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Maritime container terminal service quality in the face of COVID-19 outbreak

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ABSTRACT

The COVID-19 pandemic had a serious impact on global trade in 2020. The interruption of the supply chains due to various restrictions influenced the rapid drop in the transport demand. In the last decade, the global containerized trade has noted the growth of approximately 55,5%, with an average pace of growth of about 5% yearly. Container shipping, as one of the industries vulnerable to economic shocks, has noted a significant drop in trade. The role of maritime container terminals as an integrator and facilitator of global trade in the global supply chains is undisputed. Therefore, the role of services provided by the maritime container terminals has grown in importance. This situation generates the necessity to adapt to these circumstances in a way that expresses the need of improving the service quality, as one of the key aspects of competitiveness. The purpose of this paper is to determine the possibility to verify the relation between COVID-19 impacts on maritime container transport and maritime container terminal service quality. Based on the findings the suggested actions for service quality improvement are proposed.

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1 Introduction

Nowadays, in global trade, the key factor of smooth flows of cargoes are efficient and resilient supply chains [9, 11, 34]. Within these chains, which have very complex, network-like structures [37], an essential role is played by maritime transport [49, 53]. Due to containerization and its significant impact on global trade, the role of the maritime container terminal is essential. At this point, various stakeholders meet, and the attractiveness and competitiveness of the terminal depend on the various element directly and indirectly connected to the terminal, one of the few aspects that can be developed and managed solely by the terminal is service quality [12, 13]. Other aspects of competitiveness are e.g. maritime access, hinterland connections, and customs [3, 21].

Maritime container terminals are operating in a volatile environment, therefore these objects need to be resilient. The resilience of the terminal is tested through economic shocks [29]. The COVID-19 pandemic is having a major impact on global trade and economic activity in maritime container terminals. Ports were confronted with a significant decrease in cargo volumes and vessel calls (e.g., the container ship calls in Europe dropped by 7% in 2020 compared to 2019 - total container throughput in Rotterdam dropped by 3,2%, in Hamburg by 7,9%) [28, 48]. Furthermore, this lower economic activity, combined with other ongoing global trends, makes port management revisit the development and investment plans [29]. The service quality is one of the few aspects of competitiveness, which can be molded and developed by the terminal's operator. Moreover, service quality has been noted as the most important factor of competitiveness [21]. Therefore, especially in current volatile times, it is essential to have the ability to properly measure and improve the service quality.

The purpose of this paper is to determine the possibility to verify the relation between the COVID-19 crisis on maritime container transport and maritime container terminal service quality. Therefore, this paper is structured into five chapters. Following the introduction, the second chapter presents the literature review on the significant

role of maritime trade, with emphasis on the container terminals. The third chapter provides information concerning the impact of COVID-19 on the maritime container traffic. Chapter four includes suggestions concerning the relation between service quality improvement in the face of COVID-19. Finally, chapter five presents the conclusions.

2 Maritime trade and the role of the container terminals – literature review

In the modern complex economy, the maritime trade has an undisputed role, which is expressed in the quantity of cargo transported by the sea – around 11 billion tons in 2018, which accounts almost for 80% of global merchandise trade [36, 48]. The average pace of growth in the volume of merchandise trade in the period 2008-2018 was 2,5% and the average world economic growth was 2,3% [48, 51]. In the last decade, the global containerized trade has noted the growth of approximately 55,5%, with an average pace of growth of about 5% yearly [48], moreover, the containerized trade is accounted for 17% of global seaborne trade [47]. An estimated 811,2 million TEUs were handled in container ports worldwide in 2019 [49]. Therefore, maritime container terminals are an essential part of global supply chains and due to their important role in global trade, the terminal can be perceived as an integrator and facilitator of container trade. Due to the above-mentioned characteristics terminals are the bottleneck of the maritime supply chains [10]. The maritime container terminal is creating added value through the integration of the cargo further into value chains [13]. During this action, the smooth flow of information and product is essential – any failure in provided services influences the cargo to the next link of the supply chain [54].

Since the introduction of containers in the 20th century, this type of transportation plays a crucial role in globalization and integration processes [5]. Changing market environment caused a need for adaptability for various participants in this market, like shipping line operators and container terminals operators. This adaptation was expressed in the strategic alliances [2, 6, 25, 33, 38] and mergers and acquisitions [17, 20, 32]. These actions led to a more concentrated market, where few shipping operators can dictate the conditions for other participants, such as terminals [7, 8, 20]. The oversupply market [27, 48], where the demand growth is comparatively low, needs further cost-cutting actions [47, 48], which is an important challenge.

In these conditions, where there is no market equilibrium [20] due to shipping line actions, other participants, such as terminals need to react and adapt to this environment. Adaptation can be expressed in the internalization of the container terminal industry – there have been three consecutive waves of this action. The first two waves included companies like HPH, P&O, PSA, and SSA, who thanks to expanding activities gained a competitive advantage. The third wave of terminal operators included the container carriers, who were looking for an opportunity to expand and support their core business [32]. Many other companies have attempted to enter the market, although, besides the shipping lines, only a few have succeeded [6].

Under these circumstances, terminals need to compete as transshipment points as well as parts of global supply chains. Implementation of the proper management system, which could improve terminal activities at the strategical, tactical, and operational levels would be useful [14]. Since the services are globally homogenous, terminals must operate and perform with the highest quality. Service quality, one of the major factors of a terminal's competitiveness [1, 3, 21], should be measured and controlled by the management. It is important to collect feedback from various types of stakeholders, mostly from maritime carriers, land carriers, and freight forwarders [13]. Due to the constantly growing market, it was possible to neglect some of the aspects of maritime container terminal service quality. Although the COVID-19 pandemic showed that maritime container terminals must be resilient and ready for reconfiguration.

3 COVID-19 impact on the maritime container transport – selected issues

The COVID-19 pandemic has tested the resilience of the maritime supply chains. In general, they are resilient [31], therefore during the pandemic access to essential goods and the medical item has been secured by them [52] – in April trade in medical products related to COVID-19 noted the growth of 116 % [47]. The effect of COVID-19 on global trade is unprecedented – it is estimated that global trade has fallen by 5% in the first quarter of 2020, and it is expected to decrease by 27% in the second quarter [46]. Therefore contraction caused by the COVID-19 is even deeper than one observed during the financial crisis 2008-2009 [31, 46, 52] (Figure 1) [46].

The first half of 2020 was characterized by widespread lockdowns, travel restrictions, lower consumer demand, market crashes, fast-rising unemployment, therefore a decrease in economic activity (e.g. GDP) [30]. This was also expressed in the maritime container trade, where ports faced a rapid drop in vessel calls. During the second quarter of the year, around 44% of all respondents indicated that container vessel calls were down by more than 5 % [30]. Therefore more than 40% of worldwide container ports have experienced blank sailing, which indicates changes in demand. More cancellation has been announced in June 2020, moreover, it was suggested that blank sailing for Q3 of 2020 eventually lead to 20% of the originally planned sailings [22].

Another important implication of blank sailing is the fact, that some of the ultra-large container ships (ULCS) carry less than half of their capacity [22], which greatly affects the efficiency of the vessel. This situation requires terminals to adapt to the new conditions through significantly improving their competitiveness and prepare to be

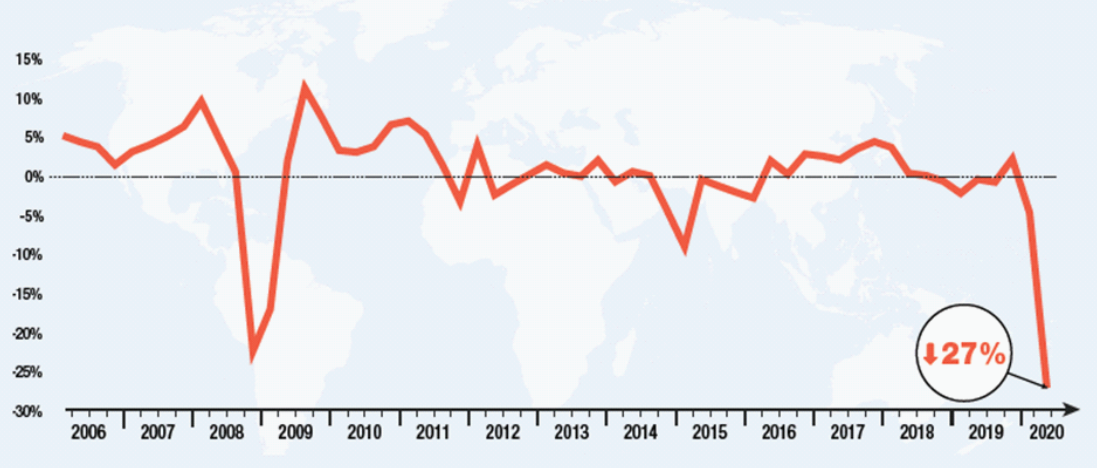

Figure 1 Trends in global trade

Source: UNCTAD (2020) *Global Trade Update. June*

Table 1 Container ship calls by region (2019-2020)

All	Australasia & Oceania	Europe & Mediterranean	Far East	Gulf & ISC	Latin America	North America	Sub Saharian Africa
Calls 2020	4.081	54.663	103.801	15.045	18.574	11.279	5.840
Calls 2019	4.658	58.996	104.001	15.005	19.363	12.230	6.688
Total	-12,4%	-7,3%	-0,2%	-0,3%	-4,1%	-7,8%	-12.7%

Source: WTO (2020a) *When Trade Falls — Effects of COVID-19 and Outlook*. Geneva.

more resilient to similar disruptions in the future. The way of dealing with the above-mentioned requirements is to improve the quality of the services

It is stated that the above-mentioned disruption has at least four stages [52]. The first stage is connected with early 2020 with a typical decrease in container shipping demand due to Chinese New Year and Chinese factories shut down. The second stage includes the extension of the Chinese New Year for extra weeks due to the Wuhan lockdown, which extended the time of blank sailings. This situation, where cargo that was originally mentioned to be transported from the Far East after the Chinese New Year, was catching up led to the third stage. The fourth stage is connected with the COVID-19 outbreak outside of China and the impact of lockdowns and restrictions in Europe and North America on consumer and business demand [52]. The result of these disruptions is a decrease in the container shipping calls by 3,5% in the first half of 2020 (compared to a similar period in 2019) [52]. Changes in port calls concerning world region are presented in table 1 [52].

The busiest container port in the world is Shanghai, where 43,5 million TEU were handled in 2020, which is a slight increase of 0,4% compared to 2019 [42]. The recovery of manufacturing and domestic demand in China influenced the growth of the container volumes at the major Chinese ports by 3,3% [41]. The second busiest port in the world, the port of Singapore, noted a drop of 0,9% yearly [26]. Only non-Asian port from the top 10 busiest container ports in the world, Rotterdam noted a significant drop of 3,2% [28].

Among 15 top European container ports, only two noted overall TEU growth in 2020 compared to 2019: port of Antwerp and port of Gioia Tauro [28]. Belgian port is the only gateway port in Europe that was able to generate positive growth (+1,4%). The large growth of throughput in Gioia Tauro (+26,6%) was possible mostly because of the acquisition of Medcenter Container Terminal by Terminal Investment Limited, therefore, more MSC container flows were directed to the Gioia Tauro [28].

Among the group of 15 top European container ports, large differences could be observed. Some ports, like Le Havre, Barcelona, Marsaxlokk, noted a significant TEU drop – more than 10% yearly, while others (e.g. Bremerhaven, Valencia, Algeciras) noted a drop below 1% yearly [28].

4 Suggestions for service quality improvement in the face of COVID-19

Strong demand decrease and rising consumer requirements force terminals to adapt to these new circumstances through the implementation of tools helping to achieve a higher level of competitiveness. One of the tools, that would help the terminal in improving its position, would

be the implementation of a suitable tool for service quality measurement [12]. This action could bring benefits to the management through providing various information concerning the evaluation of each service concerning the selected criteria and type of the customer. Thanks to this, terminal management could more precisely improve their services and creating their competitive advantage, which is critical during such a volatile time. Constant control of the service quality and continual improvement are essential elements of the implementation of the presented model – especially during a crisis such as the current COVID-19 pandemic. Moreover, the current situation showed that monitoring of service quality can be perceived as one of the major factors of competitiveness. Therefore, it is essential to develop and implement a suitable model for terminal service quality evaluation.

The concept of service quality and its capturing can be perceived subjectively. Therefore, in the literature, it is possible to find references to various types of industries [15]. The most popular method for service quality measurement is SERVQUAL [35], which consists of five dimensions: tangibles, reliability, responsiveness, assurance, and empathy. Even though this tool has been widely used in the measurement of service quality (e.g.: [19]), it is said that SERVQUAL is not suitable for any industry [23], especially for supply chains and other B2B services [4]. In the literature little space has been devoted to service quality of the maritime industry in general and container terminal in particular.

The ROMPIS method was dedicated to measuring service quality in the maritime industry [44]. This tool contains six dimensions related to resources, outcome, management, process, image, and social responsibility. This tool has been utilized for measuring the quality of port services [54]. Results indicate that management and image and social responsibility are the only dimensions that affect positively the customer satisfaction. Most of the research in the field of service quality concerning the maritime industry focus on the relationship between service quality and customer satisfaction, utilizing the SERVQUAL method [19, 24, 54].

The main limitation of ROMPIS and SERVQUAL is the fact that both methods do not recognize the differentiation of importance of each criterion and factors for each group of stakeholders. All service receivers are eager for quality improvement, although not every change will affect their level of satisfaction equally. Various groups have different types of priorities, therefore, improving one category of the service, does not need to affect the improvement of overall satisfaction. To properly measure service quality it is important to implement a suitable tool, which can measure important quality criteria. Essential criteria for evaluating service quality are speed, reliability, availability, security, non-discriminatory access, eco-friendliness [21]. The evaluation framework of service quality of maritime container terminals [12] is presented in figure 2.

Each type of customer (maritime carrier, land carrier, freight forwarder) needs to evaluate the importance of the six quality criteria, each criterion consists of numerous factors. The most suitable way to configure the importance of each criterion in the group and factors within the criteria would be the AHP technique in which importance weights guarantee the evaluation reliability between quality attributes [24, 39]. Respondents need to answer the questions concerning the importance of each criterion concerning each other. The next step is to define what is the correlation between the criteria with relation to various services – what is the influence of one criterion on another. This part is crucial in the decision-making process concerning which type of service should be improved. To find these relations the DEMATEL technique should be implemented [18, 40], in which decision-makers would perform a pair-wise comparison regarding the influence of each criterion on each other. The next step would include the causal diagram, which would provide important information concerning the mutual relation between various criteria. This could grant the management essential data concerning the operational issues connected with service and its quality. The result of the above-mentioned research process would be helpful in service quality improvement.

Implementation of the efficiency evaluation system of a maritime container terminal, which consists of four mutually correlated modules [14] can provide more data concerning operations and strategical, tactical, and operational plans, which can also are transferable to the services and the quality of them. Moreover one of the modules in the system is the control tower module, which main target is to constantly control the actions of the terminal. This is the only module that constantly controls processes

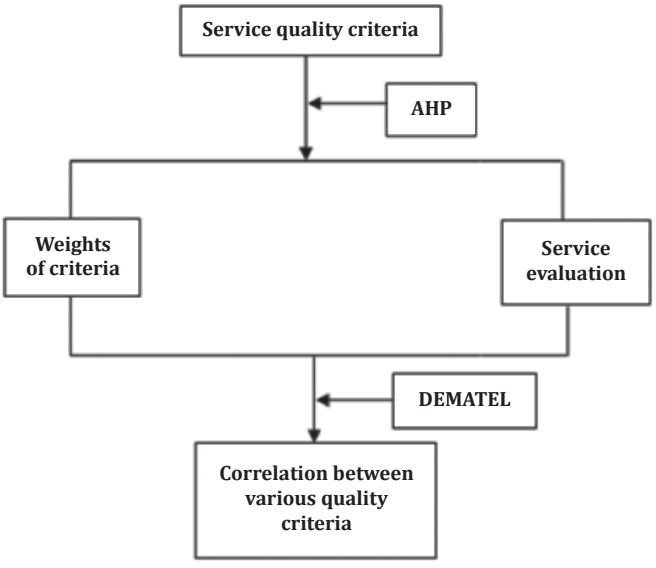

Figure 2 Evaluation framework of service quality of maritime container terminal

Source: Author's elaboration

and objectives, which can be changed almost every day, of course, those changes should be made regarding tactic and strategic plans. The possibility of frequent adjustments of operational objectives requires the ability to the agile adaptation and quick response to dynamically changing conditions. Reports, as well as related actions, should be taken almost immediately after operational objectives modifications and just as fast as the case of variation between objectives and results occurs [14].

Another important aspect of improving service quality is the implementation of digital technologies [1], which can improve the reliability, flexibility, security, and competitiveness of the port. Seaports are already implementing digital technologies, connected with gathering data based on IoT [43]. Moreover, new IoT solutions will be developed and deployed in eight container terminals: Antwerp, Dunkirk, Montoir, Rouen, Malta, Sines, Thessaloniki, and Genoa [45]. Other types of digital technologies which are most frequently implemented to the port are the following [1]:

- Big data analytics,
- Cloud computing,
- Machine learning,
- Digital twins,
- Blockchain technology,
- Three-dimensional printing (3D),
- Artificial intelligence (AI),
- Sensor technology,
- Augmented reality.

These technologies, with proper staff training and implementation, can provide various information concerning different categories of operations taking place at the terminal. One of the critical categories is service quality. Since the terminal is a part of the supply chain it is worth noting that, only when other participants also implement digital technologies into their systems, the overall efficiency and quality can be improved. Even though the terminal will implement some digital tools, as only in the chain, the overall efficiency of the terminal will increase, although the synergy effect will not be possible to achieve.

Measuring and evaluating the level of service quality is an essential factor for achieving competitive advantage, especially in volatile times, such as the COVID-19 pandemic crisis.

5 Conclusions

The impact of the COVID-19 pandemic on port varied dependent on the cargo mix of the terminal, position in the global supply chain. The current crisis confirmed that the maritime shipping, and maritime container terminal industry, is resilient and it can readapt to the changing environment, although the time needed for the adjustment is dependent on the characteristics of served markets and its ability to recover during and after the crisis. Under these circumstances, the ability to improve service quality is essential for achieving a competitive advantage. The proposed method for measuring service quality concerning the various stakeholders could be beneficial for the terminal, although the model needs to be confronted with the business reality.

Improvement in service quality could reduce the negative effects of disruptions. This improvement can be expressed in various forms, one of them is to measure, evaluate, and constantly control the terminals' service quality evaluated by shipping line operators, land carriers, and freight forwarders. This could provide suitable information concerning services or groups of services that should be improved and developed. Another possibility to enhance competitive advantage is to implement digital technologies, which can provide various information concerning different categories of operations taking place at the terminal, such as service quality. This solution could be beneficial for all participants of the supply chain.

The purpose of the paper was to determine the possibility to verify the relation between COVID-19 impacts on maritime container transport and maritime container terminal service quality. The COVID-19 had a significant impact on container shipping expressed in a decrease in the container shipping calls and decrease the port's container throughput – although the size of the lesions was depending on the terminal's position in the global supply chain and terminal dependence on foreign markets and their ability to recover. Therefore, the quality of the terminal services, as one of the major factors of terminals' competitiveness, needed to be superior to still being a beneficiary of the supply chain as one of the links. Chinese ports were not suffered as much due to the COVID-19 pandemic, mostly due to recovery of the manufactury and domestic demand. Therefore, for the European container terminal, a suitable way for improving their competitiveness is to improve their service quality. This could be expressed in the improvement of the provided services based on monitoring their quality utilizing the presented research method. Moreover, based on service quality evaluation, further improvement could be achieved like the implementation of digital technologies in areas where it could improve service quality.

The main limitation of this paper is the fact that the COVID-19 pandemic is still ongoing, therefore, it is impossible to evaluate the true impact of the crisis on maritime container shipping. Another limitation is connected with the lack of empirical verification of the presented model for service quality evaluation with the business reality.

When the pandemic will end, then further research directions should include the research concerning capturing the COVID-19 pandemic on the adaptability of the maritime container terminals to the new conditions, as well as findings connected with a real impact of the current crisis on the maritime container supply chains. It is worth noted that this type of disruption creates opportunities for future improvements.

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