at the beginning of the crisis described themselves as profiteers of the crisis, now describe a very strong decline in transport volume. In some cases, entire trips were cancelled for economic reasons. As an emergency measure the

remaining goods were transported using trucks. EFT #2 spoke of a decline in transport volume, but notes that the other negative impact concerning the regulations has been solved. At the moment, they are trying to avoid situations that are legally uncertain, e.g. changing crews on Hungarian territory and they are relying on the Danube Commission to sort these situations out for good.

For freight transport using IWT it is of major importance that sectors which transport a large amount of goods via the waterway show positive developments. That applies to the steel industry, since over 40% of the transported goods on the Austrian Danube are associated with this sector (via donau, 2018). The demand of other sectors stabilised or has not recovered yet. This is an excellent example, which demonstrates the importance of dividing the transport volume of a transport mode into various cargo segments. The division into cargo segments helps to find the critical factors and is useful for a better prognosis of further developments (Maresch, 2021). The statements of the experts showed how volatile and changing a crisis can be. Often companies are struggling to deal with volatility, as volatility often increases the complexity within corporate operations (Nürk, 2019), which makes the handling of a crisis even more difficult.

Three experts in passenger transport reported that they are running cruises in the autumn, but due to a lack of tourists and severe COVID-19 measures they had far fewer passenger than in prior years. EPT #3 added, that their company usually organized major events, such as company events or festivities along the Danube, which were cancelled due to the crisis. For the moment, the five experts reported negative development of the impacts, since passenger shipping has been suspended again for a certain period.

Up until now, the crisis has been progressing and its actions are much better coordinated than at the beginning, where the crisis hit the unprepared sector (Fakhruddin, Blanchard and Ragupathy, 2020). The first 'recovery phase' began in early summer after most European countries prevailed over the first wave of the pandemic (Zhang, et al., 2021), which was followed by a new preparation phase for the next wave. This new preparation phase helped to improve the cooperation between authorities and improve the regulations (EFT #2).

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4.4 The future: since winter 2020/2021

Freight shipping experts are more optimistic than the passenger shipping experts about the recovery from the COVID-19 crisis. While freight experts expect that a recovery from the crisis will occur in up to 12 months, the passenger experts rather assume up to 24 months.

Lessons learned

When it comes to the lessons learned from the crisis, the freight shipping experts raised several issues: It is important to diversify customers to avoid dependencies (EFT #1 and EFT #3). An honest and targeted exchange of information with customers and employees is essential to strengthen customer and employee loyalty. Moreover, contingency plans are useful, and it has to be ensured that employees are able to deal with these plans (EFT #5). The crisis has made people realize how essential the work of organisations such as Pro Danube International or the Danube Commission is to represent the interests of IWT (EFT #2).

An important measure is to raise awareness for contingency plans among the staff, since it is not sufficient to develop contingency plans in a particular team without integrating the employees (EFT #5). A good way to practice this is with the help of gamification. Gamification may help to retain the knowledge for a longer period (Putz, et al., 2018) and is able to improve problem solving skills (Lee and Hammer, 2011), which is particularly useful in times of crisis. By gamification we mean the use of game-design elements in a non-game-system context (Treiblmaier, Putz and Lowry, 2018).

The experts in passenger shipping learned from the crisis to be more cautious with investments in new buildings and to build up a stable financial reserve. Moreover, it is essential to also calculate profitability at the level of individual journeys (EFT #2).

Strengths & weaknesses

The answers varied regarding the strengths of IWT during times of crisis. Some experts emphasized the reliability of IWT, which was observed during the crisis (EFT #2 and EFT #5). Others added that spare capacities are particularly relevant for shippers and that the lack of border waiting times represents a great advantage (EFT #4). In addition, the mass

transmission capability and the low-cost transport of IWT were emphasised. The passenger shipping experts added flexibility in programme planning as a strength of passenger shipping during the crisis.

Experts evaluated the dependency on tourists and the more difficult crew changes as a major weakness of IWT during the crisis. The two experts from the production industry added the lack of responsiveness due to the long transport times and criticized the lack of unity in the inland navigation community. From the perspective of passenger shipping, the major weakness were local ties, which means that starting a cruise from a non-home port is associated with high costs.

The experts in the freight shipping sector were more optimistic than the experts in the passenger shipping sector about how long it would take for the recovery from the crisis. However, since passenger shipping experienced a boom several years before the crisis (Fastenbauer, et al., 2019), it might be possible that the positive trend will continue after the crisis. The literature on freight transport revealed that the recovery from crises can sometimes be very lengthy. The recovery from the 2008 financial crisis, for example, took many years and was not completely finished before the COVID-19 crisis emerged in some sectors (Chi and Baek, 2013; Islam, 2018).

Considering the strengths and weaknesses of IWT in this crisis, two experts observed the reliability of IWT as a strength and the slow transport speed and the low flexibility as a major weakness (EFT#4 & 5). Indeed, these qualities (i.e. speed and flexibility) were essential in this crisis. Thus, road transport has advantages over other modes of transport in this crisis due to its speed, flexibility and the possibility of door-to-door transport. It should be noted that each crisis is different and therefore other characteristics of transport modes become important. E.g. in the financial crisis, the transport price was important, which gave IWT an advantage compared to the other transport modes (Maresch, 2021).

5 Conclusions

The aim of this paper was to identify the impact of the COVID-19 crisis on freight and passenger inland waterway transport (IWT), as well as to identify the strengths and

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weaknesses of IWT during the COVID-19 crisis. We used qualitative research and conducted ten expert interviews with five experts from passenger and freight transport respectively. The results showed both positive and negative impacts of the COVID-19 crisis on the freight and the passenger IWT sector.

Besides the general worldwide reduction of transport demand resulting in a reduced transport volume on waterways, other negative impacts on IWT were largely due to inconsistent regulations on an international basis. These inconsistent regulations for changing crews or quarantine measures complicated the daily work of freight and passenger shipping companies. Additionally, major ports limited their working hours, which impacted IWT negatively. Due to panic buying and the resulting increase in production volumes, transport speed became a priority for many companies. To deliver products fast, particularly within countries, meant that road transport was the preferred option for transport, rather than IWT, which caused a reduction in demand for IWT.

A positive impact was the higher demand for IWT at the beginning of the COVID-19 crisis due to a higher demand for RoRo transports in order to avoid border waiting times. Another reason for an increased use of IWT was the use of storage spaces at ports. Companies which rented additional storage space decided to use the close-by waterway and transport their freight using IWT, generating growing demand for IWT. Moreover, IWT was perceived as an overall reliable transport mode, as the availability was excellent throughout the crisis.

Passenger transport suffered tremendous losses due to the governmental decision to suspend traffic for several months. When passenger traffic was allowed again, the lack of foreign tourists and the cancellation of events increased the financial losses. Limitations regarding the maximum number of passengers and crew members permitted on vessels, the different regulations and the lack of foreign tourists forced many passenger transport companies to end the season prematurely.

Hardly any positive effects were observed for passenger transport. Experts named an increase in experience and know-how for future crises and the possibility to analyse and optimize internal processes as positive impacts. Furthermore, in some cases the crisis led to an increased bond with customers.

When considering the strengths and weaknesses of IWT, reliability as a strength and the lack of flexibility and low transport speed as weaknesses were perceived as the most present during the COVID-19 crisis. Road transport, which offers a higher degree of flexibility and speed, was preferred for many products rather than IWT. Another major weakness is the lack of unity in the inland navigation community, in particular on an international basis. Indeed, the crisis demonstrated the need for international collaboration to deliver an appropriate crisis response for the IWT sector.

With our paper, we provide insights for the scientific community as well as the freight and the passenger shipping sector. This study gives an overview of the impacts of the COVID-19 crisis on IWT, which can be used to better anticipate or assess the impacts of future crises and thus may help practitioners to prepare for a future crisis by, for example, installing an appropriate crisis management structure. Furthermore, our paper serves as a starting point for further in-depth research and evaluation of the COVID-19 crisis. Further research can focus on the analysis of quantitative, statistical data to identify the fluctuations in transport volumes during the crisis and compare the transport modes to identify patterns and create foresights. Several limitations exist for our paper, leading to the need for further research options. First, our research findings were limited to the information gathered within the expert interviews. This is a rather limited view and could be expanded for future research. Second, our research focuses mainly on Austria, which is expandable as well. Third, the interviews were carried out within a specific timespan.

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