Shipbuilding and early forms of modern management. Six months to rebuild the Ottoman fleet after the defeat at Lepanto

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Abstract
This paper focuses on the reconstruction of the Ottoman fleet following the naval defeat at Lepanto (1571). It examines the event from the perspective of management studies. Drawing on extensive archival research, we reconstruct the Ottoman Empire's decision-making processes, looking at the main organizational conditions that made this remarkable feat possible. This allows us to make a preliminary comparison with the management of the Venice Arsenal in the same period, as an example of early forms of modern management. To what extent this extraordinary effort was – at the same time – a consequence and a driver of a different pattern of organizing economic activities on the two sides of Mediterranean Sea? Differences between the two contexts are discussed, while addressing the importance of shipbuilding in the development of early form of management and the invention of the factory system in preindustrial, state run manufacturing, shipyards in particular.

Keywords
Venice Arsenal, Ottoman shipyards, Lepanto battle, Protoindustrial settings, Shipbuilding

"[T]he power of this Exalted State is such, that if a fleet were commanded with anchors of silver, ropes of silk thread and sails of satin, it could easily be built"
The Grand Vizier, Sokollu Mehmed Pasha, 1571

1. Introduction: From shipbuilding to history of organizing

One of the biggest events in naval history is the Battle of Lepanto. On October 7, 1571, the Ottoman Empire suffered a serious defeat by the Holy League, and lost almost the entire imperial fleet in a single day. This could have been an irreversible disaster, but the Ottomans overcame it in a matter of six months: with an unprecedent effort, a new fleet was ready in spring 1572.

There are countless papers and books on the Battle of Lepanto, from a variety of historical perspectives, including Venetian historiography (for example, Brown, 1895; Braudel, 1958; Lane, 1973; Rapp, 1976; Tucci and Tenenti, 1996). and the Ottoman perspective (for example, Shinder, 1971; Inalcik, 1974, 1977, 1985; Imber, 1996, 2002; Ari, 2006, 2019; Pamuk, 2009). with a few comparative contributions (for example, Inalcik, 1977; Pedani, 2008; see also the important exhibition by Ölçer et al., 2010).

What is missing, however, is an investigation of the reconstruction of the fleet from an economic, business, management and accounting history point of view. This paper takes this approach, examining the episode as a chapter in the long-term history of organizing. Based on in-depth archival research, we look at the decision-making process at the central level – the Vizier and the Council – examining all the decisions that were documented in the Ottoman archive in Istanbul. In addition to the reconstruction process itself, we infer possible elements about shipbuilding, and the organizational specificities of Ottoman shipbuilding that made the effort possible. We also speculate on the situation of the Ottoman arsenals in comparative terms with the development of organizational aspects that were taking place in Venice at the same time, though in indirect ways, based on a parallel in-depth archival investigation by one of the authors some years ago (Zan, 2004; Zan, Rossi, Zambon, 2006; Zambon and Zan, 2007).

From a theoretical point of view, our project shares the view that is taking place in recent debates in management and accounting history. Though the importance of the industrial revolution in the UK in the late 18th century and the managerial revolution in the US in the 19th century cannot be forgotten, with crucial discontinuities as stated by economic and business history, more subtle processes of knowledge production necessary for managing complex entities can be found some centuries before (e.g. Carmona et al, 1997; see also Hopwood, 1987, 1992; Mepham, 1988; Fleischman and Parker, 1991; Edwards and Boyns, 1992; Scorgie, 1997). The European Renaissance provides early examples of modern forms of management, and not only in relation to the 'old' issue of the development of double-entry bookkeeping – as in, for instance, the Sombart/Yamey controversy. There is much more in the Venetian archives in terms of a sophisticated conversation about running the Arsenal: a precise debate on the *discorso del maneggio*, as Drachio puts it in 1586.[1] Indeed, this includes the establishment of important elements of the factory system well before what is normally assumed (Safley and Rosenband, 1993).[2]

In this sense, our research contributes to a broader debate about the rise of capitalism in the preindustrial world (for example, Gelderblom and Trivellato, 2018), with a particular emphasis on the establishment of early examples of the factory system, in other places and before Britain (Hudson, 2002; Berg, 2004, both include a marginal reference to state manufacturing, and shipyards in particular). We contend that an important role in developing managerial knowledge is likely to have been developed by state bureaucracies managing at distance and/or in direct manufacturing on a permanent basis (see also Zan and Deng, 2017). This paper examines the extent to which the Ottoman case is similar or different to the innovative aspects of the Venice Arsenal around the time of the Battle of Lepanto.

[1] Very few MBA students have any perception of the etymology of the term management itself, coming from *maneggio*, the Italian verb *maneggiare* – literally 'handling'– which still have a similar meaning in the Spanish terms of *manejo*.

[2] The perspective adopted in this paper is that of management as rhetoric or as discourse (for a discussion see Zan, 2006). While the 'general' historian is interested in major events and decisions, for the management historian it is not just the outcome of the process what matters, but the process itself. If, according to March (1988), management is basically an issue of addressing attention, our view as organizational/management historians is to reconstruct how attention was addressed.

In seeking to answer the general question of how it was possible to build a fleet in such a short period, we pose two research questions. First, was it the result of the innovative invention of organizational solutions as early forms of modern management? Second, to what extent does comparing events on the either side of the Mediterranean Sea confirm managerial and organizational innovation in the *discorso del maneggio* at the Venice Arsenal? Regarding the former, the paper will show that despite the achievement of the important results to rebuilt the fleet at a substantive level, this was *not* the result of the adoption of modern forms of management by the Ottomans. Despite the overall *effectiveness*, from a procedural point of view the logic of the Ottoman shipyards was far from the *efficiency* imperative and the need to invent new forms of organizing. Simply put: too rich, too many resources, too many venues, and too strong time pressure, to invest in a kind of managerial revolution such as the Venetian a few years later. Regarding the latter, the innovative character of what was going to take place inside the Venice Arsenal is corroborated: the triggering effect of Lepanto in calling new invention in the managing of the shipbuilding according to a logic of efficiency and control in Venice as an early example of the factory system, for opposed conditions in terms of abundancy of resources.

The structure of the paper is as follows. Section 2 reports the findings about the emergence of forms of modern management at Venice Arsenal just after the Battle of Lepanto and the reconstruction of the fleet by the Ottomans. Section 3 presents a literature review of the Ottoman shipbuilding up to the period of our focus (the reconstruction that took place in the six months after Lepanto). Section 4 shows methodological aspects of the archival investigation at the basis of this article. Section 5 presents the analysis of archival data. Section 6 discusses the findings and compares elements in shipbuilding with the Venice Arsenal. A few concluding remarks follow.

2. Shipbuilding at the Venice Arsenal and early modern management: a recap

While the lack of attention to what came 'before' the industrial revolution is the subject of recent debate in business history, the management field is even more blind to this issue (indeed, the lack of any sense of historicity in this field deserves investigation on its own: Zan, 2016). There is no mention of the Venice Arsenal at the turn of the 16th century as a crucial example of the development of an early form of modern management, with two exceptions. George (1972) focuses on the history of management thought and provides a chapter on 'Management during the mediaeval period', with a long summary of Lane's research about the Venice Arsenal (pp. 35–40). Pelton et. al (2018) explicitly refer to this contribution, but mention neither the Arsenal nor Lane, despite the wonderful title of their book.

In this section we sum up some of the important findings in accounting, management, business and economic history about the Venice Arsenal. The literature on the history of Venice is a vast body of work. However, in terms of the economic history of Venetian shipbuilding, Lane (1945, 1973)[3] emerges as an important scholar, with earlier contributions by Forsellini (1930: in it see the telling title) and Romano (1954/68). Some more recent contributions shed further light on shipbuilding activity and its urban architectural context (especially Concina, 1984; see also Davis, 1991).

These contributions include several important details. First, they trace the history of the Arsenal from its establishment around 1150 as a maintenance area and depot, to the opening of new parts (the New Arsenal in 1325–26 and the Newest Arsenal in 1473 as part of a never-ending process of the transformation of the site). As its functions transformed, it focused on building galleys, and later specialized in, and came to hold a monopoly on, the production of war ships, mostly galleys.

Referred to as the *officina de'e meravegie* (workshop of wonders). it was one of the biggest work sites in the world at the time. It drew on an elite cadre of permanent professionals and employed thousands of workers (2,000–3,000) in a rather structured production process. Indeed, Venetian historiography stumbles on intriguing issues of organizational transformation that can be seen the end of the 16th century. Precise references to organizational innovation during this period can be found in the work of Drachio and Tadini (which Lane misspells as 'Taduri') respectively in 1586 and 1596, and 1593 and 1594. Unfortunately, however, historians largely disagree about the interpretation of similar innovations in Venice. Lane (1973) sees it as 'the' invention of modern management; which Concina argues that the

[3] For more on the contributions of Lane, see also Bullard et al. (2004).

ongoing disorganization of the Arsenal shows a lack of capability in dealing with management and production problems ("administrative capabilities seem to be lacking": Concina, 1987, p. 175).

A management or accounting historian with a more in-depth understanding of the cognitive aspects of decision-making processes, and with less superficial views of organizational change, would arrive at less simplistic interpretations, based on in-depth archival research.[4] First, from an institutional point of view, the Arsenal was a hybrid organization. While it provides a very precise example of the establishment of 'modern organization' with internalized labor transactions (the Arsenal hired and paid artisans, rather than buying the products of their labor, within a 'hierarchy' instead of a 'market' context, to use the transaction cost vocabulary). this still does not mean getting control over workers and the residual impacts of the guild system. More specifically, one of the critical issues is the gap between workers being 'enrolled' and 'present'. People had the right to go to work and get paid when they did so; but the Arsenal's officers did not discipline their presence. A lot of discussion in the archival documents of the period is exactly how to reduce this gap, sometimes using explicitly incentive-based mechanisms and rewards (see Drachio's and Tadini's documents).

Second, the impacts of the Battle of Lepanto in terms of organizing need to be addressed. The battle had a huge impact in its immediate aftermath, but historians often do not consider it to be particularly important. Seen from the Venetian point of view (and archives). despite the fact the Venetians confiscated and destroyed the Ottoman fleet during the battle, it was a largely useless victory: a few months later, the Ottomans showed up with a new fleet. Two years later (1573). the Venetians were even forced to pay war indemnity to the Ottomans (Ari, 2019: pp. 140–142). From the perspective of management/organizing history, however, we see the Battle of Lepanto battle in 1571 as a crucial triggering event, with long-term consequences for production, organizational approaches and accounting. Venetians were shocked when they realized the Ottomans' 'production capacity' allowed them to build a new fleet in a few months: they became obsessed with the decision to build a reserve of galleys to be ready in case of war, including 100 light galleys and 12 large ones.[5] This put serious pressure on ship production in Venice, ushering in a century defined by "the rise and fall of the 100 galleys" (Zan, 2004). Without fully understanding the consequences of the decision, they opted for a 'production on stock regime' – to use current management jargon – without fully grasping the cognitive and organizational challenges of producing 100 ships in parallel, with the booming complexity that it eventually caused, and with the search for new solutions to the challenges it allowed/caused (Zan, 2005).

In fact, the 100 + 12 ships goal was difficult to achieve. Trying to control this strategic military project, the Senate of the Republic decreed in 1580 that there would be periodic reports on the situation concerning the 100 galleys reserve (for a detailed reconstruction on these aspects see Zan, 2004; Zan et al., 2006; Zambon and Zan, 2007).[6] Indeed, recent research on the management of the Venice Arsenal has shown that Drachio's and Tadini's documents were not exceptional insights into the operational conditions of the Arsenals, but rather, were part of a systematic and periodic *stream of reports* that the Senate had imposed, mainly concerned with the completion on the 100-galley reserve. In discussing the issue of 100-galley reserve, though, much more emerged. These reports describe the establishment of a conversation about managing issues, a *discorso del maneggio*, as it was called by Drachio 1586, wherein organizational and accounting innovations were taking place, including the establishment/invention of notions such as

[4] The archival research on the Venice Shipyard was done between 1994 and 2006. Just to sum up, two main sources were used. First, a screening of any deliberation concerning the Arsenal between 1545 and 1594 (more than 2500 entries for the period 1570-95). This allowed us to reconstruct from a substantive point of view any decision concerning material, staff, money regarding the Arsenal, and thus to provide a quantitative picture of changes across a 50 years period (Zambon and Zan, 2007). But also, it allowed us to discovery on a qualitative level major regulations and changes regarding the Arsenal. Most important, we discover a regulation that was prescribing to the people in charge of the Arsenal to give account of the work done at the end of their mandate, with a particular reference to the achievement of the 100 + 12 galley target (A.S.Ve, *Senato*, *Deliberazioni Mar*, reg. 47, cc. 215r–216v). We then discover a flow of documents of this kind, 31 in total from 1590 up to 1781, as opposed to the two couples of documents discussed in the literature as Drachio 1586 and 1596, and Tadini/Taduri 1593 and 1594 (see Lane, 1934; Concina, 1984; Davis, 1991), allowing us to investigating regularities and changes in the *discorso del maneggio*.

[5] The 100 galleys issue is something incredibly long lasting in the Venice history, with very strange ups and downs, from 1442 to 1577 (see Zan, 2004, p. 153).

[6] In this sense we share the call by Lipartito (2013, p. 702) in looking at "how managers talk about and process the signals from their environment".

cost, work in progress, budgets, the design of work teams and so on: “An example of this is the introduction of a method for measuring ‘work in progress’ in man months. Also, forecasts and expenses relating to consumption materials became current, as did calculations bearing on the workforce. The type of general complaints made during the preceding period gave way to calculative practices of labor needs that were based on technical parameters, in a sense reifying it as a ‘factor’ of production, for instance in terms of calculating the production made possible by the amount of man months available. Criteria were elaborated for reaching decisions on the restructuring of ships and on contracting out. To all of this was added a further new development: the systematic use of concepts and data regarding annual consumption and costs of materials, culminating with the astonishing document by Molin in 1633 … which presented the cost of manufacturing extra-large and light galleys. In substantive terms, comments about consumption of material and waste of working time can be found ... A more aware discourse on resources of the Arsenal makes it possible to question of feasibility of the 100 galleys goal, autonomously self-reducing the goal to 50” (Zan, 2005, p. 475).

It should be noted, avoiding any simplistic conclusion, that the establishment of a rather sophisticated discourse about managing does not imply *per se* solving the problems in managing.[7] What is surely intriguing in the Arsenal context is how such a development of an in-depth awareness of managing issue is coupled with persisting problems, which can be found throughout the reports following the Drachio’s one. This fact probably explains the negative attitude by Concina toward the over positive position by Lane: however, talks and actions can differ, as a huge literature on strategic change has clearly underlined (see for all Mintzberg, 1994).

In short, the Venice Arsenal at the turn of the 16th century, and due to the consequences of Lepanto, appears as a crucial discontinuity in the history of management as a body of knowledge – particularly in terms of management and accounting discourse – which tends to be overlooked for its impacts on organizing innovations by historiographies on both sides of the Mediterranean Sea.[8] More than a specific and local meaning, this also allows for an important generalization compared with conventional views in business and economic history. What the Venice Arsenal suggests is that the evolution of management knowledge – of modern forms of management– seems to have taken place: before (toward the turn of the 16th century); elsewhere (not in private business in the UK, but in the context of permanent production inside state manufactures, certainly in Venice, but probably in other bureaucracies as well); for reasons that are not related to the economic imperatives of maximizing profit, or economies of scale, or competition, as usually alleged: rather, the reference is to the *common goods* of the Republic (Zan, 2004, p. 165).

3. Shipbuilding in the Ottomans: insights from the Ottoman literature

Our two research questions help positioning the paper within the current literature about Ottoman shipbuilding. One problem, however, is that most of the contributions focused on shipbuilding relate to the situation a century or more after our period of interest, with a few examining previous periods. For instance, Çizakça (1981) studies ship construction at the Istanbul Arsenal in 1529 and 1645, mainly looking at labor costs. It is an interesting research, however taking two points in time makes it difficult to interpret the transformations that occurred during the 120 years between the two dates.

Bostan (1992) provides extensive research on the Istanbul Arsenal. While the analysis of workforce, raw materials and production data are of great interest in general, most of his sources refer to the mid-17th century. Mantran (1987) and Fabris (2015) also focus on the 17th century. Toraman et al. (2010) introduce interesting details from an accounting point of view, but again focused on the 17th century: moreover, their focus is on the main transformation of empirical shipyard following (caused by) the Lepanto’s defeat, with no reference to the situation before it. Aydin (2011) studies an even more removed

[7] Drachio explicitly underlines the lack of what he sees as a crucial question in managing the Arsenal, i.e., the measure of actual outcome in terms of ships produced. “To this question the foreman of carpenters would answer he doesn't know'” (Drachio, 1586, ASVe).

[8] According to Zambon and Zan (2007, p. 121), “the very notion of cost seems to some extent ‘emerge’ … as a sort of accidental by-product of the Senate effort aimed at introducing tighter forms of control on, and responsibility for, the Arsenal”.

context: the transition from the production of galleys to galleons in the 18th century. Zorlu (2014) and Sefer (2008) focus on late 18th and early 19th century, as does Bostan (2006).

There are other contributions in the literature for earlier periods, which take a broader perspective on Ottoman history. These, however, tend to pay less attention to shipbuilding, and focus more on naval and military history. This is the case for Imber (1996). for example, which provides interesting insights on the functioning of the Ottoman fleet, and Imber (2002). with just one chapter focusing on 'the fleet' in a broader study of the Ottoman power. Here the general focus of the study does not allow for a detailed analysis of shipbuilding in various periods with adequate finetuning.

Thus, we can identify three gaps in the literature. The first is the lack of attention to discontinuities in the organization of Ottoman shipbuilding around (and possibly caused by) the Battle of Lepanto. Indeed, as seen in the previous section, Lepanto deeply affected the management of the Venice Arsenal. The extent to which this happened to the Ottomans is a crucial point in our research.[9]

The second gap is the lack of a specific management studies (or organizational) perspective, which makes the literature less relevant than for other research contexts (and other research questions) or periods, more interested in the possible contribution to economic, business and organizational debate. Perhaps the closest contribution to our research is the paper by Imber (1996). one of the few researchers focusing on the reconstruction of Ottoman navy after the Battle of Lepanto. His article provides information on political events and discussions in the Sublime Porte, while providing details about construction sites, including the number of ships constructed and the general amount of raw materials, equipment and war materials used for reconstruction of ships. However, Imber looks at the fleet reconstruction as a chapter in political and military history. We examine the same data with a different lens, looking at the fleet reconstruction as an event in the history of organizing, using the lenses of organizational and management research (starting from a notion of bounded rationality, which no maritime historian adopts).

The third gap concerns a methodological difference in relation to archival sources. Imber (1996) selects certain series of important documents that give an overall perspective on the reconstruction of the navy. While providing important evidence, the article does not provide a systematic analysis of all archival materials on the matter in a chronological order: which is what our paper does.

Even if adequate archival evidence is missing – adequate to the research questions we address – some important elements of Ottoman shipbuilding literature can be nonetheless acknowledged to provide a description of the context. At a general level, compared with the Venetians, the Ottomans were relative newcomers to the business of shipbuilding. But from the mid-16th century onwards, the Ottoman Empire increasingly required fleets for their troops to cross the Dardanelles (Imber, 2002, p. 295; Bostan, 2007, p. 1, 12; Inalcik, 1977, p. 85; İnalcik, 1985, p. 180). Given that the Byzantine Empire did not have a navy, the Genoese and Venetians dominated the Levant for a long while, along with the Aegean, Dardanelles, Marmara Sea and Black Sea trade through the Bosporus. However, after the conquest of Istanbul and gaining control of Suez, Ottoman naval and land forces totally controlled the Levant region. The Ottoman Empire then required not merely small accompanying fleets, but huge numbers of ships to control the Mediterranean.

In terms of *technologies*, in the second half of the 16th century inside the Mediterranean Sea, warships meant galleys, and galley production was "mature" technology at that time.[10] What makes a difference, though, is the locations of production. Throughout 15th and 16th centuries, Ottoman ship construction venues varied. Shipyards were first established at Gallipoli at the end of the 14th century, and the effort soon involved several other locations: Istanbul just after the conquest in 1453, then Izmit, Sinop, Suez and Basra (Imber, 2002, p. 302; Bostan, 2007, pp. 9-11). We have limited number of registers from this period to evaluate the Ottoman arsenals in terms of management, labor force, costs and capabilities. Numbers defining the production characteristics of these sites are not easy to find, and of course could

[9] Countless papers on the Battle of Lepanto itself are available. But this is out of the scope of our research questions. Balli (2004) provides references for a few original documents on ship construction in his appendix.

[10] In the rest of the world, new ship technologies and ship formats were already being deployed: it is only the specific features of the Mediterranean context, and the state monopoly on warship construction, that explain the survival of these technologies that were already obsolete elsewhere (Wilson, 1976, p. 132).

change dramatically over time, but the impression is that of a rather modest scale, at least in the earlier period. For instance, Gallipoli had a capacity of 40 galleys, with another 30 under construction after 1522.

In terms of *labor* in early periods, Gallipoli shipyards employed 81 men, including some temporary employees (Imber, 2002, p. 301; Inalcik, 2002; see also Bostan, 2017). In Istanbul, despite having 123 docks in 1557, the number of permanent employees was rather small, around 90 (Imber, 2002: 301; the data is confirmed by Bostan, 2007, p. 5, referring to 84–89 people between 1527 and 1531, and 838 in 1604; recently, Bostan, 2017 refers to 2,279 employees in 1550). Here we find a different phenomenon compared with Venice and the challenge to reduce the gap between workers being 'enrolled' and 'present': the Ottomans seem to quite deliberately use a small number of permanent posts that are supplemented with an additional workforce when needed (Imber, p. 301). Important details are also provided by Toraman et al (2010, p. 202) in this regard, despite their focus on the following period: "when shipyards expanded suddenly, masters initially working in small shipyards (boat construction loots) of private sector on sea shores of various regions of the Empire were drafted to state shipyards"; it is only later "that these masters were … raised within master apprentice relations in these shipyards."[11] That the early 17th century was an extraordinary period of huge efforts is also provided by workers number provided by Bostan (1992, p.50) from 1601 (3.524) to 1695 (821). a great part of which is military personnel.

In terms of *shipbuilding materials*, a distinction was made between raw materials and intermediate, or semi-manufactured products, also called "equipment" (Toraman et al, 2010, p. 200). What is interesting to note from our point of view is the listing of equipment, including oars, anchors, which in the Venice context would be the result of internal production rather than procurement. In other words, the lower degree of vertical integration of the Ottoman's shipyards is here involved.

Resources were certainly abundant in the Empire (Imber, 2002, p. 302). But what is striking in comparison with the situation in Venice is again the involvement of a widespread number of sites where ships materials were prepared, starting from wood, to be cut and shaped, and then transferred to the nearest port and sent to one of the shipyards. Not only were these operations performed 'outside' the boundary of the main shipyards, but, in financial terms, costs were also managed outside the shipyard system, in the villages where wood was cut, with either tax exemptions or (generally) daily pay at the local level. For other materials, "[t]he organization of the work had some resemblance to timber felling, with the local judge or a commissioner from Istanbul allocating work between villages and overseeing production" (Imber: 303). Similarly, rope was spun locally before being dispatched to shipyards.

In terms of *finance*, what makes research difficult is that solutions about raw materials, equipment and wages differed according to the situation, distance to the arsenal, and type of the material, so it is difficult to identify a general rule (and any changes to it). For instance, before the Battle of Lepanto, in forested coastal areas, villagers were expected to cut a certain amount of timber for the main Arsenals of Istanbul, Gallipoli, Nicomedia (İzmit) and Sinop, in return for tax exemptions. Bostan (1992, pp. 14–24) gives detailed figures on the procurement and financing systems for these materials. Additional detailed information about the annual budget and expenditure of the Imperial Arsenal is also available for later periods. According to a manuscript written in mid-17th century by Hezarfen Hüseyin, a member of an Ottoman Chancery and an Ottoman intellectual, the annual budget of the Imperial Arsenal – not including the amount needed to pay rowers, and tax exemptions in return for cutting timber (*ocaklık*) – was about 24.5 million aspers (*akche*), approximately 80,000–100,000 Ottoman gold pieces or venetian ducats (Hezarfen, 1998, pp. 162–169). This was allocated yearly from the central budget. The degree to which this was similar to budgets in the previous century is an open question.

At a general level, Ottomans' shipbuilding was embedded in overall state activity: "the provisioning policies of the state ensured the unremitting supply of these [shipbuilding] materials through the system of *ocaklık,* which required that the tax-paying population of a given judicial district (*kadılık*) is to fulfil their tax obligations by way of supplying resource materials to the state … The collection of the *ocaklık* obligations as well as extraordinary taxes took place by the hands of the financial officials who were dispatched from the

[11] These authors also developed an in-depth analysis of the organizational structure, including cadres were later provided by the Imperial Shypyard and the administrative staff by the central state, which is however out of the period of investigation in our paper.

center and collaborated with the provincial authorities (*sancakbeyi* and *kadi*). They realized the procurement of the demanded materials at the point of production" (Ozveren and Yildirim, 2006, pp. 5–6).

In short, what emerges is a very 'extensive' use of both shipyards and material production sites, as opposed to the 'intensive' approach at the Venice Arsenal, where everything was built and accounted for on site. "Venetians were more constrained by the scarcity of their resources than the Ottomans with a vast territory were … it seems to us that a further consequence of pending resource scarcity in Venice had been to strengthen the vertical, highly centralized and all-encompassing organization of the Arsenal in accordance with the principles of strategic storage of supplies, economizing logic and the subsequent obsession with quality control. In contrast, the Ottoman *Tersane* could afford a more flexible organization of production in conformity with the relative ease with which resources could be tapped" (Ozveren and Yildirim, 2006, p. 15).

There is little reference in the literature to the role of the private sector, because the state had a monopoly on warships: galley construction was not open to the private sector. In fact, the private sector and the market were quite marginal in that period. The only indirect reference in the literature is to the purchasing of raw or intermediate materials. Raw materials were largely provided from the extensive resources of the Empire (for example, timber). and by local administrators in return for tax exemptions (Imber, 1996, p. 96; Bostan 1992, pp. 102–3). In periods of high need, additional materials could be purchased on the market (Hezarfen, 1998, p. 162). In any case, it seems that the private sector played a major role than in the Venice context, given the relatively lower degree of vertical integration also before the 17th century reforms.

After the Lepanto defeat, the Ottomans undertook unprecedented efforts in ship construction. To complete the fleet in such a short time, all previous ship constructing centers were activated, in forms that had not been seen before, and which drew on the abundance of resources, while building galleys simultaneously in many places outside the Istanbul Arsenal (Imber, 1996, pp. 85–101). Four main sites were involved: Istanbul, Gallipoli, Izmit and Sinop. "To build the new fleet, the government had to assemble a vast labor force and huge quantities of shipbuilding materials within a few weeks. As Sokollu realized, the Empire was deficient in none of these things: the richness of its material resources was one of its greatest strengths" (Imber, 1996, p. 90). Timber, iron foundry, oakum and pitch, ail-cloth and awnings: none presented a great problem, according to Imber (1996, p. 92). The problems lay in acquiring skilled masters and sufficient eligible workers, especially given the emergency situation and the mobilization of many historical and inactive Arsenals. This meant that masters were transferred to different places, voluntarily or by state order.

Imber provides two further important details. First, the ordinary chain of command of the state was used: "As was customary, the central government issued orders to the *kadis* in the appropriate places, to collect the materials necessary for the ships … The same *kadis* were to send pitch, hemp and other equipment as required and, since the needs of wartime were urgent, they were to purchase for cash any naval materials and equipment in private hands, even from those who claimed exemption from state levies" (Imber, 1996, p. 95). Second, "The government's problems did not end with the construction of the new fleet. To levy a new fighting force was a task perhaps equally difficult, especially after a humiliating defeat when available troops had been decimated and morale was low" (1996, p. 96, and extensively up to p. 101). The implications are that for the Ottoman Empire, and for historians as well, the issue of shipbuilding is subordinated and under-problematized in the context of the overall war efforts of the extraordinary (military) crisis.

4. Methodology: the nature of archival sources

This article is based on extensive archival work done at the Ottoman archive in Istanbul. This involved a complex effort of archival retrieval, transliteration and translation of the documents, before analyzing their content. The original documents were written in Turkish, with Arabic script. They needed to be transliterated into Latin script, then translated from Turkish into English language, within a complex process, before being coded and analyzed.

While most of these aspects are common to archival research, what is peculiar with the Ottoman document is a serious question of archival retrieval and ordering. There are hundreds of documents

available in the Ottoman archives regarding the whole campaign over Cyprus and the emergency measures to recover the naval vessels lost at Lepanto. We had to put the documents in chronological order from the second phase of the expedition to Cyprus onwards.[12]

The documents used include decrees by the Sultan – *firmans,* imperial mandates or decrees issued by the imperial *Divan*. The Ottoman archival system contains registers with copies of each document. The orders are the result of decisions made by the Imperial Chancery, which comprised the Grand Vizier, other viziers, the Finance Minister and two senior *kadis* (judges). The Sultan did not attend the meetings personally, but all decrees/firmans were written in the name ('from the mouth') of the Sultan. These documents comprise 266 volumes between the years 1554–1905 (111 volumes up to the end of the 17th century, which are called *Mühimme Defteri*, Register of Important Issues).[13] Documents for the previous dates are missing. Some volumes are available and kept under the name of *Ahkam Defterleri.*

We selected the documents from among the *Mühimme Defteri* pertaining to 1571–72; we only used documents regarding naval affairs and ship construction, from the many available volumes.

One of the most difficult issues is that individual documents do not follow a chronological order. We undertook to put the relevant documents in order, to reconstruct the development over time of decisions made by the *Divan* (Ottoman Chancery). To facilitate future studies, the volume of the register, page and document numbers are associated with each document (we are considering the possibility of making this material available in the future in some form). The dates are also converted from Hijri /lunar calendar to Gregorian dates. Through this method, the reader can easily follow the developments of both parties – Ottoman Empire and the Holy League. These selected archival documents provide rich information about the decisions of the Ottoman government to rebuild the navy, in terms of organizational management. This includes information about the newly revived shipyards, the function of the Imperial Arsenal in Istanbul, sources of raw materials, production processes and the combination of naval utilities.

The final step was coding, structuring the meaning of the information in each document, and the meaning of various archival sources in different classes (see the next section).

The archival documents are mostly the decisions about the emergency measures of the Ottoman government for the construction of a new fleet. The government (from the mouth of the Sultan) sent decrees to all possible locations to cut timber, prepare or produce raw materials and construct ships. Where materials were far away, decrees were sent to collect them together. The process of construction was followed up by the viceroys, governors or the kadis/judges, as well as the imperial officers at the imperial court. Sometimes documents concern the provision of workers and crew (mainly rowers and warriors).

The content of the documents has another important aspect. Although letters from local authorities replying to or requesting something from the government are missing or difficult to find in the archives, they can be detected in the *Mühimme* registers. When the Sultan gave orders to local authorities, letters from those authorities are summarized in the introductory chapter. This gives us valuable information about the replies to former requests or excuses. In this manner, the sequence of the progress of each step can be followed from this series of documents.

The paper analyzes nine different kinds of imperial *firmans* that we collected from the period (446). starting from July 1571. We started our analysis a few months before the Lepanto defeat to understand the normal content of these kinds of documents, and we end with March 1572, with a decree announcing the substantial achievement of the goal, while calling for further efforts in setting up the ships for war: "With God's help, a huge navy would sail in the spring. The voluntary captains in your dominions should be ready with their ships" (MD.16, 145/285).

5. An outstanding organizational effort: building a fleet in six months

[12] The relevant documents were detected from different register books. Since copies of each original document were registered into Chancery books, they were not in chronological order. Thus, decrees relating to the Arsenal were among many others on several issues within those register books.

[13] Since 17 volumes were discovered much later, they are classified as 'appendices of Muhimme registers' which include the dates between 1572–1746 (980–1159).

Based on the search, structuring and reading of the archival documents, this section provides a reconstruction of the events through the lens of the organizing perspective, in four main sections: first, a short focus on the months before the Battle of Lepanto; second, the long day of decisions following acknowledgment of the defeat; third, the six months that followed, with various streams of issues that arose, including venues and goals for ship production; and fourth, a focus on the overall picture within a decision-making perspective.

5.1 From victory (Famagusta) to defeat (Lepanto): a shocking turn

On August 1, 1571, Famagusta, the last resisting fortress on the island of Cyprus, fell after a year-long siege. The intentions of the Holy League navy following this event, though, were hard to predict. The Ottoman government was sure there would be an assault on one of its major locations. Thus, the Ottoman navy was ordered to sail to the western shores, to follow the Holy League navy. From 23 September to 24 October 1571, a series of orders from Ottoman Court sent directives to the navy, and the commanders of the fortresses, to confront the enemy and to destroy it where and when possible. We found seven of this kind of deliberation in the archives, up to October 13.

Following a period of silence for almost 10 days, on October 24, 1571, the Sultan and the Sublime Porte learned of the heavy defeat at Lepanto (which had actually happened on October 7): only a portion of the navy, the fleet commanded by Ouliccia/Kılıç Ali Pasha, was saved; the major part either sank or was captured by the Holy League navy.

Our analysis first focuses on that crucial day, October 24, where first decisions appeared, providing a general imprinting of the following process. Second, we classify the various documents according to their nature, identifying nine categories, and reconstructing the dynamics of the decision-making process; finally, we will comment on some specific elements characterizing the whole set of data.

5.2 A day of dramatic decisions

The same day that the Lepanto defeat was acknowledged (or explicitly referred to, see below). the Ottoman government immediately decided to rebuild the whole navy for the next season: “The imperial navy should be ready in the next spring for an extensive naval war” (MD 16 69/141; see also Balli, 2004). If not, every settlement on the Ottoman shores, from the Adriatic to the Aegean, from Algeria to the Eastern Mediterranean, would have been open to naval attacks. The Ottoman government would be unable even to defend its towns and cities with land forces, because there was no navy to transfer troops and military equipment.

What is interesting from an organizational point of view is the set of several important decisions made in that day, with impacts during the following period (see Table 1 for a short summary).

Table 1

We know the goal of having a new fleet within six months was achieved – but how it was done so is what interests us. It was a huge effort, indeed, with 100 galleys eventually emerging from the decisions made on this very first day. This magic number, which was already around in the Venice Arsenal from the mid 1540s (see section 2) was also later taken into account by the Venetians after Lepanto, as noted before (see Zan, 2004 for details).

Most importantly, and radically different compared with their enemies, the Ottomans decided from the very beginning to use a number of sites: 50 galleys would be built in the Asian side, and 50 on the European side, extensively using their shipyards: “Previous decree was to construct 50 ships at Asian and 50 ships at European side” (MD16 78/156).

In parallel with this main decision, other specific orders to build are included in Table 1, concerning supervision responsibility: “You should also spend all efforts to complete the construction of new ships and repair of old ships” (MD. 16 63/131). or “15 ships should be constructed at Sinop, and Mehmed Chavush would be responsible for the issue” (MD. 16 68/140). The predisposition of cannons according to the need of the new fleet is mentioned: “The navy is in need of casting cannon balls for 100 pieces of galleys at the weight of 11 *vukiyye* (14 kg). You should attain copper, pine timber and other necessary material to cast those cannon balls” (MD.16, 75/151). Other orders concern measures for information gathering about

available materials at different sites, asking to define what is missing for the general goal of producing 100 galleys: "You should report the amount of existing nails at the depots, and immediately send the amount necessary for 100 ships to the relevant points' (MD.16, 78/156), and the same with anchors. [14]

There are two main questions here from a decision-making point of view. The first is hard to answer, and is perhaps a research question for the future. When did the Ottomans really get the news of the defeat? On October 24, we have the first record of a written document referring to it, with huge decisions already established (see Table 1). We would love to be able to understand how long it took them to 'think' and react to the dramatic bad news of the loss of the fleet. Decisions are not acts; they are processes, and it normally takes a while to make them, particularly in a complex context (and in war as well: see the seminal work by Allison, 1972, on the Cuban missile crisis of 1962).

The second question concerns the dynamics: here, some insights on the flow of decisions can be developed based on our database.

5.3 The flow of decisions over six months

The documents present a variety of aspects summarized and commented upon here according to our coding (see Table 2; Table 3 provides a selection of most relevant quotations, as example of the coding process). Note that all kinds of decisions about shipbuilding and fleet setting are made here, at the very top level of the state, with detailed instructions for procurement of timber and other materials; sometimes the same order is reiterated at a later stage.

Table 2

Table 3

1. The first group of orders comprise imperial firmans to the commanders of the coastal fortresses. These relate to more general issues of military intelligence and decisions; they often do not directly address shipbuilding, yet provide context. Since there was no Ottoman navy anymore, the fortresses were in great danger. The commanders were ordered to make up for any lack of war materials, including gunpowder, weapons and troops, in order to defend themselves. They should not expect any naval assistance for the time being. Until the springtime, all coastal areas would face the danger of a possible enemy attack. Women and children in these areas should be sent to mountainous places. If the walls of the cities and towns needed any repair, they should be strengthened immediately. The sea should be surveilled day and night for the movement of enemy ships. In case of any attack, they should defend themselves by collecting additional manpower from surrounding villages and towns. If any enemy ships or fleets are observed, a message should be sent to the government immediately. Although there would be no naval support, they could seek military aid from troops in surrounding areas, but this might not be possible during winter (e.g., MD 18 88/192 in Table 3).
2. The second group of imperial firmans on 24 October calls for information about raw material in the arsenals. In the beginning, this is in relation to existing material. It included an inventory of timber stocks in the surrounding areas. The Sultan wanted to know if it was possible to construct a huge number of galleys. The government was aware of the existence of wet timber. Nevertheless, there was no time to wait for attaining dried timber to be used in various arsenals throughout the Ottoman dominions. The government knew that there were old shipyards in locations with abundant pine trees that could be cut and easily transported. These shipyards could be revived to construct ships before winter. However, such information gathering changes its nature over time, referring to materials available for the effort of rebuilding the ships (e.g., MD 16 62/128; MD 10, 107/170 in Table 3).
3. Another group of imperial firmans contains information requests about available naval war vessels. In parallel with the above, at first the concern is for available material. The Ottoman government was aware of the existence of many ships in various places, but many of them were out of use or needed

[14] A central issue of the Battle of Lepanto was the introduction of galleasses by the Venetians. Archival sources show that the Ottomans had known about Venetian galleasses since October 10 (MD.16, 20/34). Moreover, in a document of December 5 (MD.16, 150/296). a reference is made to the previous order to build five galleasses (three in Sinop and two in Istanbul).

thorough repair. The orders at this initial step required immediate information on the number of ships plus their condition. This information was necessary, because the main coordinator at Istanbul would send additional orders according to the general inventory of the ships at the arsenals and the ports along the coast. If there were enough ships to form the future navy, they would be repaired. However, the government already knew that those ships were not in good condition. Thus, they did not join the Cyprus expedition, nor the naval battle at Lepanto. Now the pressure to build a whole fleet was huge. So even the old and wounded vessels would be necessary for the next season. These orders are to get a wide information about the real condition of the remaining ships to put them on the sea as soon as possible. Later, there is information exchange about the availability of vessels under construction (e.g., MD 16 135/263 in Table 3).

4. The most interesting group of firmans for our purposes, however, are about the orders to construct new warships. These orders were sent to the old arsenals on the Ottoman coast that were used as ship construction centers. Many of them were historic arsenals from Roman times. When Constantinople was conquered, they continued as local shipyards. They were near forests so it was easy to attain timber and other raw materials. Thus, these old shipyards could be easily mobilized for the construction of naval vessels. Orders were sent to such centers on the Black Sea, the Aegean Sea, and the Mediterranean coast. The judges (*kadis*) of these centers were responsible for all kinds of construction activity. The central *kadis* would source carpenters, workers, artisans and manufacturing processes, and if there were problems, the *kadis* had the power to solve them. The *kadis* were sent budget or they would spend from local revenue. All materials would be purchased from local merchants at current prices. No one was pressed to work for free, and nothing would be purchased for free or obtained by force. The orders emphasize that the government had enough budget for the construction of the ships (e.g., MD 16 41/74; MD 16 62/128 in Table 3).
5. The fifth group of orders are about obtaining secondary materials for the ships. Among these are sail cloth, hemp, ropes, iron works, nails, oars and *kalafati*. These kinds of materials requested to be produced in due time by the local artisans and villagers. Their production should be completed quickly, so they would be ready when the ships put to sea. Merchants were ordered not to sell these naval materials to other parties and trading these materials to foreigners, and especially to the enemy, was strictly forbidden. The local *kadis* were responsible for purchasing these materials. Only after the local Arsenal had been supplied could other people buy them. These materials were to be purchased by the local authorities at current prices. Local subjects and peasants would not be pressed to deliver them by force (e.g., MD 16 135/263 in Table 3).
6. The sixth group of archival material is about manpower, and the acquisition and activities concerning various kinds of workers: *kalafati*, hemp workers etc. (e.g., MD 16 53/105 in Table 3).
7. The seventh group of archival material is about the recruitment of warriors and rowers for the ships. Thousands of the slave *forsas* (rowers) had been captured and enfranchised from the ships by the Holy Alliance, so there were almost no rowers for the nearly 200 new ships. Also, since many warriors had been killed, the navy needed new ones. Thousands of crews at all level were to be collected from the countryside and recruited by the navy. Rowers would be collected from among the subjects, and were to be paid wages. In addition, serious criminals would be chained and sent from all over the Ottoman dominions to be recruited by the navy as rowers (e.g., MD 16 311/550 in Table 3).
8. The eighth group of archival material refers to the production of biscuits for the crew. On the sea, no fresh food is available, so the crew needed biscuits at the ships' depots. Therefore, the production of adequate biscuits was very important.
9. The last group of sources refers to administrative and financial details. These records are not numerous, and indeed have only marginal meaning compared with the huge financial effort of the whole reconstruction. This is something we will come back to (e.g., MD 18b 103/2229; MD 18 38/72 in Table 3).

Table 4

Fig 1

Based on this coding, a count of different classes of decisions is provided in Table 4 (multiple coding is possible). In addition, Figure 1 represents the mapping of different shipyards that were involved in the reconstruction of the fleet in the six months following Lepanto defeat.

All in all, the Ottomans were effective in achieving the ambitious attempt to rebuild the fleet in a short period. One very specific element in this process is the use of a variety of large and small shipyard sites: around 20 shipyards in the country, with a goal of 10–20 galleys maximum for the biggest ones (Sinop, Yeniada, Varna, Kemer, Antalya and Gallipoli). yet involving a variety of small shipyards with a goal of a few units each (Ahyolu, Suzebolu, Vize, Midye, Trabzon, Çay, Amasra, Kefken, Samsun, Biga, Bartın, Kandıra, Yalova, Kefe, and İzmit).

On this very crucial aspect, our data totally corroborate the interpretation already provided by Imber (1996). And from this point of view, that would be enough for a scholar interested in the substantial elements of the dynamic of Ottoman history in the period. However, from the organizational perspective, some additional comments are in order.

5.4 Insights from a decision-making perspective

Management is an issue of addressing attention (March, 1988): making sense of problems, setting priorities and structuring time and action. The set of decisions in Table 4 opens the way to some interesting comments. From an organizational point of view, some elements in the dynamic of the overall decision-making process can be highlighted:

- A huge number of activities took place in October, soon after news of the defeat. Many decisions had been made already on October 24 (21). followed by another 23 in the last days of October (for a total of 44 for the whole month).
- While November seems a 'quiet' month, with only 18 decisions (with six on the crucial issue of ship production). December is a crucial month, with 93 orders (21 regarding ship production).
- January was quite active (49 orders, but we cannot split five orders between December and January for archival issues). February again is a very intensive month: 119 orders (18 regarding ship construction, sometimes as reiteration of previous orders).
- March is the month of completion, with 59 orders (just a few, four, regarding construction, as reiteration of previous orders).

In short, the situation can be described as follows, identifying three main phases in the period:

Phase 1 (October and November): the starting the process, with major decisions in terms of ship construction, and a sustained activity of information gathering about existing material (surviving ships and raw material). and with an ongoing activity of military intelligence.

Phase 2 (December and January): most of the decisions about ship building are done, with a sustained activity of information monitoring regarding the production process (with a particular emphasis on raw material). ongoing military intelligence, and a new set of decisions regarding the crew of future ships (both rowers and warriors).

Phase 3 (February and March): the months of completion. It seems that the construction of the fleet is almost completed during March, though a huge number of orders about material provision and above all crew preparation are reiterated, while military intelligence continues.

In terms of major concerns and priorities emerging from data, some aspects are particularly interesting in terms of decision-making processes, and in comparison with the Venice Arsenal:

- Only a few of the orders (76 out of 446) are directly related to ship building, and over time, there is a shifting of priorities (from shipbuilding to others). In terms of composition, the constant presence of military orders of different kinds (surveillance, prepare for attack, etc.) shows the double nature of information and orders involved. It is not merely a technical/professional discussion on shipbuilding, but a set of communication within a military context on setting the fleet.
- Relatively few orders refer to workers (36). Moreover, these orders are mainly late ones, once they realized that manpower was a problem, a missing resource. This seems to signal a kind of unanticipated

issue, in a context where the needs of the workforce were not well understood nor foreseen in advance.[15]

- Very little information emerges about money: indeed, class 9 in Table 4 is interesting for what is not there. It contains just minor issues and details, while the overall financial picture of the effort does *not* appear in our database. The financial burden was sourced using normal administrative procedures, and funded by taxes gathered at the local level. It seems that no additional information nor decision was needed. This also emphasizes that shipbuilding was deeply integrated with the whole administrative and military bureaucracy, rather than being a relatively autonomous activity (as is the case with the Venice Arsenal).

Certainly, collecting troops and rowers, and moving thousands of people, seems to have been the most complicated issue, in the context of the decisions the Great Council was involved in. In this context, it is not totally surprising that – on the whole – shipbuilding appears relatively unproblematic, or not in any case the main preoccupation.

However, from an organizational perspective, numbers and details still provide interesting insights on shipbuilding. This opens the door to preliminary comparison with what can be found elsewhere:

- What is involved here is the extensive access to 'the market', buying more of a lot of materials and components including ship timber, different types of wood, sail cloth, hemp, tallow, ropes, iron works, nails, oars, cannons, cannon balls, gunpowder and anchors, and sourcing these from many areas. From this perspective, the Ottoman shipyards not only appear more widespread than the Venetian Arsenal, but also present a lower degree of vertical integration ('buying' more than 'making' a lot of components, according to the current managerial jargon). The recommendation to buy at fair prices is also interesting.
- In this regard, the private sector seems to play in the Ottoman context a more important role compared to Venice: not that much in terms of direct involvement in ship production, but in providing intermediate products and materials that in the Venice case were internalized. Whether or not they were obliged to provide these intermediate products, the documents reiterate several times that market price conditions should be respected.
- Quite surprisingly, from the very first day of decision making, the issue of the 100 galleys was also present in the Ottoman context: it had already been addressed in Istanbul on October 24, the same day of the first reference to the defeat, and later as an issue of the associated need for raw material (see MD.16, 75/151; MD 16 78/156 in the Table 3). Is it simply a coincidence that this was the same number of ships that had been cited in Venice since 1545?
- Reorders (or reiteration of orders) appear after less than two months (MD.10, 265/414). showing very strong pressure by the center on what was going on at the periphery, on the one hand, and the emerging of some problems of 'implementation', to use a current expression, on the other hand. If decisions were already executed unproblematically, no reorder would have been issued.
- Interesting enough, not all orders are so clear and well defined: a few unfinished orders can be found, within a very generic call – a plea more than a clear-cut order – to build as much as possible: 'New ships also should be constructed as possible' (see MD 16 35/65 in Table 3).

6. Discussion

There are two main contributions in the archival research presented in this paper so far. On the one hand, we collected, put in chronological order, transliterated, translated and coded in a systematic way all possible *firman* connected to the reconstruction of the fleet after the defeat at Lepanto. On this basis, we analytically reconstructed the six months after the defeat, looking at kinds of decision, typifying them (with

[15]Archival document (MD.18. 76/162) provides figures on the number of personnel in the Arsenal: in the year 1547, there were 1,800 people, 230 of which were captains, the rest sailors and *komi*s. Later their number reached to 2,652, with 377 of them captains, and the rest sailors and *komi*s. The number of rowers is unclear in the archival documents, but it can be determined according to the total number of warships. Most had 25 rows on both sides, each needing four rowers.

nine codes). and identifying three major phases within the six months, as well as changes in priorities and concerns, while commenting the whole set of data and the overall process.

While these two elements could be of interest to Ottoman scholars, we would like to address the more specific contribution this analysis adds to comparative historical shipbuilding. More explicitly, the organizational perspective used in our analysis could contribute to the development of the literature about shipbuilding in the Ottoman context, further improving research already available, and increasing its visibility with the international literature on protoindustrial economic or business history.

Of course, the specific context has to be clearly understood: the extensive primary sources we are using portrays the decision making at the very top of an empire trying to react to dramatic and potentially disruptive consequences of the defeat at Lepanto. Building ships is just one of the tasks in setting up a fleet: ships need rowers and troops, and captains, to become an operating fleet. And in this regard, the Ottomans were surely effective: they eventually completed the fleet during March, just six months after the defeat.

Nonetheless, important insights on specific features of shipbuilding can be inferred. Our findings largely confirm the reconstruction already available in the literature, particularly the use of a multiplicity of sites (Imber, 1996). However, some elements of chaos to be dealt with in shipbuilding can be identified using an organizational perspective, including:

- the huge effort in 'procurement', getting and transporting material for 'assembly' in many shipyards (the internal production mainly consisting of construction of the ships' hulls);
- relatively little reference to human resources in the archival sources, and only later, when it appeared as a problem;
- examples of poor coordination, such as situations where it is not clear who is doing what, and the direction of information: 10 or 13 ships? 20 or 25 in Sinop? No information about the construction stage? (MD 10 260/405 in the Table 3is particularly insightful about possible organizational difficulties).

Furthermore, the organizational lens opens the door for a comparative analysis with other shipyards, examining the commonalities and differences, helping to understand the variety of solutions that historically took place. In this regard, some more general remarks emerge from the analysis, particularly when comparing the Ottoman efforts with their Venetian counterparts, in terms of organizing following the Battle of Lepanto.

The obsession with producing 100 galleys emerges as a common issue on both sides of the Mediterranean Sea (initially in Venice, used by the Ottomans after Lepanto defeat, then further reinforced by Venetians once they realized the Ottoman fleet had been reconstructed in such a short period of time). Yet it is dealt with differently, mainly in extensive uses of a plurality of sites by the Ottomans (Imber, 1996) as opposed to intensive use of the Venice Arsenal by Venetians (Özveren & Yıldırım, 2006). within a new development of managerial discourse (*discorso del maneggio*: Zan, 2004).

Even acknowledging the specificity of the context – to build up a new fleet and to be ready to use it – and the associated worries that occupied the Ottomans – recruiting crew and warriors, and preparing biscuits in adequate quantity – what is interesting for us is that orders to build ships are not so prevalent, in our database, suggesting a different division of labor (much lower than in Venice). If this again shows the different nature of shipbuilding in the Ottoman context and its embeddedness in the overall military logistics (no information of similar kind would be found in the Venice Arsenal, which specialized in shipbuilding solely). it seems to prove indirectly a kind of 'unproblematic' situation in terms of building ships, and funding them. In other words, the worries seem to have been to have a 'usable' fleet on the sea for war purposes, rather than to simply produce ships on their own.

Also, very little (if any) information emerges in these documents about shipbuilding in itself. Only orders are sent, and sometimes repeated and checked by the center. It seems that knowledge was available locally. An important issue deserving further reflection is that these documents represent a dialogue between non-experts (not shipbuilding officers) directly. This may sound obvious, but one imagines the same dialogue would have been completely different in the Venation context, with a more developed separation between shipbuilding and the management of war issues.[16] In the Ottoman context,

[16] The issue of literacy and skills of officers in Venice has been underlined: "Writing seems to be a 'normal' activity for many of the individuals involved in the Arsenal activity, either professionals or politically appointed figures. As Valleriani (2010) reveals, Galileo

documents and orders are sent by central governors, mainly to judges and *kadis*. The line of authority is formal power, more than professional knowledge.

More explicitly, construction knowledge and skill emerge in this picture as a sort of ghost. There is no reference to them in these documents, yet they exist somewhere, in a sense 'hidden'.[17] We cannot help but notice two additional issues:

- what appears in the documents is a very descriptive talk about physical steps in production (MD.10, 260/405). far from a 'work in process' notion that was going to be 'invented' by the Venetians in a short while (Molin, 1633);
- there are no references to manpower needs or calculations in the beginning, but these emerge later as problems. This is not simply due to a lack of skill at anticipating future labor needs – it is a production issue that is not reflected in the military planning for crews and soldiers, which was better handled.

Extensive use of multiple sites for both ship construction and procurement of material is one element differentiating the Ottomans and the Venetians, and possibly a condition to 'achieve the impossible' (rebuild the fleet in six month). as discussed above. But also, this involves a very different institutional/organizational model: a military regime rather than a modern separate organization devoted to ship production:[18]

- documents refer to orders, often rather crude and harsh orders: if failing, people will be removed/humiliated: 'In this respect, any excuse would not be accepted, and you might be not only fired, but punished severely' (MD 16 341/604);
- workers themselves appear sometime close to constraints: 'if escaping again they will be chained as rowers' (for example, 10.02.1572 Kadi of Ahyolu and two officers). as well as a kind of military regime for carpenters (see MD 18 2/3 in the Table 3);
- whereas the whole event seems to be basically embedded in and involving the 'normal' state bureaucracy (judges). more than specific elements in the shipbuilding affair.

A double non-ordinary process is here involved in the Ottoman context. On one side it is an 'extraordinary' effort in quantitative terms, due to the extraordinary contextual pressure (the consequences of Lepanto defeat). that is, the need to produce such a huge number of ships in a short period. This implies the raising of the production levels of 'ordinary' shipyards (already more widespread than Venice) above their normal level. On the other side, the effort is also extraordinary in qualitative terms, involving temporarily sites (that is, not permanent production) in extensive ways.

Going back to our general research question: how was it possible? Huge pressure and complexity, of course, and a more overarching effort than shipbuilding per se (setting a fleet for war, from timber to biscuits, to rowers and soldiers). In such a context, shipbuilding in itself exploited abundant available resources, knowledge (and possibly people) allowed the fleet the be built using several sites that were widespread and less vertically integrated; the latter element also reflects the use of market and private businesses for what concerns the procurement of intermediate materials. This confirms Imber's (1996) explanation, and provides additional archival evidence. In this sense, our findings further reinforce what was already partially available in the Ottoman literature, about the uses of existing arsenals, re-adopting a very peculiar logic developed in the past, adding the economic organizational lens. Many small arsenals were set up, representing a sort of potential production capacity, 'sleeping' organizations that could be activated when needed, with workers and material, rather than permanent ones. And the re-activation of these

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himself was able to interact with some people inside the Arsenal about issues addressed by Aristotle on the Art of Navigation; and many people were 'writing' in the context of the reports on the Arsenal which are found in the Venice archives, including professionals and technicians" (Zan and Deng, 2017, pp. 537-538).

[17] This is probably also an issue of the nature of these sources: we are looking for some of the reports that are referred in our database, which could involve a more 'technical' and professional discourse. In any case nothing of this kind can be found in the decision making at the very top of the empire.

[18] This corroborates the comments by Imber (1996, p. 199): "The fleet of 1572 was a tribute to the energy and genius of Sokollu Mehmed Pasha who, as Grand Vizier, must have had the largest share in drawing up the many hundreds of commands which his Council issued for the reconstruction of the fleet. He was, however, working within a traditional and clearly defined military system which guided his actions at every stage."

potential sites (in general and confirmed in the reconstruction after Lepanto) seems to have used a variety of different administrative mechanisms rather than a stable or standard organizational method. This meant that approaches to issues such as obtaining workers, producing or buying materials could be adapted according to need.[19] No doubt, such a smart solution can be very effective in the short run, for 'getting things done': the eventual reconstruction of the fleet after Lepanto is the best proof (though it was achieved using very strict and sometimes harsh military control and threats of punishment).

Going back to our first analytical research question (was the reconstruction of the fleet the result of innovative inventions of organizational solutions as early forms of modern management?). what is sure is that nothing similar to what will soon after emerge in Venice in terms of accounting and managerial innovation can be found in the Ottoman context – despite their effectiveness in achieving the goal of such a quick reconstruction of the fleet. Nothing like 'modern management' can be found in the Ottoman context, which highlights the importance of what was achieved at the Venice Arsenal just a few decades later. Moreover, the conditions at Venice, when trying to build (in parallel on the same vertically integrated site) a 'reserve of 100 galleys' were thus not found in this context (in a sense, too rich, too many resources and venues available for triggering a profound conversation on efficiency). In Venice, the causes of the development of rather sophisticated management and control mechanisms in the following years – that is, the drivers of its organizational innovation in the *discorso del maneggio* – were precisely those specific institutional, organizational and financial conditions, and above all the relatively autonomous nature of a *permanent organization*, devoted to shipyard activities. Considering the lack of similar conditions on the Ottoman side, one might expect fewer managerial innovations in this context in the following years. Indeed, quite explicitly, Toraman et al. (2010, p. 191) acknowledge that "the concept of cost is not developed within [this] era".[20]

While decision-making lenses could highlight particular elements in the episode itself, the achievement of the extraordinarily challenging aim of reconstructing a fleet in six months – the crucial focus for Ottoman scholars – does not confirm the existence of early features of modern management conditions in the Ottoman shipyards – which is our focus as accounting/management/business historians. On the contrary, going back to our second analytical research question (to what extent does comparing events on the either side of the Mediterranean Sea confirm managerial and organizational innovation in the *discorso del maneggio* at the Venice Arsenal?). the whole event underlines the indirect triggering effect of Lepanto in the history of management. The innovations at the Venice Arsenal, starting with the 1580 order imposing periodic reports on the effort to build 100 galleys, opened the door to the development of a sophisticated conversation about management. The development of skills and knowledge about managing, rather than just the ability to bring together a large number of workers, is what places the Venice Arsenal (but not the Ottoman shipyards) at the dawn of the modern factory system.

7. CONCLUDING REMARKS

A few concluding remarks are here possible. First, in line with the call for research on preindustrial settings (Gelberblom & Trivellato, 2018). the importance of state manufacturing is confirmed, which calls into question to some extent the late emergence of the factory system.[21] Shipyards in particular seem to be a very good candidate for such a research: in the context of complex production and huge investment, they anticipated several of the innovations in the organization of production and labor that would follow. What makes comparison particularly promising is that facing very similar technical issues, solutions are on the contrary largely idiosyncratic, based on peculiar differences and features at the local level, as we see in this

[19] At the methodological level, this explains the difficulties of applying an organizational perspective in shipbuilding in the Ottoman context: the job of historians becomes difficult, more than studying one single entity in its evolution, you have to follow the dynamics of many intermittent venues, activated with ad hoc solutions in specific context (individual expeditions and wars).

[20] Neither a concept such as w.i.p was therefore developed, which rises a serious doubt about numbers provided in the Ottoman literature about "ships constructed and repaired" in a specific year (e.g., Toraman et al., 2010, pp. 194, 203): without such a concept, inside a multiperiod production, the evaluation of output is indeed problematic.

[21] For instance, the statements by Berg, 1994: "The rise of the factory system was a result [of the Industrial Revolution]" (p. ii); or "the rise of the factory system remains a vital pillar of our industrial revolution" (p. 162).

paper about Venetian and Ottoman shipyards.[22] All of this would have serious impacts in terms of the development of production regimes and the associated managerial challenges, and the emergence of forms of modern management and accounting knowledge. In any case, it is the permanent production and the largely unanticipated consequences of (the military decision) of producing a huge reserve of galleys that triggered the development of a very clear example of early management at the Venice Arsenal, and makes it so different that the Ottoman solutions. The good news for historians is that, because shipyards are often part of state bureaucracy, there are large amounts archival documents: certainly, in the 62 kilometers of shelves at the Venice State Archive, or the 100 million documents in the Ottoman archive in Istanbul; and probably elsewhere, though in different magnitude.

Second, the opportunity to use a micro perspective seems still largely underutilized, calling for more intensive archival research under a management and accounting perspective. The long-lasting life of similar organizations could provide exceptional long-term longitudinal focus, very rarely used, if ever. In the case of Venice, the Arsenal provides scholars with the possibility (and availability of archives) for studying one single organization across 900 years!

Finally, this kind of research would be capable to add new micro foundation insights in one of the most intriguing debates in global history, i.e., the debate on the Great Divergence between East and West. Indeed, already comparing Venice and Istanbul in these pages, we were overcoming to some extent the persistent west centric bias of many historiographic traditions. A more direct tentative in this sense was developed by Zan and Deng (2017). working on shipyards and using a micro focus. But much more can be done in future research.

Economic historians and business historians probably could get to this point with a hidden question: if the Venetians were so good at inventing early forms of modern management, and if these aspects are a crucial part of the invention of the factory system, why were they not among the early industrializers at the turn of the 18th century? There are many elements explaining this. On the one hand, Venetians were and will remain largely a merchant society. While private business will flourish in luxury sectors (silk, lather, jewels, glass: see Ciriacono, 1994). the Arsenal being an exception to the rule in heavy production: in any case, there are not many other examples of Venetian 'state' manufacturing. Moreover, the Republic was ended in 1797 by Napoleon, after a long period of decline which had long term causes in the discovery of the Americas in 1492, after centuries of marginalization in new trade with the new world (Rapp, 1976, refers to a process of relative poverty, i.e., being unable to take part of the new economic developments during the 16th and 17th centuries). And with the 'technological trap' of being in the Adriatic Sea, too far from the ocean, not deep enough, and lacking competitiveness in ship production when war galleys were losing relevance (even getting modern galleons into Venice was problematic).

However, a question for future research can address the *indirect* impacts of Arsenal innovations on the industrial revolution. Was the diffusion of 'Venetian methods' simply to do with double-entry bookkeeping, as normally acknowledged in accounting history (e.g., Gleeson-White, 2012). or was it something more complicated? Are there any diffusion patterns of knowledge about managing (the *discorso del maneggio* and the notion of cost, work in process, budget and similar) that could be traced from Venice?

[22] Indeed, local variety can be even bigger: take for instance the need to have some sort of ship reserve, a common issue in the whole Mediterranean area, dealt with very differently. For instance, while Venice opted for internalizing the production of a reserve of 100 galleys, in the same years Genoa was opting for a much smaller reserve of 14 galleys, which in any case were bought by private shipyards; or again Barcelona seemed to use private ships in case of war, with a complex accounting calculation for compensating the end of the war private owners.

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Table 1: Major decisions on October 24, 1571

Contents (summary)	To whom	Source
Info request about timber available at Arsenal; ordering to buy all kinds of wood eligible for ship construction. Order to construct ships (make all efforts); to repair all available ships; to reativate Anatolia & Rumelia Arsenals, and to list he places where ships can be constructed	Ruler of Vize, Sa'îd kethüdâ	MD.16, 62/128
Reference to the defeat. Ordering intelligence about the enemy manuveur and fortress coverage. Requesiting info about the navy	Viceroy of Algeria	MD.16, 62/129
Order about timber and ships construction and repair	Ruler of Arsenal in Gallipoli	MD.16, 63/131
Alert for enemy attack	Governor, kadi and commander of Rhodes	MD.16, 63/130
Resisting possible attack	Decree to Vezîr Ahmed Paşa	MD.16, 67/139
15 ship to constrcut at Sinop; Money from MoF. Treat people well	To all the Kadis from İnebolu to Trabzon	MD.16, 68/140
Supervising ship construction and material	Agha of Janissaries	MD.16, 69/141
Preparing resistance in case of attack	To all the Kadis at the Coasts of Rumelia and at the Mediterranean	MD.16, 69/142
Prepaere defense of Morea	Viceroy of Rumelia	MD.16, 70/144
Preparing cannon balls casting for 100 galley	Mayor [of Istanbul]	MD.16, 75/151
Send information about existing stuff. Production of compentary material for the 100 ships	Commander of Vize, (Representative) Sa'îd kethüdâ and Secretary of the Arsenal	MD.16, 78/156

Table 2: Coding orders and *firman*
1. orders to the commanders of the coastal fortresses
2. information available raw material
3. information on the available naval war vessels
4. orders of constructing new warships
5. orders concerning secondary materials for the ships (sail clothes, hemp, ropes, iron works, nails, rows orders
6. concerning manpower, and the acquisition and activities concerning various kinds of workers
7. recruitment of warriors and rowers for the ships
8. production of biscuits for the crew
9. administrative and financial issues

Table 3 – Extracts from firmans (selection from firmans quoted in the paper, as example of the coding process)

MD 10, 107/170 [4 Ramazan 979/ 20 January 1571]
"In your letter you mention that the timber of 5 galleys to be constructed in Samsun is ready, and they would be completed in due time. Nitre/saltpeter would be processed and transmitted when the galleys are ready."

MD 18 38/72 [Ramazan 979 / January 1571]
"Khan of Krimea -Devlet Giray- has conveyed a letter stating that the freight cost of the ships [*navlun*) and the ship timber to be cut there would be paid from the Treasury of Caffa. When you get this decree, prepare the ships to load timber. The cost of timber would be paid from the Treasury of Caffa. Timber should be sent immediately. When you convey the ships, prepare a cost register and send us."

MD16 41/74 [24 Cemâziye'l-evvel 979/ 14 October 1571]
"The Admiral of Kavala was ordered to construct 5 galleys. Whatever he demands, it should be provided as soon as possible. The issue is very important and it should not be compared with the others."

MD 16 62/128 [4 Cemâziye'l-âhir 979/ 24 October 1571]
"How much wood and timber are available at the Arsenal? All kinds of wood eligible for ship construction should be brought. You should make all efforts for the construction of those ships. All available ships, which can be repaired should be ready. The previous arsenals in Anatolia and Rumelia should be revived. You should also list the places where ships can be constructed."

MD.16, 75/151 [4 Cemâziye'l-âhir 979/ 24 October 1571]
"The navy is in need of casting cannon balls for 100 pieces of galleys at the weight of 11 *vukiyye* (14 kg)."

MD.16, 78/156 [4 Cemâziye'l-âhir 979/ 24 October 1571]
"Previous decree was to construct 50 ships at Asian and 50 ships at European side. If the necessary (nails) has not been sent yet for the ships, you should report the number of existing nails at the depots, and immediately send the amount necessary for 100 ships to the relevant points."

MD 16 311/550 [11 Cemâziye'l-âhir 979/ 31 October 1571]
"You were previously ordered to move towards Morea and protect those regions. This order is still valid. The Ottoman navy is nearby Lepanto but they are lacking of troops and rowers. The kadis were ordered to provide enough number of rowers. You should move nearby Lepanto and meet with Vizier Pertev Pasha to attain soldiers for the ships and for the protection of the Straits. The additional troops are necessary to protect Morea and Ayamavra. The necessary number of rowers should be provided immediately. If the enemy troops attack and siege any of the fortresses there, immediately send military aid. Write when and where this letter arrived, and of the details of your measures."

MD 16 341/604 [10 Cemâziye'l-âhir 979/ October 1571]
"In Ahyolu, ships will be constructed. For their necessities, you should mobilize all peasants, and subjects to cut timber from all around and transmit them to the shipyards there. The price of the timber and all kinds of wood should be paid them at current prices."

MD 16 53/105 [22 Cemâziye'l-âhir 979/ 11 November 1571]
"Whenever the Kadi of Ahyolu ask timber, carpenter, kalafati or any other necessities, each of you should provide and send him as soon as possible. You should not expect any other decree to deliver the raw material there."

MD 16 135/263 [14 Receb 979/ 2 December 1571]
"To collect information on the development of the construction of ships under your authority, you should send detailed information on how many ships are under construction, how many more can be constructed, what are the situation of the ships at the shipyard there. They should be completed before the end of March. You should also send 300 Janissaries to the places where they are needed to guard those areas."

MD 18 88/192 [15 Receb [979/ 3 December 1571]
"Kadi of Alexandria has sent us a letter informing that you are at the guard of fortress of Bar. However, since it is wintertime, the roads are closed and there was difficulty in transmission of food for the troops. Since that region is close to Corfu, the enemy fleets could reach easily at a nice weather. You should not move to far distances. If there no danger of attack, move to the Plain of Ipek with your troops, which is 1,5 days far from the fortress you are in now. But you should locate watchmen to the necessary places to inform closing enemy ships. If there is any enemy attack because of your omission, none of your excuses will be accepted and you will not be forgiven."

MD.16, 35/65 [18 Receb 979/ 6 December 1571]
"The ships at Alexandria should set sail at the spring for a general attack to the enemy. The galleys and galleots there should be repaired. New ships also should be constructed as soon as possible. You should spend all efforts to fulfill them."

MD.10, 260/405 [Receb 979/ December 1571]
"In your letter you inform us that for the ships to be constructed at Sinop, Mehmed Chavush came with the decrees on 18 Cemaziyelahir/7 November 1571. The next day he went to the direction of Trabzon for carpenters, kalafati and other necessities, but not returned yet. Hasan Chavush, who was appointed as the authority to the horse ship, started to the construction until then, for 20 days (8 Receb / 26 November). In the meantime, wooden cover of 15 galleys are ready, and 3 galleys are almost ready for their belts, while 6 of them are at the level of board. For the remaining 11 galleys, wooden raw materials for main bone and little pieces are ready. While they are almost ready for skeleton construction, it was heard that a new order was sent for construction of more 5 galleys at Samsun. Sinop and Samsun is close, All the ship constructing competent masters, kalafati and other materials are between Samsun and Trabzon. Most of the masters are now in Samsun. Some of them did not arrive yet. The decree was not able to be sent to Caffa because of the weather conditions in winter. Ships are under construction at Amasra, son of masters are able to come from there. At Sinop, total number of carpenters and kalafati are 30. So, it will be really difficult to complete that number of ships in a short time. If the ships to be constructed at Samsun are among the ones ordered at Sinop, their materials would be ready here and they can be

completed in due time with the help of the God. But if the expected ships are additional ones, it will be really difficult to construct them until the end of March. If their construction can be postponed, they can be started and easily to be constructed after the Sinop ships are completed. All your information is evaluated at the capital. Now, the decree is for the reason that source of timber is near to Samsun. 5 galleys to be constructed at Samsun is additional to the ones at Sinop. You should also construct those ships. Take the carpenters who are allocated to you, and recruit them for necessary works. Complete the ships at Samsun until the deadline given to you. Carpenters are ordered from Trabzon and Caffa. When the wind is suitable, send it to Caffa. Captain Suleyman is sent there for construction of 10 ships. If he is in need of any assistance, do your best. Decrees were sent to the governor of Kastamonu and to Mehmed Chavush including the order that you should send them utilities and materials. Do not save any effort to do all your best."

MD 18b 103/229 [Şa'bân 979 / 19 December 1571-16 January 1572]

"From among the imperial Chavushes, Behram Chavush has sent a letter stating that pine tree timber was distributed to the kadis. Certain amount of Money was given to the kadi of Zağra-i Cedîd, but he did not pay in return for the timber. When the subjects asked the amount, he reduced from the original fee, and exploited for his personal use. Now, when Huseyin Chavush arrive there, gather the complaining subjects and the kadi. You should inspect the issue throughly. If the kadi has exploited the subjects, take back from kadi of Zağra-i Cedîd and return the amount to the subjects."

MD 16 62/128 [20 Ramazân 979/ 5 February 1572]

"How much wood and timber are available at the Arsenal? All kinds of wood eligible for ship construction should be brought."

MD.18. 2/3 [27 Ramazân 979/ 12 February 1572]

"Mustafa Chavush has sent a letter stating that the carpenters at Suzepolis are used to flee from Arsenal there. Carpenter Murad, son of Ilyas from the village of Keydcur bound to Dimetoka, has fled. They have also encouraged many masters and fled together. You should find all the masters he encouraged, and bring them as chained. If they flee any more, no excuse will be accepted, and they would be bound to ships as rowers."

Table 4: Document's nature and their evolution over the six months period following Lepanto

	1c OrdMilitar	2a InfoMaterial	3b InfoShips	4d OrdBuildShips	5e OrdMaterials	6f OrdManpower	7g OrdCrew	8h OrdBiscuits	9i Money	
October<24	6	0	0	1	0	0	0	0	0	7
24-31.10.1571	5	4	4	4	4	0	0	0	0	21
October 25-31	7	1	2	4	5	3	1	0	0	23
October 1571	12	5	6	8	9	3	1	0	0	44
November 1571	1	0	1	6	7	3	0	0	0	18
December 1571	26	8	4	21	18	7	7	0	2	93
Mid Dec 71/Jan 72	0	0	0	1	2	0	0	1	1	5
January 1572	3	3	3	8	11	3	14	2	2	49
February 1572	29	3	1	18	13	15	35	2	3	119
Mid Feb/Mar 72	1	0	0	1	3	0	2	0	1	8
March 1572	14	11	0	4	5	2	21	1	1	59
total	104	35	21	76	77	36	81	6	10	446

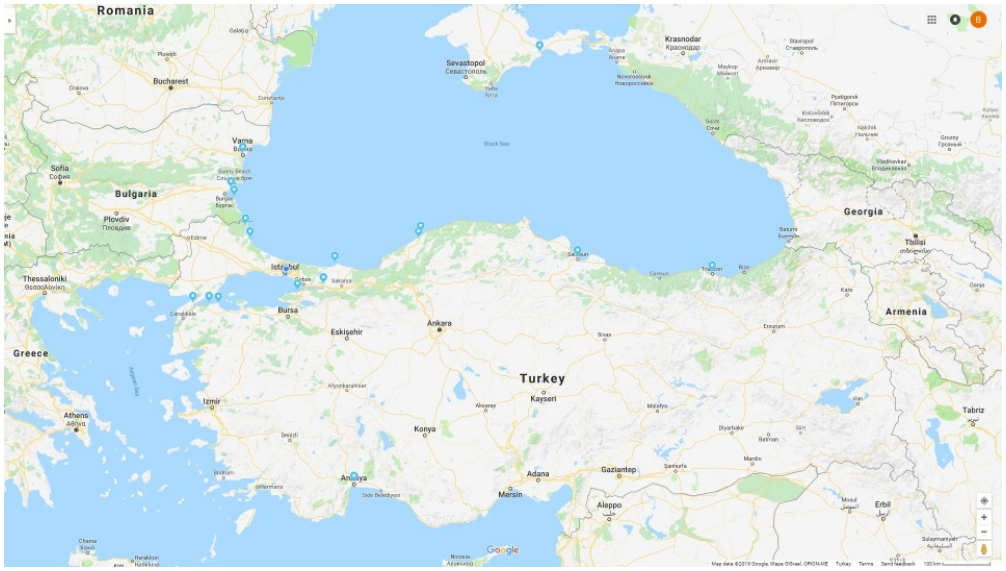

Fig 1: Mapping the use of multiple shipyards in post-Lepanto fleet reconstruction

254x142mm (96 x 96 DPI)