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Transport Technologies and Infrastructure in the Premodern Era

1 Introduction

Transport technologies and infrastructures constituted the material components of networks that enabled historical processes of mobility such as migration and trade. Routes were the most durable spatial expression of such networks; together with cities as important nodes—with their ports, warehouses, taverns, guesthouses, etc.—they constituted their own kind of infrastructural assemblages, and it is they that form the thematic focus of this chapter. In this way, the diffuse information on transport infrastructure at a time when this term did not even exist can be presented in its different contexts, i. e., mainly the economy and trade, but also the military. For a region centering on a sea, maritime connections, shipping, and ports are usually the focus, but this chapter also will pay attention to land traffic, its technologies, and infrastructures. The latter were of equal importance, because before the era of steam shipping, which began on the Black Sea in the 1830s, the regional weather conditions largely prevented sea voyages during the four to six months of winter, and even in summer adverse winds made travel times highly unpredictable. In contrast, land traffic was more reliable but also slower and impractical when heavy loads had to be transported. Besides purely regional transport networks, which throughout the ages constituted the Black Sea Region as a political, cultural, and economic space, this chapter will pay special attention to those networks that by combining sea and land routes integrated the Black Sea region into even larger contexts. For the Middle Ages, Brătianu has highlighted this important aspect by using the railway metaphor of a "plaque tournante" (turntable, in the sense of a distribution hub) to characterize the function of the Black Sea regarding trade and transport.[1]

2 Geography and Transport in Antiquity

Infrastructures and technologies of transport developed in close connection to the geographical features of the region; they transformed natural geography into mobility

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1 Gheorghe Brătianu, "La Mer Noire, plaque tournante du trafic international à la fin du moyen age," *Revue historique du Sud-Est européen* 21 (1944): 36 – 69.

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spaces. From the Bronze Age on, navigation of the Black Sea was not only undertaken along its shores as cabotage, but due to the proximity of the north and south coasts and favorable currents, ships also crossed the open sea between Crimea and the northern Anatolian coast.[2] At any time, the linkages between the north and south coasts of the Black Sea were particularly dense and enabled a lively trade and in some instances the development of common political structures. Cases in point are the Pontic Kingdom (first century BC) and also the Ottoman Empire from the late fifteenth century on, which united the Anatolian coast as well as Crimea under one rule.

Via rivers such as the Danube, the Dniester, the Dnipro, the Don, and the Rioni in Georgia, the Black Sea was linked to its hinterlands. Although rivers were not easy to navigate until their regulation in the nineteenth and twentieth centuries, they established traffic corridors, sometimes in connection with roads or towpaths that were used for upstream transportation or circumvented difficult places such as rapids, as in the case of the Dnipro, for instance. In addition to these riverways, in the south the Bosporus provided easy access from the Mediterranean. This canal-like access supported mobility networks beginning with the Greek colonization in the eighth century BC, which created a network of port cities often placed at the sites of natural harbors. By sea, these cities were linked with one another but also remained connected to their metropolises, resulting in close trade relations with the Aegean (especially with Athens and Miletus) throughout the classical and Hellenistic epochs.[3]

The easy integration of the Black Sea into Mediterranean empires such as the Roman Empire from the first century BC on (and much later the Venetian Empire) also hinged on the access the Bosporos provided to their fleets. Roman control over the region was largely established after the Mithridatic Wars (89–63 BC) against the Pontic Kingdom and reached its peak with the occupation of the Darial Pass (Portae Caspiae) in the Caucasus in the late first century. This pass offered an important north-south route bypassing the Black Sea and was thus of strategic and economic importance.[4]

Being part of the Roman Empire did not fundamentally change the close connection between the port cities, especially on the western Black Sea coast and the northwestern coast of Anatolia. At the same time, the garrison cities on the Danube border were also integrated into these Black Sea trade networks. This was possible because the Romans build the first roads in the Balkans, most importantly the road along the Danube in the first half of the first century BC as well as the coastal road from the Danube

2 Alexander A. Bauer and Owen P. Doonan, "Fluid Histories: Culture, Community, and the Longue Durée of the Black Sea World," in *New Regionalism or No Regionalism? Emerging Regionalism in the Black Sea Area,* ed. Ruxandra Ivan (Burlington, VT: Ashgate, 2012), 18.

3 Jurij G. Vinogradov, "Der Pontos Euxeinos als politische, ökonomische und kulturelle Einheit und die Epigraphik," in *Pontische Studien: Kleine Schriften zur Geschichte und Epigraphik des Schwarzmeerraumes,* ed. Heinz Heinen (Mainz: Philipp von Zabern, 1997), 1–73.

4 Helmut Halfmann, "Die Alanen und die römische Ostpolitik unter Vespasian," *Epigraphica Anatolica* 8 (1986): 39–50.

Delta to Byzantium. In Asia Minor the Romans extended the existing Hellenistic road network, which connected the dense network of cities, including the port cities.[5]

3 Long-Distance Trade Routes of the Middle Ages

While for Rome the Black Sea was a distant periphery whose northern shore was only ruled indirectly, for the Byzantines who controlled its southern entry it was an essential part of their sphere of power. The Byzantines maintained sea and land routes centered on Constantinople as important infrastructure that held the empire together. The port cities of the western and southern Black Sea coast were directly connected to Constantinople by ship. Moreover, the Byzantines were the direct heirs of the Roman road network in the Balkans and in Asia Minor, which they adapted over the centuries to their own purposes. However, it is difficult to assess how well maintained these roads were, especially in areas such as the Balkans, which the Byzantines had lost in the seventh century and only could partly regain in the tenth century. Because there was a greater degree of territorial continuity and a larger population that could work on the maintenance of roads in Anatolia, it is likely that here the transport network that connected the port cities with the cities of the hinterland functioned better.[6]

As a direct consequence of the presence of the Byzantine navy on the Black Sea, Chersonesus (near present-day Sevastopol) remained an important Byzantine possession until the fourteenth century.[7] Crimea proved an important site for the Byzantines' contacts and trade with Kyivan Rus, which intensified in the tenth century. Kyivan Rus was a state that united a number of cities that had grown by taxing the trade in slaves and "Oriental goods," mainly silk and other textiles as well as spices and drugs, along the trade route from the Baltics to Byzantium. To a large extent, this trade route used rivers such as the Daugava (Polish: Dźwina, Russian: Zapadnaia Dvina [Western Dvina]) and the Dnipro to reach the Black Sea. In the tenth century, a yearly trade expedition went from Kyiv to Constantinople along the Dnipro and the western Black Sea coast.[8]

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5 Octavian Bounegru, "The Black Sea Area in the Trade System of the Roman Empire," *Euxeinos* 14 (2014): 8–16; *Brill's New Pauly Online*, s.v. "Roads," by Hans Lohmann, Josef Wiesehöfer, and Michael Rathmann, accessed January 23, 2021, http://dx.doi.org/10.1163/1574-9347_bnp_e12225290.

6 Anna Avraméa, "Land and Sea Communications, Fourth-Fifteenth Centuries," in *The Economic History of Byzantium: From the Seventh Through the Fifteenth Century*, ed. Angeliki E. Laiou (Washington, DC: Dumbarton Oaks Research Library and Collection, 2002), 1:57–90; Matthew Larnach, "The Via Militaris in Transition: From Late Rome to the Crusades," in *The Balkan Route: Historical Transformations from Via Militaris to Autoput*, ed. Florian Riedler and Nenad Stefanov (Berlin: De Gruyter, 2021), 21–52.

7 Anne Bortoli, "Kherson and its Region," in Laiou, *The Economic History of Byzantium*, 2:659–65.

8 Thomas S. Noonan, "The Dnieper Trade Route in Kievan Russia, 900–1240 A.D." (PhD Thesis, Ann Arbor, University of Michigan, 1979); Christian Raffensperger, *Reimagining Europe: Kievan Rus' in the Medieval World, 988–1146* (Cambridge: Harvard University Press, 2012); Gottfried Schramm, *Altrusslands*

Because of the position of their capital, the Byzantines were able to control the export of grain, slaves, and fish from the northern Black Sea to the Mediterranean. It was only after the conquest of Constantinople by the Crusaders in 1204 that Italian merchants, especially those from Genoa, took over this trade and held onto it even after the resurrection of the Byzantine Empire in 1261. In the thirteenth and fourteenth centuries, Genoese merchants exported goods such as fish and grain from the ports at the mouth of the Danube and probably also moved up the river for their trade ventures. At the same time, their ships transported Oriental goods such as spices and silk upriver, from where they went overland to Central Europe via Moldavia, Wallachia, and Transylvania.[9]

The Genoese made by far their biggest profits by tapping the transcontinental trade network that linked China and India with Europe, colloquially known as the Silk Road. It was in Crimea and at the mouth of the Don at Tana (Ottoman: Azak, Russian: Azov) where land and sea routes converged. Therefore, rather than just entertaining small merchant colonies, the Genoese integrated cities complete with their hinterland such as Caffa (today: Feodosiia) and Soldaia (today: Sudak) in Crimea into their colonial empire.[10]

The Oriental goods that were transhipped to Italy arrived by camel caravans in the ports of the northern Black Sea coast. From the second half of the thirteenth to the middle of the fifteenth century, the main branch of the Silk Road had shifted to a route along the Amu Darya, passing north of the Caspian, crossing the Volga and the Don before reaching the Black Sea. The reason for this shift was the promotion and protection of trade by the Khanate of the Golden Horde, one of the successor states of Genghis Khan, which centered on the lower Volga. The Ilkhans, a rival dynasty of Mongolian origin in Iran, also attempted such a rerouting towards the Black Sea. During their rule, a considerable part of the spices and silk usually going via Baghdad to the Levant was redirected to their capital Tabriz in historical Azerbaijan and from there it went on to Trabzon, the capital of their Byzantine vassals in the Empire of Trebizond. Their main partners in trade were the Venetians, who had a large merchant colony in the city.[11]

Anfang: Historische Schlüsse aus Namen, Wörtern und Texten zum 9. und 10. Jahrhundert (Freiburg im Breisgau: Rombach, 2002).

9 Constantin C. Giurescu, "The Genoese and the Lower Danube in the XIIIth and XIVth Centuries," *The Journal of European Economic History* 5, no. 3 (1976); Zsigmond Pál Pach, "Die Verkehrsroute des Levantehandels nach Siebenbürgen und Ungarn zur Zeit der Könige Ludwig von Anjou und Sigismund von Luxemburg," in *Europäische Stadtgeschichte in Mittelalter und früher Neuzeit*, ed. Werner Mägdefrau (Weimar: Hermann Böhlaus Nachfolger, 1979).

10 Angeliki E. Laiou and Cécile Morrisson, *The Byzantine Economy* (Cambridge, Mass.: Cambridge University Press, 2007), 200–15; Evgeny Khvalkov, *The Colonies of Genoa in the Black Sea Region: Evolution and Transformation* (New York, NY: Routledge, 2017).

11 Virgil Ciocîltan, *The Mongols and the Black Sea Trade in the Thirteenth and Fourteenth Centuries* (Boston: Brill, 2012), 95–139.

4 Ottoman Control and Transottoman Connections

Ottoman control of the Black Sea from the last quarter of the fifteenth to the last quarter of the eighteenth century was only possible after the conquest of Constantinople. The Ottomans relocated their wharves and maritime arsenal from Gallipoli to Galata and founded a separate arsenal in Sinop to conquer the Crimean coastal cities and Azak at the mouth of the Don in 1475 and those at the mouth of the Danube a decade later. The Tatar khans who ruled inland Crimea as well as the northern Black Sea coast became vassals of the Ottomans, and the economy of the Black Sea soon became centered on the Ottoman capital. After a transition period, the Genoese were pushed out of the trade, and the region's principal export goods, such as grain, fish, butter, hides, and slaves, were directed to Istanbul, which could grow into one of the largest cities in Europe thanks to this constant provisioning.[12]

From the sixteenth to the late eighteenth century, when first Russian and then British and Dutch merchant ships were allowed entry, only Ottoman ships could sail the Black Sea. Over the course of the sixteenth century the Ottomans conquered or controlled most of the coastal areas, patrolled the sea with their war galleys, and eradicated piracy. This situation gave rise to the image of the Black Sea as an "Ottoman lake." However, this image is somewhat misleading. The Ottoman Black Sea was neither a dead end nor a closed system; it remained an important conduit between the Ottoman Empire, Poland-Lithuania, Muscovy, and Persia, as will be shown below. With the circulation of people, goods and ideas, the routes on and around the Black Sea created spaces of interaction that can be labeled Transottoman. In their manifold expressions such spaces can be found until the end of the Ottoman Empire and beyond.[13]

Moreover, the Ottomans' control over the Black Sea always remained contested. From the late sixteenth century on, the Zaporozhian Cossacks of the lower Dnipro and later also the Don Cossacks conducted regular raids along the Black Sea coasts as far as the Bosporus and Anatolia. They relied on river boats called *chaika* that could operate in shallow coastal waters as well as on the high sea and were very hard to control by the Ottoman navy relying on large galleys.[14] Against this highly mo-

12 Halil İnalcık, "The Question of the Closing of the Black Sea under the Ottomans," *Archeion Pontu* 35 (1979): 74–110; Halil İnalcık, *Sources and Studies on the Ottoman Black Sea,* vol. 1*, The Customs Register of Caffa 1487–1490* (Cambridge, Mass.: Harvard University Press, 1996); Gilles Veinstein, "From the Italians to the Ottomans: The Case of the Northern Black Sea Coast in the Sixteenth Century," *Mediterranean Historical Review* 1, no. 2 (1986): 221–37.

13 Lyubomir Pozharliev, Florian Riedler, and Stefan Rohdewald, "Introduction to the Special Issue: Transottoman Infrastructures and Networks across the Black Sea," *Journal of Balkan and Black Sea Studies* 3, no. 5 (2020): 13–18; Albrecht Fuess, Stefan Rohdewald, and Stephan Conermann, eds., *Transottomanica – Osteuropäisch-osmanisch-persische Mobilitätsdynamiken: Perspektiven und Forschungsstand* (Göttingen: V&R unipress, 2019).

14 Victor Ostapchuk, "The Human Landscape of the Ottoman Black Sea in the Face of the Cossack Naval Raids," *Oriente Moderno, Nuova Serie* 20 (81), no. 1 (2001): 23–95; Dariusz Kołodziejczyk, "Inner Lake or

bile enemy the Ottoman fortresses of Özü (today: Ochakiv) and Azak became very important as infrastructures of immobility. It was their task to prevent the outbreak of the Cossack fleets from the rivers, or at least report on their movements.[15]

To supply their fortresses, move troupes and officials, and convey messages quickly, the Ottoman state tightly integrated the Black Sea region into its network of official routes that radiated out from Istanbul on land and sea. Of the four officially maintained sea routes, two concerned the Black Sea, one leading along the western Black Sea coast to the mouth of the Danube, where it linked up with the Ottoman Danube flotilla's range of action. The other connected 126 ports on the Anatolian shore from Istanbul to Faş (today: Poti). This route was also used by Evliya Çelebi (1611–87[?]), the famous Ottoman traveler, when he accompanied the 1640 naval expedition to recapture Azak from the Cossacks. Before returning to Istanbul, Evliya was left shipwrecked and washed ashore half dead in Dobruja and vowed never to board a ship on the Black Sea again. The account of his roundtrip provides a vivid insight into the Ottoman experiences with and their mental maps of the Black Sea.[16]

Two land routes integrated the extended coastal hinterland in Anatolia and the Balkans. On these and other routes the Ottoman government came close to what can be considered an active infrastructure policy: it organized stations (*menzil*) where post riders and travelling officials could change horses; for merchants, caravanserais were built in between the cities; guard stations protected travelers against highway robbers and bandits, especially on mountain passes; sometimes the road surface was even leveled or paved, especially near the capital and in Ottoman Europe, where wheeled traffic was more frequent than in Anatolia.[17]

In Anatolia, one of the principal routes ran behind the Pontic Mountain range and split up near Amasya into the Anatolian Middle Route, continuing via Diyarbakır to Baghdad and the Left Route that ran via Erzurum to the Ottoman-Persian border and ultimately to Tabriz. Moreover, there were important connecting roads crossing the mountains to major ports such as Samsun and Trabzon. In the sixteenth and seventeenth centuries, the main share of the silk exports from northern Iran went via this route to Istanbul and Bursa, where it was processed or exported on to Europe. The

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Frontier? The Ottoman Black Sea in the Sixteenth and Seventeenth Centuries," in *Enjeux Politiques, Économiques et Militaires En Mer Noire (XIVe–XXIe Siècles): Études à La Mémoire de Mihail Guboglu*, ed. Faruk Bilici, Ionel Cândea, and Anca Popescu (Brăila: Musée de Brăila, Éditions Istros, 2007), 125–39.

15 Brian Davies, *Warfare, State and Society on the Black Sea Steppe, 1500–1700* (London: Routledge, 2007), 89 speaks of their "tripwire" function.

16 Cemal Çetin, "Anadolu İskele ve Kara Yolu Bağlantıları (XVI. Yüzyıl Sonları)," *The Journal of Academic Social Science Studies* 28 (2014): 349–67; Evliya Çelebi, *An Ottoman Traveller: Selections from the Book of Travels of Evliya Çelebi*, trans. Robert Dankoff and Sooyong Kim (London: Eland Publishing, 2011), 47–55; *Evliya Çelebi Seyahatnâmesi*, 8 vols. (Istanbul: Yapı Kredi Yayınları, 1996–2003), book two tells the Black Sea episodes.

17 Yusuf Halaçoğlu, *Osmanlılarda Ulaşım ve Haberleşme (Menziller)* (Istanbul: İlgi Kültür Sanat Yayıncılık, 2014); Ümit Ekin, "Klasik Dönemde Osmanlı İmparatorluğu'nda Karayolu Ulaşımını ve Nakliyatı Etkileyen Faktörler (1500–1800)," *Belleten* 81, no. 291 (2017): 387–418.

French traveler-*cum*-diamond-merchant Jean-Baptiste Tavernier (1605–89) provides the most detailed account of how this route worked in the mid-seventeenth century.[18] Iranian raw silk was usually transported by camel caravans on the land route, because the sea route was considered too dangerous. Only the silk directly exported to Poland went via Trabzon to Crimea, from where it was transported across the steppe to Lviv (Polish: Lwów) by wagons on a route called the *Via Tatarica*, which had been used since the Middle Ages.[19] Armenian merchants from Isfahan were very active in the silk trade, which ceased in the eighteenth century due to a decline in production.[20]

Also, in Ottoman Europe, an official route, the Rumelian Right Route, followed the Black Sea coast inland with connecting roads to major port cities such as Burgas and Varna. This route crossed the Danube at Tulça (Romanian: Tulcea) or İsakça (Romanian: Isaccea) and continued until Özü, the Ottoman fortress at the mouth of the Buh and the Dnipro. At the Danube, it linked up with an important trade route to Central Europe, which led through Moldavia, crossed the Dniestr into Poland-Lithuania, and terminated at Lviv. In the sixteenth and seventeenth centuries this route was customarily used by the envoys of the Polish-Lithuanian Commonwealth to travel to Istanbul. Likewise, it was a preferential route for Armenian merchants who traded in Oriental goods such as silk, carpets, and luxury weapons, which were important for the self-presentation of the Polish nobility. According to the vivid account by Martin Gruneweg (1562–1618[?]) of Gdańsk (German: Danzig), a merchant's apprentice who travelled six times to Istanbul in the 1580s, big caravans composed of up to forty wagons needed six to seven weeks from Lviv to the Ottoman capital.[21]

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18 Jean-Baptiste Tavernier, *The Six Voyages of John Baptista Tavernier, Baron of Aubonne, Through Turky, into Persia and the East-Indies, For the Space of Forty Years* (London: Godbid and Pitt, 1677); Franz Taeschner, *Das anatolische Wegenetz nach osmanischen Quellen,* vol. 1 (Leipzig: Mayer & Müller, 1924); András Riedlmayer, "Ottoman-Safavid Relations and the Anatolian Trade Routes: 1603–1618," *Turkish Studies Association Bulletin* 5, no. 1 (1981).

19 Dariusz Kołodziejczyk, "Polish-Ottoman Trade Routes in the Times of Martin Gruneweg," in *Martin Gruneweg (1562–nach 1615): Ein europäischer Lebensweg,* ed. Almut Bues (Wiesbaden: Harrassowitz, 2009).

20 Rudolph P. Matthee, *The Politics of Trade in Safavid Iran: Silk for Silver, 1600–1730* (Cambridge: Cambridge University Press, 1999); Ina Baghdiantz McCabe, *The Shah's Silk for Europe's Silver: The Eurasian Trade of the Julfa Armenians in Safavid Iran and India* (1530–1750) (Atlanta: Scholars Press, 1999); Murat Çizakça, "A Short History of the Bursa Silk Industry (1500–1900)," *Journal of the Economic and Social History of the Orient* 23, no. 1/2 (1980).

21 Martin Gruneweg, *Die Aufzeichnungen des Dominikaners Martin Gruneweg (1562–ca. 1618) über seine Familie in Danzig, seine Handelsreisen in Osteuropa und sein Klosterleben in Polen*, ed. Almut Bues (Wiesbaden: Harrassowitz, 2008); Kołodziejczyk, "Polish-Ottoman Trade Routes"; Aleksandr Osipian, "Voting at Home and on the Move: Elections of Mayors and *caravanbashi* by Armenian Merchants in Poland and the Ottoman Empire, 1500–1700," in *Cultures of Voting in Pre-modern Europe,* ed. Serena Ferente, Lovro Kunčević, and Miles Pattenden (London: Routledge, 2018), 310–28; Andrzej Dziubiński, *Na Szlakach Orientu: Handel Między Polską a Imperium Osmańskim w XVI–XVIII Wieku* (Wrocław: Leopoldinum, 1998).

In the sixteenth century, the fur exports from Russia to Istanbul were also carried partly along this route. The official buyers from the Ottoman Treasury travelled with cash and some Oriental goods via Moldavia, Kamianets-Podilskyi (Polish: Kamieniec Podolski, Ottoman: Kamaniçe), Minsk, and Smolensk to Moscow and returned with fur, which were an important item of Ottoman court culture. Alternatively, there was a land route further to the east via Kyiv. These two routes were considered safer than the more direct one from Crimea through the steppes, where caravans were prone to attacks by Cossacks and Tatars. On the other routes, the caravans were protected by the Moldavian Prince, an Ottoman vassal, and the Polish-Lithuanian king, who usually entertained friendly relations with the sultan.[22]

The official routes were the expression of a pre-modern infrastructure policy on an imperial level that had a dual military-*cum*-economic purpose. It was designed for integrating the empire but at the same time provided the material basis for Transottoman connections beyond its borders. The organization of routes relied on accumulated knowledge and even material structures of imperial predecessors; Ottoman roads frequently used the foundations as well as the surface of older Roman and Byzantine roads. However, because camels and packhorses were used more frequently than carts, the Ottoman state did not have to pay so much attention to road surfaces. The major investments were rather in bridges and a service and security infrastructure. Caravanserais were directly taken over from the Rum Seljuk Sultanate, which had ruled large parts of Anatolia from the end of the eleventh to the middle of the thirteenth century. The Ottomans also spread the architectural model of the caravanserai to the Balkans. In organizational terms, the system of post riders and halting places strongly resembled the system of the Mongol Empire, the *yam*, which was also used as a model by the Muscovite state.[23]

5 Muscovy's Approach to the Sea

By way of combining land and sea transport and investing in road infrastructure, the Ottoman Empire integrated the southern, western, and northwestern coasts of the Black Sea. On the eastern coast, Ottoman rule depended on fortresses that were only accessible by sea. The unsuccessful Ottoman military expedition to Astrakhan in 1569 shows the degree to which imperial rule was dependent on a functioning trans-

22 Alexandre Bennigsen and Chantal Lemercier-Quelquejay, "Les marchands de la Cour ottomane et le commerce des fourrures moscovites dans la seconde moitié du XVIe siècle," *Cahiers du Monde russe et soviétique* 11, no. 3 (1970): 363–90; Arkadiusz Blaszczyk, "From the Forests of Siberia to the Urban Jungle of Istanbul: The Ottoman-Muscovite Fur Exchange in the Sixteenth and Seventeenth Centuries," in *Transottoman Matters: Objects Moving through Time, Space, and Meaning*, ed. Arkadiusz Blaszczyk, Robert Born, and Florian Riedler (Göttingen: V&R unipress, 2022).

23 Florian Riedler, "The Istanbul-Belgrade Route in the Ottoman Empire: Continuity and Discontinuity of an Imperial Mobility Space," in Riedler and Stefanov, *The Balkan Route.*

port infrastructure. The aim of the expedition was to recapture the city from the Muscovite state, return it to its previous Tatar ruler, and close the emerging direct trade link between Muscovy and Safavid Persia, a geopolitical rival of the Ottomans in the Caucasus. During the campaign, the Ottomans failed in their attempt to transport artillery across the steppe and to deploy ships, which had sailed up the Don from Azak, to the Volga. The idea to dig a 60-kilometer canal between the two rivers proved impossible under the contemporary technological conditions. Unable to take Astrakhan, the Ottoman expedition forces had to retreat through the steppes, where many soldiers died of thirst.[24]

Trade on the south-north route that circumvented the Black Sea was less dependent on infrastructure than the military, but thrived on political encouragement. Muscovite-Safavid relations, which were opened in the late sixteenth century, were largely driven by commercial interests. Trade between the two states that went via Astrakhan became very significant in the second half of the seventeenth century. Iranian silk in particular was brought by Armenian merchants over the Caspian Sea, transported to Arkhangelsk on the White Sea—later directly to the Baltic—and from there exported to Europe. Russian negotiations with the Armenian merchants to redirect the entire silk trade to this route proved unrealistic, but the episode shows once more how dependent early modern empires were on extra revenue from trade.[25]

From the second half of the seventeenth century on, the Muscovite state also began to intervene directly in the Black Sea region after it had managed to restrict the regular incursions by the Crimean Tatars. The Tatar raiding parties used customary routes or trails (*shliakhy*) for their slave raids into southern Muscovy and Poland-Lithuania. These routes followed open country that was ideal for riding avoiding dense forests and large streams. Similar to rivers or sea currents, such trails can be considered natural infrastructure that needed no or only minimal human intervention. The opposite is true for the formidable infrastructure of immobility that the Russians built to cut the trails. From west to east, more than a 1,000 kilometers of abatis lines, i. e., defense lines constructed from felled trees, were created, and later earthen walls with forts were also built to prevent Tatar incursions.[26]

With growing military superiority, the Russians were able to go on the offensive against the Tatars, which also brought them into conflict with the Tatars' Ottoman suzerain. In 1696, as part of the Wars of the Holy League against the Ottomans, Tsar Peter I was able to conquer Azak, which the Russians called Azov. The fortress not only became the first Russian foothold on the Black Sea, but also what in the twentieth century would be called a "white elephant," a costly infrastructure project without much

24 Akdes Nimet Kurat, "The Turkish Expedition to Astrakhan' in 1569 and the Problem of the Don-Volga Canal," *The Slavonic and East European Review* 40, no. 94 (1961): 7–23.

25 Jarmo Kotilaine, *Russia's Foreign Trade and Economic Expansion in the Seventeenth Century* (Leiden: Brill, 2004), 451–66.

26 Davies, *Black Sea Steppe*, 17–22, 44–47, 88–95.

use.[27] Azov and the new port of Taganrog, which was built adjacent to it, was intended as the base for the Russian navy, which had been built at the wharf in Voronezh on the Don. However, the Ottomans flatly refused to allow any Russian ships to leave the Sea of Azov, the bay on which the city was situated, and to enter the open sea through the Kerch Strait, which was guarded by an Ottoman fort. Hence the Russian navy was left to rot in the shallow waters of the Sea of Azov. Moreover, creating and maintaining a functioning base at Azov proved very expensive, because all building materials and provisions, as well as the work force, had to be shipped down the Don. The logistics were immense and due to disease and supply problems many of the forced laborers perished or deserted. In 1711, everything that had been built up at such immense costs was razed again when the fortress had to be returned to the Ottomans after a military defeat.[28]

In the subsequent Russian-Ottoman wars of the eighteenth century, the Russian Empire was able to conquer Crimea and all of the northern Black Sea coast. This fundamentally altered the geopolitical situation of the Black Sea region and with it the layout of transport and infrastructures that were to be built up from the nineteenth century onwards.

27 Dirk van Laak, *Weiße Elefanten: Anspruch und Scheitern technischer Grossprojekte im 20. Jahrhundert* (Munich: Deutsche Verlags-Anstalt, 1999).

28 Brian J. Boeck, "When Peter I Was Forced to Settle for Less: Coerced Labor and Resistance in a Failed Russian Colony (1695–1711)," *The Journal of Modern History* 80, no. 3 (2008): 485–514.