Masters of war: state, capital, and military enterprise in the Dutch cycle of accumulation (1600-1795)

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Citation for published version (APA):

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Chapter 3
Production, supply, and labor relations at the naval shipyards

The building and equipment of a fully armed warship was one of the largest, most concentrated forms of investment in material goods that either the state or private entrepreneurs could undertake. Navies depended on interaction with their economic hinterlands of an intensity that was comparable to that of few other early modern institutions. Whereas the last chapter dealt with the evolution of the structural relations between Admiralty Boards and merchants in the protection and conquest of trading routes, this chapter will examine the organization and economy behind the war fleet at home. Especially after the launching of major in-house shipbuilding programs with the tactical revolution of the 1650s and 1660s, the Admiralty shipyards became the focus of production and supply at an enormous scale. The Amsterdam naval shipyard was the second biggest production facility within the Dutch Republic, only surpassed by the VOC shipyard. The shipyards of the other Admiralty Boards were far smaller, but nevertheless remained among the biggest manufacturing enterprises of their respective regions.

The sheer size of naval shipyards all around Europe, the fact that they brought together hundreds or even thousands of workers at the same premises in an area where most production was still fragmented and small-scale, the complex nature of planning, costing, and coordination involved in the production of fully equipped men-of-war, the difficulties of

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1 As estimated by John Brewer, The Sinews of power. War, money and the English state, 1688-1783 (Cambridge, MA 1988) 34.
technological innovation in a sector still dominated by craft labor, the strains on labor relations and friction between state demand and private suppliers – have all contributed to making these institutions into laboratories for historians interested in questions of modernization, the evolution of administrative cultures, and the development of capitalist relations. And whereas in the past much of the literature on war and state formation concentrated heavily on finances, production, and supply for warfare on land, in recent years naval institutions have become the focus of an increasing number of studies on the evolution of states, bureaucracies, and practices of contracting.

These larger debates, however, have as yet largely passed by Dutch historiography on the naval shipyards. Labor relations, supply systems, and management culture have been far more central in investigations of the VOC and smaller private yards than they have been for the Admiralty Boards. Like the debate on the employment of the navy in commercial protection, the debate on the functioning of naval shipyards is still heavily influenced by the image of a binary opposition between the efficient and market-oriented practices of the

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seventeenth century and the image of financially strung, nepotism-infested and lethargic institutions of the eighteenth century. Only very recently have historians started to nuance this view, for example concluding that in the application of scientific drawing in the shipbuilding process, the eighteenth century was not as stagnant and wedded to age-old practices as was assumed heretofore. The previous chapter purported to show that the shifts in employment and make-up of the fleet were much more adapted to the needs of merchant communities and much less driven by financial constraints than is often suggested. Similar conclusions can be drawn for the functioning of the Admiralty Boards in their relation with the home economy.

To examine the evolution of the naval economy, the chapter will focus on the diverse but connected issues of the accounting culture (section 3.1), the shipyards as focal point for large scale supply (3.2) and the functioning of supply networks for different kinds of goods (section 3.3), developments in the scale of production at the shipyards (section 3.4), the ensuing development of the size of the shipyard workforce (section 3.5), the structure of interaction of shipyards and the labor market (section 3.6), the development of hierarchy (section 3.7) and attitudes to labor (section 3.8) and the evolution of ideas on the application of science and experimentation in shipbuilding (3.9). Most attention will be given to the Amsterdam shipyard, by far the largest naval institution of the Dutch Republic. However, comparisons with the smaller shipyards will be included to draw attention to the consequences of the differences in scale and the implications of the federalist divisions between Admiralty Boards for production and supply. By taking this broad view of the functioning of the naval economy, this chapter will show how the market-oriented systems of

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6 For the old view of stagnation, see W. Voorbeijtel Cannenburg, ‘De Nederlandsche scheepsbouw in het midden der 18de eeuw’, *Jaarverslag Vereeniging Nederlandsch Historisch Scheepvaart Museum* (1924) 76-84, for the more nuanced new approach, see A.J. Hoving and A.A. Lemmers, *In tekening gebracht. De achttiende-eeuwse scheepsbouwers en hun ontwerpmethoden. Met daarin opgenomen De groote Nederlandsche scheepsbouw op een proportioonale reegel voor gesteld door Pieter van Zwijndregt Pauluszoon* (1757) (Amsterdam 2001).
pricing, costing, and accounting, capitalistic attitudes to the organization of production and the workforce, and an experimental mindset in the application of inventions were carried over from the seventeenth century into the eighteenth. Again, the close connections between state administrators and local economic elites typical for the federal-brokerage structure of the Dutch Republic remained an important factor in determining the direction of development of production and supply.

3.1 Capitalist rationality, accounting, and the naval revolution

The centralization of naval production and supply in a small number of large facilities associated with the naval revolution of the mid-seventeenth century was accompanied by a revolution in administrative practices and ‘rational’ attitudes to state management. John Brewer has drawn attention to the central role of accounting in the development of relations between the central institutions for warfare and the internal functioning of economies:

‘Of course, the fiscal-military state presented a different face to civil society (…) than it did to the world at large. On the frontiers of the empire, in Europe and on the high seas it relied on the coercive brute force deployed by all the main military powers; but at home state power worked more subtly and less obstrusively. Its key technology was not derived from the arts of war but from the counting-house – slips of paper rather than shot and cannon, slide-rules rather than the blades of swords. Its ethos was that of bookkeeping, penmanship and political arithmetic, its ambiance entirely compatible with commercial society. Yet its unobtrusiveness did not preclude remarkable powers of surveillance: basic measuring skills, aided by calculus, the measuring rod and the slide-rule, together with exacting standards of bookkeeping, enabled the state and its functionaries to observe and record an astonishing amount of activity.’

It is no coincidence that three of the outstanding figures in this process – Jean Baptiste Colbert, Samuel Pepys and Johan de Witt – all combined great influence on the general course of state policy with direct involvement in naval reform. But in the Dutch Republic

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reforms in Admiralty administration pre-dated the tactical revolution by half a century, making standardized accounting practices, strict centralized control over accounts, and active price comparison the basis for managerial choices. Already before the 1650s Dutch naval administrators built on the achievements in accounting of the Italian city states, and on a widespread culture of using advanced mathematics in state administration, in order to rationalize administration.⁹

The high level of involvement of the commercial classes in politics made Dutch politicians and administrators susceptible to innovations in this area. As Jacob Soll points out: ‘The *ars mercatoria* was a rich part of everyday urban life and an essential element of state government. The Dutch ruling elite was familiar with the minutiae of finance, industry, and trade.’¹⁰ This intimate relation between merchant practices and administrative attitudes is borne out by contemporary sources. A revealing set of notes of Stadtholder Maurits’ mathematician Simon Stevin conveys the content of a discussion between himself and ‘His Princely Grace’ around the turn of the seventeenth century. In his rendering of the debate, Stevin explains the advantages of replacing the traditional system of accounting for the princely domains with the Italian style double-entry bookkeeping commonly used by merchants. Up to that time, bailiffs of the domains had brought income and expenditure in one single column, determining the balance by a simple process of adding and deducting. At the start of the stylized ‘conversation’, Stevin gives the reasons why a merchant prefers the double-entry system over the system commonly used in state administration:

‘First, that he always knows how much money his treasurer has, or ought to have, in his cash register, which is now unknown to the Prince and his treasurer (…). Further, the merchant has a handy certainty of all goods handed over by him to the control of his factors, whereas the Prince in all commodities supplied to him must rely on the information of his officers. Thirdly, the merchant always has a clear view, not only of the remainders on the accounts of his debtors and creditors, but also of the stock of all goods that he should have in his possession, 

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the profits or damages incurred on every category of goods. And he obtains all of this with such short shrift that can be held for impossible if the ordinary method of accounting of the bailiffs would be applied to a large trade.'

Stevin thus laid much stress on the connections between commercial accounting, orderly management of stocks, and the possibility to gain a separate overview of costs and profits for the discrete elements of business brought on the accounts. This cut two ways. Not only did proper accounting enable administrators to make far more precise economic judgments. It also enlarged state control over the administrators themselves, diminishing the possibilities for fraud. According to Stevin, ‘bookkeeping is a well-known means to force unjust people with violence to behave justly, out of shame and fear of what might follow.’ According to his own rendering, Stevin managed to convince Maurits of the usefulness of his suggestions, and with the help of ‘an experienced accountant in trade’ he wrote an annotated model account for the princely domains. In 1604 Stevin’s system of accounting was put to practice for the first time. Significantly, a thorough reform of the system of naval accounting was proscribed by the States General in the same year.

The 1597 instructions for the Admiralty Boards had already summoned that proper accounts should be kept of every area of Admiralty income and expenditure, from the collection of customs and the sale of confiscated goods to the acquisition of ammunition and the hiring of ships. It was the task of the receiver general of each of the five Admiralty Boards to turn these separate accounts into general reports. Every six months, the accounts should be sent to the States General, no later than three months after the end of the period covered therein. The aim of this was ‘that the Gentlemen States General from time to time will have perfect knowledge, both of the income and the expenditures’. These instructions did not establish general rules for the style of accounting. But in 1604 the States General delegated a commission to work out a standardized system of accounting for all five Admiralty Boards. The aim was ‘that the entire administration of income and expenditure of each board will be brought on one account by the receiver general’. The report of the commission, accepted by the States General, contained detailed prescriptions on how the accounts should be subdivided

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11 Simon Stevin, *Verrechting van domeine. Mette contrerolle en ander behouften vandien* (Leiden 1649) 3-4. The notes were first published after Simon Stevin’s death by his son Hendrick.
12 Ibid, 10.
15 NA, Archief Staten-Generaal, no. 12561.14, ‘Poincten van Advijs, waer near de Heeren van den Admt hun sullen reguleren int dresseren der selver reecckeningen’.
into separate posts or *summae*, established that the receivers general should keep proof of all expenditures mentioned in the accounts for control by the Audit Office, and also determined that every ledger should contain a summary report (*borderel*) following the same subdivisions as the account books themselves.

The result of these interventions in Admiralty management was a system of accounting that was extremely well-ordered for its time. The only place where completely standardized bookkeeping was applied to naval management at such an early date was Venice, where the senate had decreed regulation much akin to the Dutch system already in 1586. Zambon and Zan have rightly pointed at the great significance of this regulation, arguing ‘that the Venetian Senate was clearly posing the problem of costing and the efficient use of resources within the Arsenal.’

In a fascinating account of the role of the printed word in the development of East India trade, Miles Ogborn emphasizes the function of accounts as a way to achieve managerial control of means, materials, and men, focusing on the second half of the seventeenth century as a period of rapid development of orderly administrative practices by the English East India Company. As the discussions between Simon Stevin and Maurits show, very similar aims motivated Dutch administrators in the improvement of bookkeeping practices. Unfortunately, most of the accounts of the period before 1680 have been lost, except for those of the Zeeland Admiralty Board. But the almost complete series of ledgers of the receiver general that remain for the last decades of the seventeenth and most of the eighteenth century show that with a few minor variations, the system designed at the start of the century was maintained by all five Admiralty Boards. The introduction of this unified system of accounting helped to rationalize management of naval affairs both for the state as a whole and within the separate Admiralty Boards. For the state, it enhanced the possibilities of comparison and control. For the individual Admiralty Boards, it helped in the development of internal costing methods based on extensive comparisons of expenditures over time and in different branches of naval production and supply.

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16 Zambon and Zan, ‘Controlling expenditure’, 108.
18 Comparisons of the efficiency of the different Admiralty Boards based on their accounts survive for example for the early 1680s, the 1750s and the 1780s. Resp. NA, Archief Van der Hoop, no. 160. ‘Staet ende memorie van de ontfangh ende de lasten’ (1681-1685), no. 153. ‘Secrete missiven van de Admiraliteiten op de Maaze, te Amsterdam en in het Noorder Quartier, 30 Juny 1751’, and no. 151. ‘Missive en memerie door zyne Hoogheid den heere Prince van Orange en Nassau aan hun Hoog Mogende op den 7 October 1782 overgegeven’. At the end of the eighteenth century, there were even cases where pre-printed administration forms were sent to the Admiralty Boards to fill out. NA, Familiearchief Steengracht, no. 157 ‘Notities betreffende de vordering’.
19 Especially for the second half of the eighteenth century there is abundant evidence of this use of the accounts to make projections on the future costs of building and equipping ships, determining the desired price, and
At the time of the naval revolution of the 1650s and 1660s, then, the Dutch Admiralty Boards already possessed important administrative tools to enhance cost-cutting management practices. But it was the building of large centralized shipyards and storehouses in the period between the First and Second Anglo-Dutch Wars that enabled naval administrators to really bring these methods to fruition. The Amsterdam shipyard and storehouse provide the best illustration of the advantages of concentrating all naval activity at one location. During the first half of the seventeenth century, the Admiralty shipyard and storehouse were cramped in amidst VOC and private shipyards in a small area at what was then the eastern outskirts of the city. The storehouse was so small that the Admiralty Board was forced to hire a number of private warehouses in different parts of the city, making it harder to keep a precise overview of stocks. The wharf itself was more suitable for maintenance than for the building of large ships. Already in 1648 the Admiralty directors had requested the Amsterdam city council the rights to build a new storehouse, but this was refused. However, under the impression of the First Anglo-Dutch War the Amsterdam burgomasters changed their minds and allocated an area called Kattenburg – one of three newly created islands in the main waterway the IJ – to the building of both a new storehouse and a shipyard ‘of astounding length’. Shortly after the Admiralty Board started moving its facilities, the VOC acquired the adjacent island (Oostenburg). The two islands, separated from the rest of the city by bridges, now became the center of Amsterdam’s shipbuilding industry.

The first building that was erected was the naval storehouse. The total cost of the facility was just under f 400,000, and after laying the first stone in September 1656 the building was made ready for use in a remarkably short period. According to Dapper’s

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20 The storehouse was situated at Uilenburg, the wharf at Rapenburg. Jan Wagenaar, *Amsterdam in zyne opkomst, aanwas, geschiedenissen, voorregten, koophandel, gebouwen, kerkenstaat, schoolen, schutterye, gilden en regeeringe*, Volume II (Amsterdam 1765) 78. From 1608, the VOC shared the same terrain at Rapenburg. Madeleine de Haas, ‘De gebouwen van de Verenigd Oost Indische Compagnie. De scheepswerven en de lijnbanen’, in: Wieringa (ed.), *VOC in Amsterdam*, 63-75, 63. Throughout this chapter, the term ‘private shipyard’ will be used for the many independent shipbuilding enterprises producing for an open market, not for the VOC-shipyards which functioned as embedded institutions within the larger framework of this specific monopoly trading company. Also see C.A.de Feyter, *Industrial policy and shipbuilding. Changing economic structures in the Low Countries 1600-1800* (Utrecht 1982) 155.

contemporary history of Amsterdam, the concentration of all naval facilities around this single imposing building brought both organizational and financial advantages:

‘[F]irst, to have all the prerequisites for war that are needed for the equipment of warships together at short distance in one place. On the other side to avoid the high costs of renting warehouses and cellars, in which all shipbuilding tools and battle-gear were stored, spread out over the whole city. Because the yearly costs of this were so high, (…) that the money laid out on the building of this edifice will be paid off within five years.’

In all its features, the four stories high building was to elude power and wealth. Its frontispiece represented the protection of seafarers, and the lines by Amsterdam’s celebrated poet Vondel under a painting in the conference room stressed the centrality of the new navy for the Republic:

‘Now will no sea beast dare to move his fins at sea,  
Thus grows our trade, for the expansion of the state.’

In another poem celebrating the building, Vondel expressed the connection between the institution, the power of the Republic, and economic prosperity in even starker terms: ‘Thus keeps a magazine, a house, the wealth of the nation in place.’

Other Admiralty Boards followed suit and built their own central storehouses and shipyards, albeit on a smaller scale. These buildings formed the backbone of the efforts to produce a new navy. Even a century after the erection of the Amsterdam naval storehouse, one British observer could write of the methods for storage and safety and the internal organization employed there:

‘They have admirable Methods in preserving their Ships when built, and their Magazines are in good Order, every Ship having an Apartment to lay up all its Equipage in; and at the Top of their Magazines are vast Cisterns, which are kept constantly full of Water, having Pipes into every Apartment, to let it down upon Accident of Fire. And there is in their Magazines a Nursery Room, where a Woman keeps an Office, to feed, at certain Hours of the Day, a great Number of Cats, which afterwards hunt among the Store, for Mice and Rats.’

23 O. Dapper, *Historische beschryving der Stadt Amsterdam* (Amsterdam 1663) 452-453.
24 Wagenaar, *Amsterdam* II, 81.
26 Robert Poole, *A journey from London to France and Holland. Or, the traveller’s useful vade mecum* (London 1750) 184.
And another British visitor mused:

‘The Contrivance of this House is admirable. (...) The Arms and Stores belonging to the Ships, are kept in excellent Order in several Chambers. The Keepers are shy of shewing the House, though they need not be ashamed of any Thing that belongs to it. The so much boasted Arsenal of Venice is not comparable to it, though there are four other lesser Admiralities, or Docks, belonging to the Republick, besides this of Amsterdam. The Buildings and Docks of Woolwich and Chatham are indeed handsom, and well provided with naval Stores; but their Situation will not admit of the Neatness and Order conspicuous in the other.’

This ‘neatness and order’ became the hallmark of Dutch naval administration across the board, explicitly geared towards the achievement of economic efficiency.

### 3.2 Personal networks and market practices

The adoption of commercial accounting of course was not the only link that connected Admiralty administration to the logic of the market. The personal involvement of leading merchants in the direction of the navy did not only have an influence over the employment of the war fleet abroad, but also on the management of naval resources at home. One of the greatest risk inherent in this direct involvement of capitalist elites in the management of naval production and supply of course was that of in-trading. The 1597 instruction for naval administrators contained a number of clauses directed against the personal involvement of councilors and other servants of the Admiralty Board in economic activities related to the affairs of the navy. The oath sworn by all Admiralty councilors summoned:

‘[t]hat they shall not participate, directly or indirectly, in tax-farming, or collection of customs or other general means, nor in the supply of gunpowder, scarp, guns, weapons, butter, cheese, or any other victuals, in commercial services, or in selling goods to the public.’

That there was ample reason for the inclusion of such clauses soon became apparent. In 1626 the Rotterdam Admiralty Board became the center of major proceedings against fraud by its

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staff. The case had been brought to the courts when rumors started to spread among the populace of Rotterdam that naval administrators enjoyed incomes far greater than they were entitled to. One of the leading Admiralty functionaries, the fiscal advocate, as well as several councilors were found guilty of participating in the buying and selling of confiscated goods and receiving bribes. They were sentenced to long detention, banishment for life, and tens of thousands of guilders in fines. But as the contemporary historian Lieuwe van Aitzema who recorded the case made clear, the sentences were as much directed at punishing the culprits as shielding the system as a whole from popular wrath. ‘For if there would have been an examination of all councilors and magistrates in the same way according to their instructions, one might well say Domine quis sustinebit [Lord, who would remain standing].’\(^\text{29}\) Despite frequent reissuing of the rules as well as sharpening of the wording of the oath for functionaries, in-trading remained a frequently reoccurring phenomenon well into the eighteenth century.\(^\text{30}\)

However, as Michiel de Jong has pointed out in his important study of arms trade in the Dutch Republic, the tendency to see personal intervention of state administrators only as a source of corruption or inefficiency is based on an anachronistic view fueled by liberal economic theory.\(^\text{31}\) A sharp separation between state and market simply did not exist, and in fact direct connections between officials and merchants were often indispensable for guaranteeing that agreements on deliveries and payment were more or less honored by all parties. Pieter de la Court stressed that precisely because of such links, Holland officials in general were much better able than their counterparts elsewhere to mobilize funds and acquire goods at low prices:

‘The (…) fruit of free government before and during the [second] English war, is that the States of Holland as well as their Government have been able to gather all necessities, even before need arose. Which precaution, coupled to two others, namely in the first place that everything was bought and paid with ready money, and in the second place that the commission to execute this was given to plenipotentiaries representing those cities for which a good outcome of these affairs was of prime importance. Furthermore this involved gentlemen

30 Bruijn, Varend verleden, 137-138. One of the most spectacular cases of the eighteenth century involved master of equipment Willem Sautijn and master shipwright John May, who together with three other officials were guilty of large scale embezzling of goods that belonged to the wharf and fiddling the accounts. Despite all evidence, none of them was found guilty, but the clerks who had acted as whistleblowers lost their jobs. Ibid, 208-209.
whose love of our free fatherland, wise policy, and untiring laboriousness was completely secure. This was the cause why Holland, to the surprise of the entire world, during all emergencies of war could procure the means and finances to temporarily bear the shortages of the Admiralty Boards and the other provinces, and to supply at lower prices than ever in times of peace the canon, scarp, gunpowder, and victuals.\textsuperscript{32}

Personal profiteering and the introduction of more economic forms of managing state funds were not linearly opposed.

Contacts between the state and market always were in part shaped by the personal networks of administrators. Various measures were taken to check the tendencies towards favoritism inherent in such an organization. Apart from tight administrative control, the most important of these was the use of public auctioning to ensure that buying and selling took place at the most advantageous price. Central regulation was first developed for the sale of Admiralty goods, an area that was very vulnerable to in-trading. The instruction of 1597 decreed that all selling of prizes and confiscated goods should take place in this way. It also specified the conditions under which the auctions should take place. Day, time, and location had to be announced well in advance through placards posted in all cities at one day’s traveling distance from the Admiralty town. The auction itself should be held in the presence of a number of Admiralty councilors who had to make sure that the sale would go to the highest bidder, and that a detailed register of all transactions would be kept.\textsuperscript{33} As the Rotterdam case of 1626 shows, the latter condition was not in itself sufficient to prevent fraud. Nevertheless the widespread use and developed regulation for auctioning at least show a perception of central administrators that such forms of favoritism should be counteracted by open market competition.

This logic from early on was extended to the field of contracting. Auctioning of contracts became the standard practice for many different types of acquisitions. Procedures for public tendering were most elaborate for entire ships or hulls. The strong personal influence of the master shipwright on the shipbuilding process and the properties of the end-product made it difficult to determine when exactly the terms of the contract were met. To avoid endless conflict, the terms of the offer were set meticulously. One such offer, put out by the Northern Quarter Admiralty Board and finished in September 1653, contained over forty


\textsuperscript{33} ‘Instructie’, in Recueil I, 36-37.
conditions for ‘a warship, built in the way of a ship of 200 lasts as used by the VOC, length 130, width 32 ½ Amsterdam feet’. The conditions specified the exact measures of the ship and all its individual parts, the thickness of the wooden beams used in construction, the internal architecture, and the final finishing required ‘up to the point where the ship can take sea’. Once the ship was built, Admiralty officials checked whether all conditions had been met by the contractor. In the case of the 1653 tendering, a handwritten statement by the master shipwright of the Northern Quarter Admiralty Board testified under oath that the new warship had been built by a master shipwright from Hoorn ‘in conformity with the offer’.34

Conditions for Admiralty control over the execution of the contract, however, could also be used to temper with the rules of tendering to the lowest bidder, as is clear from a case described by naval historian Johan Elias. In January 1654 the Rotterdam Admiralty Board tendered for the making of four hulls of 136 feet. The States General had demanded that these contracts would go to the lowest bidder, and therefore that shipwrights from the shipbuilding areas in the Northern Quarter of Holland would be allowed to take part in the auction. The Rotterdam Admiralty councilors, in favor of employing shipbuilders from their own region, proceeded to put into the contract a condition stating that the hulls

‘should be made under supervision of aforementioned board, and launched at the easiest place for their Highly Esteemed Gentlemen to hold precise day to day inspections of the work in progress, [checking] (…) whether everything is made and done according to the offer’.35

The terms of this condition made sure that shipbuilders from the Northern Quarter were prevented from bidding. As a result, the Rotterdam Admiralty Board bought the four hulls for f 32,500 apiece, while similar contracts in Amsterdam went for f 28,500 and in the shipbuilding town Zaandam even for f 27,500.36

From ships and hulls, the practice of public tendering was extended to many smaller contracts. This strengthening of market practices continued well into the eighteenth century. The 1744 regulation of the Amsterdam shipyard stated

‘That an experiment shall be taken (…) to regulate the supply of all products from now on not through permanent suppliers, but through inscription on the basis of posters and notification in the papers, made public a convenient time in advance. And [only] for those deliveries that

34 NA, Archief Staten-Generaal, no. 12561.120.2. ‘Forma vant besteck omte maken een schip van oorloge’.
35 Elias, Vlootbouw, 142.
36 Idem.
merely consist of small quantities of little consideration, or that can only be tendered to two or three bidders, shall the contract be given to a fixed person. But also for such a tendering, [the Admiralty Board must] gather as many people as possible trading in this product.  

This decision to open up almost every area of supply to direct market competition was taken at a moment when the Amsterdam Admiralty Board was under great financial restraint as part of a thoroughgoing program of financial restructuring undertaken by the Admiralty councilors during the 1730s and 1740s – underlining that Admiralty administrators saw a strong connection between using market competition in supply and economizing management at the shipyards. The use of tendering as a way to force down costs can also be seen from its application by the Rotterdam 1782 for the rebuilding of part of the naval storehouse. Seven bidders applied for doing masonry, at prices ranging from f 9,900 to f 12,619. Bids for carpeting work varied as much, with sixteen carpenters inscribing on prices ranging from f 3,747 to f 5,820. The names of three of the lowest bidders were underlined, signifying their selection for the job, though for reasons that remained unspecified the contract for masonry did not go to the one offering the very lowest price, but to a contractor bidding the slightly higher sum of f 9,988.  

Throughout the eighteenth century, the Admiralty Boards employed the method of public tendering widely and with growing sophistication. Even in 1781, when the need to build quickly in order to meet the necessities of war put great upward pressure on prices, Rotterdam Admiralty councilors nonetheless made conscious use of the tendering process to obtain the best deal within the given circumstances. On 4 April 1781 four deputies of the States General joined Rotterdam fiscal advocate Bisdom, master of equipment Van Staveren, master shipwright Van Zwyndregt, and nine Admiralty councilors, ‘seated according to the rank of their provinces and towns’, to receive the bids for the building and equipment of two ships carrying 60 and 70 pieces respectively. The bidding started with reading the conditions for tendering. Beforehand, the deputies of the States General and representatives of the Rotterdam Admiralty Board had agreed that if the bids would contain ‘such a reasonable price that no objections could be raised’, the contract would be granted immediately. In order to determine this ‘reasonable price’ a calculation of prices for the hull and equipment of different sizes of ships was included in the documents, based on tendering contracts from the pre-war year 1779. If the bids would exceed those prices ‘but not all too excessively’, the

37 NA, Archief Van der Hoop, no. 153. ‘Secrete Missive van de Admiraliteit Amsterdam’, 30 June 1751, 86.  
38 NA, Archief Admiraliteitscolleges XXXI, collectie J. Bisdom, no. 205. ‘Stukken betreffende het Admiraliteitsmagazijn’.  

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contracts would only be awarded after three days, giving time for consultation with the States General. If all bids would exceed the calculated price by a large margin, fourteen days would be taken ‘in order to await the results of tendering by the Amsterdam Admiralty Board’. Of the three bidders for the hull of the smaller ship, Jacob Spaan from Dordrecht offered the most favorable price. However, with f 323,365 this was still almost one and a half times as high as the price indicated by the calculation from 1779. Apparently this was still within the range of expectations, since the delegates announced to give Spaan a definitive answer after three days. After the meeting was over the delegates agreed to advise favorably on giving Spaan the contract ‘because of the circumstances at the time, and the impossibility to execute all building at the nation’s shipyards with the required speed’, but to keep the price secret in order not to influence the tendering a few days later in Amsterdam for a ship of similar size.\(^{39}\)

The decision on the bid for the larger ship proved more difficult. The cheapest offer was that of Jan Schoute from Dordrecht, who at f 520,000 demanded double the price of a ship of 70 pieces before the war. In this case, the delegates demanded a fourteen days waiting period before announcing their decision. Thereafter, Schoute agreed ‘both by word of mouth and in writing’ to lower his bid to f 460,000, but the delegates still considered this price too high and therefore gave a negative advise on giving the contract to any of the bidders, suggesting to start the tendering process anew.\(^{40}\) Around the same time the Rotterdam Admiralty Board received the outcome of the tendering process in Amsterdam, in which a hull for a ship of 60 pieces had been contracted for f 278,400, and for a ship of 70 pieces for f 410,000.\(^{41}\) The Rotterdam deputies themselves had already expected the large price difference with Amsterdam, which they ascribed to more lenient conditions in the offer.\(^{42}\)

The latter example shows to what extent calculation on the basis of past prices, comparison with the prices obtained by other Admiralty Boards, and well regulated forms of public tendering had become standard procedure in naval administration. Even under duress of war such practices were not replaced by a simple reliance on direct connections with privileged contractors. While strongly tied to local commercial networks, personal preferences were at least partially held in check by a sophisticated, market-oriented culture of accounting and public tendering to search for the lowest possible price. But the example also shows that the use of auctioning in itself was not sufficient guarantee that ships and goods

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\(^{39}\) NA, Archief admiraliteitscolleges XXXII, collectie Van Bleiswijk, no. 6. ‘Secrete missive’, 5 April 1781.

\(^{40}\) Ibid, ‘Missive van de Admiraliteit op de Maze’, 13 April 1781.

\(^{41}\) Ibid, ‘Notitie waar voor alles is aanbesteed voor een schip van Oorlog van 70 stukken’. The conditions and outcome of tendering for the Amsterdam ships can be found in NA, Archief Fagel, no. 1096.

\(^{42}\) NA, Archief admiraliteitscolleges XXXII, collectie Van Bleiswijk, no. 6. ‘Secrete missive’, 5 April 1781.
could indeed be obtained at the desired price. Market conditions varied per product, for the
different localities of the Admiralty Boards, and for periods of peace or war, demanding very
different approaches to contracting.

3.3 Different products, different systems of supply

Practices for acquisitioning varied substantially for different types of goods, depending on the
size of demand and the structure of the market. Table 3.1 contains the reconstruction of the
Amsterdam Admiralty accounts for a number of selected expenses from 1681-1789.
Unfortunately, it is not possible to obtain such complete series of figures on Amsterdam
expenditure for an earlier period. But the table gives a good indication of the relative weight
different goods on the Admiralty accounts. Three categories of goods bought by the
Admiralty Board will be more thoroughly examined here: victuals; expensive bulk goods such
as wood; and finally less expensive types of goods, acquired either in bulk (as for example
was the case with nails, included under ironware), or in small quantities.

Victuals

Making up a total of 14.8% of all of Amsterdam’s expenditure, victuals invariably formed the
largest category of goods supplied to the navy. Throughout the existence of the Republic,
victualling remained a privatized activity, completely bypassing Admiralty administration.
Captains were given a fixed amount of money per crew-member per day (initially 5 stuivers,
later 7), and had the responsibility to take care of provisioning on their own account. Lists
were provided determining the amount of each type of victuals that had to be on board their
ships.43 But captains were free to choose their own suppliers, and could cut back on expenses
by buying low quality products. Because of the decentralized organization of this type of
supply very little source material is available about the exact ways in which this was done and
the profits that could be made. An – albeit denunciatory – pamphlet of the late eighteenth
century estimated the profits that a captain of a large man-of-war carrying sixty pieces could

43 UB, Universiteit van Amsterdam, Bijzondere Collecties OF63/985, Extracten uit het register van de resolutiën
der Staten Generaal en uit de notulen van de Admiraliteit te Amsterdam, alle betr. zeezaken [1671-1780]
(Henceforth: UB-BC, Extracten. ‘Specifications 1777’).
### Table 3.1 Amsterdam naval expenditure on selected goods, 1681-1789 (millions of guilders)

<table>
<thead>
<tr>
<th>Year</th>
<th>Victuals</th>
<th>Wood</th>
<th>Rigging, rope, hemp</th>
<th>Iron and ironware</th>
<th>Ammunition</th>
<th>Cloth and sails</th>
<th>Complete ships</th>
<th>Expenditure on main types of acquisitions</th>
<th>Total Admiralty expenditure</th>
<th>As % of total exp.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1681-1689</td>
<td>2.8</td>
<td>1.3</td>
<td>0.7</td>
<td>0.4</td>
<td>0.5</td>
<td>0.3</td>
<td>0.4</td>
<td>6.3</td>
<td>18.0</td>
<td>95.4</td>
</tr>
<tr>
<td>1690-1709</td>
<td>8.2</td>
<td>2.3</td>
<td>2.2</td>
<td>0.8</td>
<td>1.1</td>
<td>0.7</td>
<td>0.4</td>
<td>15.6</td>
<td>40.8</td>
<td>100.0</td>
</tr>
<tr>
<td>1700-1719</td>
<td>7.5</td>
<td>2.0</td>
<td>0.7</td>
<td>0.7</td>
<td>0.1</td>
<td>0.3</td>
<td>0.0</td>
<td>13.9</td>
<td>35.7</td>
<td>32.5</td>
</tr>
<tr>
<td>1720-1729</td>
<td>3.1</td>
<td>1.9</td>
<td>0.6</td>
<td>0.4</td>
<td>0.3</td>
<td>0.2</td>
<td>0.0</td>
<td>5.4</td>
<td>23.3</td>
<td>39.2</td>
</tr>
<tr>
<td>1730-1739</td>
<td>3.7</td>
<td>1.6</td>
<td>0.7</td>
<td>0.4</td>
<td>0.3</td>
<td>0.2</td>
<td>0.0</td>
<td>7.1</td>
<td>21.2</td>
<td>30.2</td>
</tr>
<tr>
<td>1740-1749</td>
<td>1.8</td>
<td>1.8</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.2</td>
<td>0.0</td>
<td>4.3</td>
<td>20.1</td>
<td>26.4</td>
</tr>
<tr>
<td>1750-1759</td>
<td>2.0</td>
<td>1.7</td>
<td>0.8</td>
<td>0.4</td>
<td>0.4</td>
<td>0.2</td>
<td>0.1</td>
<td>5.6</td>
<td>20.6</td>
<td>20.0</td>
</tr>
<tr>
<td>1760-1769</td>
<td>3.0</td>
<td>2.3</td>
<td>0.7</td>
<td>0.4</td>
<td>0.4</td>
<td>0.2</td>
<td>0.1</td>
<td>6.0</td>
<td>24.1</td>
<td>24.4</td>
</tr>
<tr>
<td>1770-1779</td>
<td>2.9</td>
<td>2.1</td>
<td>0.8</td>
<td>0.4</td>
<td>0.4</td>
<td>0.2</td>
<td>0.1</td>
<td>7.1</td>
<td>21.7</td>
<td>25.0</td>
</tr>
<tr>
<td>1780-1789</td>
<td>2.2</td>
<td>5.3</td>
<td>1.4</td>
<td>1.3</td>
<td>1.6</td>
<td>0.5</td>
<td>1.9</td>
<td>18.0</td>
<td>47.4</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Total: 293.3 million guilders, 100.0%

Sources: NA, Archief Generaliteitsrekenkamer 1586-1799, nos. 490-717, estimate 1780 based on NA, Archief Admiraliteitscolleges XXXIX, Van der Hoop, no. 17.

Though this seems an unrealistically high sum, in general victualling was considered to be a way for captains to substitute their otherwise meager salaries. It is known that during the seventeenth century Michiel de Ruyter, the most famous admiral of the Dutch Republic, made tens of thousands of guilders on victualling. But long delays in the payment of victualling money by the Admiralty Boards, forcing the captains to place large loans with soliciteurs, or sharp increases of food prices at times of war, could as easily make victualling a source of loss. The decentralized system of victualling almost

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44 Staat en uitrekening der enorme grove winsten, welke getrokken worden door de heeren capiteins, eerste schryvers en doctors, varende op des ’s lands scheepen van oorlog, by het Edel Mogend Collegie ter Admiraliteit (Amsterdam 1779) 22-24.
certainly favored traders in foodstuffs in the Admiralty towns and other port cities. The two remaining ‘victualling books’ for De Ruyter’s flagship The Seven Provinces from 1666 and 1672 show that he bought victuals mainly from traders in his hometown Amsterdam and Hellevoetsluis, one of the principal marine ports. In some cases, he placed very large orders, such as that with baker Cornelis Verstege for 19,439 pounds of hard tack, at a total sum of £1,371.46 A description of Amsterdam of about the same time notes that at the Angeliers Channel near the IJ (the main Amsterdam waterway) ‘live the biscuit-bakers, who make ship’s biscuit; the bakeries are very big, with as much as ten or twelve ovens’.47

It remains a matter of speculation why the Admiralty Boards did not try to gain a firmer hold on victualling by setting up their own centralized supply system. The Amsterdam chamber of the VOC did centralize this branch of supply, running its own butchery within the Company storehouse.48 One advantage of fixing the amount of money per head of the crew was that the hazard of sharp rises in food prices at times of war was put on the captains, who in turn could let their crews bear the brunt by providing lower quality goods. But of course, there was a limit to such a strategy, if not made apparent by open mutiny than still present in the danger that failure to supply in time could slow down operations. If anything, such a system of decentralized victualling presupposed a very well functioning market in agrarian supplies that could respond to large spikes in demand. It also demanded that captains were themselves well to do entrepreneurs, or had easy access to large amounts of credit to overcome the arrears of the Admiralty Boards. All of these circumstances of course were characteristic of the situation in the Dutch Republic. Even the aforementioned highly critical anonymous pamphlet from 1779 admitted that if these conditions could be met, the system actually could run rather smoothly:

‘As soon as the suppliers hear that a captain has been appointed a ship, knowing that he has means of his own and pays promptly, they each try to get into his favor, and offer him their samples of what they know the captain needs for his crew, of which he buys the best and cheapest, making conditions in advance that if the commodities sold do not equal the samples in quality, the sellers can be sure to receive them back. And in this way, the suppliers, although they make only a small profit, do not have the audacity to send goods to the ship that

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46 NA, Collectie De Ruyter, 1633-1683, no. 125, ‘Specificatie van de victualien’, 1666.
47 Melchior Fokkens, Beschrijvinge der wijd-vermaarde koop-stadt Amstelredam, van haar eerste beginselen, oude voor-rechten... en, haar tegenwoordigen standt (Amsterdam 1662) 92. Thanks to Clé Lesger for pointing me towards this reference.
48 Gawronski, Equipagie, 65.
do not have the same quality as the samples. And the crew that sails with such a captain can be confident not to be forced to eat old, rotten or bug-infested food. 49

But according to the pamphlet, the opposite was true for captains who were known to be financially strung:

‘[N]o supplier will look at him, and if he wants to have victuals for his ship, he will have to go out himself looking for traders who want to supply him with food on credit, which often costs such a captain great troubles before he gets ready and makes his head spin with all the conditions, clauses, and notes that these suppliers send him, before they are willing to supply the required provisions.’ 50

Even in these conditions, however, the Admiralty Boards were relatively shielded from malfunctions in the supply system. Crews bore the brunt of supply failures in the form of malnutrition, while the captains were the ones to face their wrath. Meanwhile, though firm evidence of this is lacking, the presence of quite a number of large oxen-traders among the Amsterdam Admiralty councilors suggests that keeping victualling out of the formal chain of supply – and thus outside the books – could create lucrative loopholes for in-trading by the naval administrators. 51 Without wanting to suggest that this was the main reason for maintaining fully privatized victualling, as long as the existing system functioned well it might have been a further reason to overlook some of its shortcomings.

Wood

For large, expensive bulk goods such as the high standard oak used for the building of ships of the line, Admiralty Boards relied on a much more limited number of suppliers than were involved in providing captains with victuals. Before the late 1660s, when shipbuilding was mostly done on private shipyards, the acquisition of wood was often left to the shipwrights who managed to obtain the tendering contracts. The accounts of the master of equipment in the Zeeland Admiralty town Flushing, for example, show the two master shipwrights Pieter Leynssen and Crijn Cudde receiving compensation for wages they paid out as well as for the

49 Staat en uitrekening der enorme grove winsten, 67.
50 Idem, 68.
51 E.g. Hiob de Wildt, the influential secretary of the Amsterdam Admiralty from 1671 to 1704, who was registered as an ox trader and according to the 1674 tax register owned an ample f 170,000. Johan E. Elias, De Vroedschap van Amsterdam 1578-1795. Volume I (Haarlem 1903) 392-393.
supply of wood. But from the onset of major in-house shipbuilding programs in the 1660s onwards, the Admiralty Boards became increasingly large players on the wood market. Since almost all wood used in shipbuilding had to be imported from Scandinavia, the Baltic region, and Germany, wealthy international merchants dominated in this line of supply. Over the course of the seventeenth and eighteenth century, this led to frequent fears of large wood-traders forming a cartel against the Admiralty Boards. This was an element of lieutenant admiral Schrijver’s long critique of naval affairs from the 1750s.

‘It is well known to everybody that in their trade of shipbuilding oak, the buyers for centuries have been cheated in the most awful way (…). And it is still daily practice that this wood is sold a capital above its value to the profit of the sellers, often supplying rotten wood instead of good quality wood, to the ruin of the account of navy and the VOC.’

Schrijver proposed the introduction of the taking of an obligatory oath against monopoly practices. But the Amsterdam Admiralty Board also devised some more substantial means to counter the combined power of the large wood traders. One was to use active price comparisons to force merchants to offer discounts. The archive of late eighteenth-century fiscal advocate Van der Hoop contains various notes in which the prices asked by merchants are compared to those actually paid by the Admiralty Board, in one case establishing a difference of more than thirteen percent in the advantage of the Admiralty.

The ability of the Amsterdam Admiralty Board to enforce lower prices rested on the availability of a large number of potential suppliers, combined with an active strategy of diversification between suppliers. An overview of accounts from March 1778 to December 1790, including the crucial years of the Fourth Anglo-Dutch War, show forty-eight wood merchants with whom the Amsterdam Admiralty Board traded. Eighteen of those can be considered large suppliers, making deliveries worth £10,000 or more in at least one of those years. Nine of those wood traders made average yearly deliveries of more than £10,000 taken over the entire period. But as table 3.2 shows, none of these very large traders were active for the entire period. The size of their supply contracts varied substantially from year to year, and

52 Zeeland Provincial Archive Middelburg (from here RAZ), Archief Rekenkamer C, no. 35520. ‘Equipagerekening Vlissingen 1665’.
55 NA, Archief Admiraliteitscolleges XXXIX, J.C. van der Hoop, no. 118. ‘Vergelyking tusschen den Eysch en de Prys van ‘t ingekogten Eikehout’, 5 December 1781 to 11 December 1783.
Table 3.2  Largest wood-suppliers of the Amsterdam Admiralty Board, March 1778-December 1790 (thousands of guilders)

<table>
<thead>
<tr>
<th>Name supplier</th>
<th>1778*</th>
<th>1779</th>
<th>1780</th>
<th>1781</th>
<th>1782</th>
<th>1783</th>
<th>1784</th>
<th>1785</th>
<th>1786</th>
<th>1787</th>
<th>1788</th>
<th>1789</th>
<th>1790</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pieter van der Stadt</td>
<td>67.2</td>
<td>70.2</td>
<td>21.9</td>
<td>336.5</td>
<td>323.8</td>
<td>103.9</td>
<td>16.0</td>
<td>7.3</td>
<td>0.9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>947.7</td>
</tr>
<tr>
<td>Benjamin van Luneschlos</td>
<td></td>
<td></td>
<td></td>
<td>112.4</td>
<td>273.9</td>
<td>124.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>510.8</td>
</tr>
<tr>
<td>Gerrit Braamcamp</td>
<td>22.3</td>
<td>21.1</td>
<td>18.9</td>
<td>112.8</td>
<td>6.4</td>
<td>57.6</td>
<td>59.8</td>
<td>29.6</td>
<td>26.6</td>
<td>32.3</td>
<td>5.7</td>
<td>1.0</td>
<td></td>
<td>394.2</td>
</tr>
<tr>
<td>The widow and heirs of Jan Frederiks</td>
<td>52.8</td>
<td>33.6</td>
<td>21.6</td>
<td>77.1</td>
<td>124.9</td>
<td>22.4</td>
<td>6.7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>339.1</td>
</tr>
<tr>
<td>Jacob Hagen</td>
<td>55.2</td>
<td>54.3</td>
<td>37.3</td>
<td>107.1</td>
<td>53.7</td>
<td>2.8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>310.4</td>
</tr>
<tr>
<td>Dirk van der Plaat</td>
<td>25.5</td>
<td>19.1</td>
<td>9.0</td>
<td>41.0</td>
<td>1.3</td>
<td>2.2</td>
<td>34.7</td>
<td>16.2</td>
<td>23.8</td>
<td>35.7</td>
<td>30.2</td>
<td></td>
<td></td>
<td>238.8</td>
</tr>
<tr>
<td>Gerrit van Harlingen</td>
<td>5.9</td>
<td>129.9</td>
<td>18.7</td>
<td>9.3</td>
<td>1.0</td>
<td></td>
<td></td>
<td>10.4</td>
<td>6.4</td>
<td>0.1</td>
<td></td>
<td></td>
<td></td>
<td>181.7</td>
</tr>
<tr>
<td>Pieter Kuijper</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>32.1</td>
<td>23.1</td>
<td>15.5</td>
<td>25.2</td>
<td>19.9</td>
<td>41.2</td>
<td></td>
<td></td>
<td></td>
<td>157.0</td>
</tr>
<tr>
<td>Casper Kreeft</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>25.7</td>
<td>71.4</td>
<td>15.0</td>
<td>30.0</td>
<td></td>
<td></td>
<td></td>
<td>142.1</td>
</tr>
</tbody>
</table>

* (Mar. - Dec.)

Source: NA, Archief Admiraliteitscolleges XXXIX, J.C. van der Hoop, no. 118. ‘Rekeningen aangekocht hout Admiraliteit Amsterdam maart 1778-december 1790’.

In no single year did one single trader completely dominate supply to the Admiralty Board. The fact that the Amsterdam Admiralty Board was not their sole client must have helped the merchants involved survive such large shifts in demand. In 1781 four of the biggest wood-suppliers to the Amsterdam chamber of the VOC also made substantial deliveries to the Admiralty Board.56

56 NA, Archief VOC, no. 7165. ‘Journaal boekhouder VOC juni 1780-mei 1784’. The four suppliers are Cornelis van Bavel, (selling f36,876 and f24,859 worth of wood to the Amsterdam chamber of the VOC and the Amsterdam Admiralty Board respectively), the firm Bontekoning & Aukes (f51,738 and f5,122), Herman van de Poll (f21,161 and f18,156), and Pieter van de Stadt (f11,959 and f649,058).
The ability of the Amsterdam Admiralty Board to actively switch between large suppliers rested on their close proximity to the main centers of wood trade in the Dutch Republic. The smaller Admiralty Boards, particularly those of Zeeland and Friesland, had to buy wood at longer distances and in all likelihood were much more vulnerable to monopoly practices of traders. For the Friesland Admiralty Board wood supply became a major problem in the run up to and during the Fourth Anglo-Dutch War. The ensuing problems show how completely dependent the Friesland Admiralty Board had been on the Amsterdam market. In the course of the war the Friesland Board had completely ceased payments to its main wood supplier, the widow of Jan Frederiks who also acted as a large supplier to the Amsterdam Admiralty Board during the same period. Her request to the States of Holland asking for support listed the phenomenal sum of f 945,950 in outstanding payment ordnances. A similar request of 28 creditors of Frederiks show that among those implicated in the Friesland forestallment of payment were the leading merchant-bankers Deneufville and Van der Hoop, as well as the large wood merchants Bontekoning and Van der Poll.

Smaller supplies
In contrast to the mighty merchant houses involved in supplying wood, by far the largest group of traders supplying the Admiralty Boards consisted of small or middle-size merchants and artisans who did not trade for more than f 10,000 per year, and often for less than f 1,000. Table 3.3 gives some figures for the distribution between large, middle and small size suppliers of the Amsterdam and Zeeland Boards for the seventeenth and eighteenth century. The large number of small traders involved indicates the great importance of naval supply for the development of local artisan economies. This was especially true in small towns such as Veere or Flushing, where a substantial part of the laboring and artisan communities were involved in supplying small ironware, textiles for the making of flags, transporting goods, or temporary jobs as subcontracting painters, woodcarvers or carpenters. Such small artisans were unable to exert the same pressures on Admiralty Boards as the large suppliers in order to enforce favorable prices. Small traders were also potentially more vulnerable to the long delays in payment customary in naval supplying. However, thanks to their proximity to the

58 NA, Archief admiraliteitscolleges XXXII, collectie Van Bleiswijk, no. 35. ‘Extracten Resoluties Staten van Holland’, 18 March 1784 and 4 August 1784.
59 Ibid, 29 June 1785.
Table 3.3  Distribution of suppliers to the Amsterdam and Zeeland Admiralty Boards

<table>
<thead>
<tr>
<th></th>
<th>Number of large suppliers (&gt; f 10,000)</th>
<th>Share in total supply</th>
<th>Number of middle-sized suppliers (f 1,000- f 10,000)</th>
<th>Share in total supply</th>
<th>Number of small suppliers (&lt; f 1,000)</th>
<th>Share in total supply</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Zeeland 1665</strong></td>
<td>19</td>
<td>72%</td>
<td>50</td>
<td>23%</td>
<td>152</td>
<td>5%</td>
</tr>
<tr>
<td>(Veere branch,</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flushing branch, and</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>receiver general)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Amsterdam 1691</strong></td>
<td>23</td>
<td>66%</td>
<td>107</td>
<td>29%</td>
<td>133</td>
<td>5%</td>
</tr>
<tr>
<td>(full account)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Zeeland 1781-1784</strong></td>
<td>6</td>
<td>64%</td>
<td>29</td>
<td>29%</td>
<td>69</td>
<td>7%</td>
</tr>
<tr>
<td>(only receiver general)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Zeeland 1781</strong></td>
<td>0</td>
<td>0%</td>
<td>9</td>
<td>39%</td>
<td>91</td>
<td>61%</td>
</tr>
<tr>
<td>(Flushing branch)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Amsterdam 1790</strong></td>
<td>16</td>
<td>59%</td>
<td>72</td>
<td>34%</td>
<td>109</td>
<td>7%</td>
</tr>
<tr>
<td>(full account)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Sources: NA, Archief Admiraliteiten, no. 1930 (Amsterdam 1691), no. 1941 (Amsterdam 1790), RAZ, Archief Rekenkamer C, no. 6980 (receiver general 1665), no. 38060 (Veere 1665), no. 35520 (Flushing 1665), no. 8050 (receiver general 1781-1784), no. 36930 (Flushing 1781).

Admiralty Boards and the influence that the Dutch political system allowed to the middle and upper layers of the artisan community at the local level, small suppliers did still manage to gain some economic protection. The resolutions of the Zeeland Admiralty Board of the 1650s and 1660s contain many examples where the receiver general acted at requests of individual merchants to grant them down payments on the arrears of masters of equipment.\(^{60}\) Similar protective measures were taken in Amsterdam. The 1744 regulation that opened up small supplies to public tendering at the same time stipulated a fine of three percent above the original price for each year of arrears suffered by traders.\(^{61}\) Other forms of protection included compensations for price fluctuations. A Zeeland resolution of 22 January 1657 granted a

\(^{60}\) E.g. NA, Archief Admiraliteiten, no. 2476. ‘Resoluties Zeeuws admiraliteitscollege 1657’, fol. 30, 32, 95, 108 vso.

\(^{61}\) NA, Archief Van der Hoop, no. 153. ‘Secrete missive’, 30 June 1751, 86.
supplier of iron nails who had waited since 1654 for payments of his deliveries that the nails would be bought at current market prices rather than the prices of 1654, thereby compensating for the stark rise in prices since the deliveries were made. Similar forms of local protection were still employed a century later, even in Amsterdam where the Admiral Board could choose from a much larger number of small suppliers. In 1779, for example, the Amsterdam Board accepted the request of suppliers of nails to compensate them for the price rise of fuels since their contracts were concluded by adding half a guilder per ship-pound to the previously established price for the duration of the entire year. Such protective measures show that the Admiralty Boards had some concern for the long-term maintenance of their supply networks, not only where large and powerful merchants were involved, but also touching the interests of the large mass of local small suppliers.

One common factor underlying all these different approaches to supply was the ease with which the Admiralty Boards could find credit, and the trust this emanated in suppliers that eventually their concerns would be met by the state. In this sense, the troubles that the Friesland Admiralty Board incurred on its major wood supplier were a real sign of crisis, conflicting with the reputation of Dutch public institutions. One British observer noticed:

‘The Lords of the Admiralty follow the same Methods which the States General observe, as to their publick Bonds, and go through this great Charge by the good Management of their Credit; for though it be true, that they are indebted great Sums of Money, yet they never want a Supply, nay, Moneys are often forced upon them by rich Merchants, who send in their Moneys and only take the Admiralties Bonds, with which they afterward pay their Customs, when their Ships arrive; at which Time the Admiralty allows them Interest for the Time they have had their Money. And this is what makes the Admiralty’s Bonds more valued than ready Money, for it saves the trouble of telling: And such is the Credit of the Admiralty, that when they have occasion for any Goods the People strive to furnish them, and rather take their Bonds than Money, because they get Interest: And all other Assignments upon the Admiralty are very punctually paid, and without Exchequor Fees; for they are Sworn Officers, who are forbid to receive any Moneys for Fees, being contented with the Salary they have from the States.’

---

64 William Carr, Travels through Flanders, Holland, Germany, Sweden, and Denmark. Containing an account of what is most remarkable in those countries (Amsterdam 1744) 10.
The great differences in organization of supply for different types of goods also underlines a conclusion drawn by Michiel de Jong in his study of the Dutch arms trade during the first half of the seventeenth century. De Jong noted the complex nature of early modern markets that forced the state to operate in a highly diversified way. Whereas in the provision of iron, canons, and guns state storehouses depended on the activity of large internationally operating merchants such as Trip and De Geer and good connections to industrial peripheries such as Liège and Sweden, for many other types of goods the state relied on locally oriented small scale handicraft production involving large numbers of artisans. The difficulty of sustaining supply networks while payment by the state remained highly erratic required creative ways of leaning on merchants’ ability to survive on credit without over-extending such reliance to the point where the supply networks would collapse. Doing so demanded a level of flexibility in operating on the market – as well as direct state support and a diversified system of state finance – for which the close personal connections between the state and economics elites proved an asset.\textsuperscript{65} The close ties of naval administrators to merchant communities have often been seen as a source of large-scale corruption and in-trading. Surely there are enough examples of this phenomenon, both for the seventeenth and eighteenth century. But on a whole it appears that Pieter de la Court’s positive judgment on the functioning of the federal, merchant directed structures of supply during the Second Anglo-Dutch War can be extended to later periods.

\section*{3.4 Naval shipyards as centers of production}

Naval shipyards not only influenced their surrounding economies as large scale buyers of products, but also acted as large scale producers in their own right. The Amsterdam shipyard became the second biggest production facility in the whole of the Dutch Republic, only surpassed by the adjacent and in many ways similarly organized shipyard of the VOC. The wharf stretched out over a length of 1,500 Amsterdam feet ($\pm$ 425 m), and was surrounded by a large wall. For most of the 1650s the terrain on which the naval shipyard was erected had been occupied by private shipyards working as sub-contractors of the Admiralty. In 1660 the

\begin{footnote}
\textsuperscript{65} De Jong, ‘\textit{Staat van oorlog’}, 348-350.
\end{footnote}
Admiralty councilors bought it of the city for the sum of £60,000. Just as the building of the adjacent naval storehouse, the move was closely connected to the new phase in naval competition that had started with the First Anglo-Dutch War.

The architecture of the shipyard reflected the many productive functions that it brought together. On entering from the street side, one first came at a square at which the workmen gathered at payday. Surrounding the square were houses of managing personnel, such as the two ‘under-masters of equipment’ and the master shipwright. At the other side were several stone sheds, one of which was used for the drying, heating and bending of wood. There also were numerous workshops:

‘Here, there is a large blacksmith’s shop, where anchors and many iron tools are made. Furthermore, special workshops for tin makers, sword smiths, carpenters and wainscoters, boat makers, gun-carriage makers, painters, mast makers, tackle makers, bricklayers, plumbers, oar makers, coopers, etc.’

A second four story warehouse was built at the other end of the terrain, mainly destined for the storage of voluminous pieces of equipment such as iron ballast, cables and rigging, and again housing a number of different workshops. In front of the wharf, there were slipways for larger and smaller ships and a floating dock. Next to the second storehouse was a cannon-foundry, and in front of it the large crane that was the most important labor saving device on the shipyard.

There were many similarities between the new Admiralty wharf and that of the VOC, the construction of which was started only two years later. In 1662 the Company directors were authorized to build a large storehouse. Its design was rectangular, not the square monolith that was its mirror institution, but its dimensions were practically the same (according to Wagenaar, the naval storehouse measured 44,000 square feet, while a map of the architect showed the VOC storehouse to be 44,520 square feet). The actual shipyard was somewhat smaller in ground surface than the Admiralty wharf, but did provide enough room for a large number of artisans’ workshops. In contrast to the Admiralty Board, the VOC did possess its own wood sawing mill (which the Admiralty Board acquired only at a much later

---

67 Wagenaar, *Amsterdam* II, 81-82.
68 Idem.
69 Ibid, 80, and De Haas, ‘Gebouwen’, 68.
date), butchery, and a special stone building for the refinery and storage of tar.\textsuperscript{70} In 1660, the VOC and the Admiralty Board decided to erect one joint building that housed their respective rope factories.\textsuperscript{71}

The new facilities provided the preconditions for a complete shift in naval production. Before 1660 the Amsterdam Admiralty Board had been fully dependent on private shipbuilders for the production of men-of-war. But this changed with the move to Kattenburg. Already during the Second Anglo-Dutch War, the Admiralty Board could take control over the production and repair of a large number of its own ships. In 1665 alone, it produced one ship of the first charter, two of the second charter, and two of the third charter on its own premises. At its seventeenth century peak during the 1690s the Admiralty Board was able to produce an average of four large warships a year. The number of large East India ships produced at the Amsterdam VOC wharf during the one and a half century of its existence far surpassed the number of chartered men-of-war produced by the Admiralty (see table 3.4 and charts 3.1 and 3.2). But at times of war, the Admiralty Board was capable of producing on as large a scale as the VOC. Moreover, the shipyards were not only used for building new ships but also for running maintenance work on existing ships throughout the year. When the French master shipwright Blaise Ollivier visited Amsterdam in August 1737, he noted that one of the four slipways was in use for the building of a large ship, and the other three for maintenance work on three smaller yachts, so that even in a year in which no ships were actually finished, all slipways were in use.\textsuperscript{72} The answers of the Amsterdam Admiralty Board to a questionnaire on building and repair at the shipyards shows that the repair of old ships took more than a quarter of all wage costs in 1776, and over a third in 1780.\textsuperscript{73}

The expansion of naval facilities that took place in Amsterdam in the 1650s and 1660s created a huge gap in capacity with the other naval shipyards. Important extensions of the facilities were made in the naval establishments of the Admiralty Boards of Rotterdam, Zeeland, the Holland Northern Quarter and Friesland, but all of these were dwarfed by those of Amsterdam. Furthermore, most of them did not exhibit the same concentration of facilities

\textsuperscript{70} The collection of Johan Cornelis van der Hoop in the archive of the Admiralty Boards contains documents considering the advantages of buying wood-sawing mill \textit{De Groote Otter}, which later indeed was in the possession of the Admiralty. NA, Archief Admiraliteitscolleges XXXIX, J.C. van der Hoop 1524-1825, no. 157.
\textsuperscript{72} David H. Roberts (ed), \textit{18th Century shipbuilding. Remarks on the navies of the English & the Dutch from observations made at their dockyards in 1737 by Blaise Ollivier, master shipwright of the King of France} (Rotherfield 1992) 317.
\textsuperscript{73} NA, Archief Van der Hoop, no. 151. ‘Bylaagen behoorende tot de Missive en Memorie door Zyne Hoogheid den Heere Prince van Orange en Nassau aan hun Hoog Mogende op den 7 October 1782 overgegeven’, 71-72.
Table 3.4  Number of ships built per decade by the Amsterdam Admiralty shipyard, Rotterdam Admiralty shipyard, and the VOC shipyard, 1661-1780

<table>
<thead>
<tr>
<th>Years</th>
<th>Amsterdam Admiralty shipyard</th>
<th>Rotterdam Admiralty shipyard</th>
<th>Amsterdam VOC shipyard</th>
</tr>
</thead>
<tbody>
<tr>
<td>1661-1670</td>
<td>24</td>
<td>9</td>
<td>43</td>
</tr>
<tr>
<td>1671-1680</td>
<td>16</td>
<td>4</td>
<td>43</td>
</tr>
<tr>
<td>1681-1690</td>
<td>23</td>
<td>10</td>
<td>34</td>
</tr>
<tr>
<td>1691-1700</td>
<td>43</td>
<td>22</td>
<td>55</td>
</tr>
<tr>
<td>1701-1710</td>
<td>17</td>
<td>13</td>
<td>57</td>
</tr>
<tr>
<td>1711-1720</td>
<td>16</td>
<td>1</td>
<td>41</td>
</tr>
<tr>
<td>1721-1730</td>
<td>14</td>
<td>4</td>
<td>34</td>
</tr>
<tr>
<td>1731-1740</td>
<td>20</td>
<td>3</td>
<td>49</td>
</tr>
<tr>
<td>1741-1750</td>
<td>10</td>
<td>5</td>
<td>53</td>
</tr>
<tr>
<td>1751-1760</td>
<td>18</td>
<td>6</td>
<td>29</td>
</tr>
<tr>
<td>1761-1770</td>
<td>18</td>
<td>4</td>
<td>28</td>
</tr>
<tr>
<td>1771-1780</td>
<td>8</td>
<td>4</td>
<td>27</td>
</tr>
<tr>
<td>1781-1790</td>
<td>30 (est.)</td>
<td>19</td>
<td>33</td>
</tr>
<tr>
<td>Total 1661-1790</td>
<td>227 (est.)</td>
<td>104</td>
<td>526</td>
</tr>
</tbody>
</table>


reached in Amsterdam, where storage and shipbuilding were all centered on one single terrain. In the Northern Quarter and Zeeland, institutional barriers prevented drawing together all facilities in one single place. In the case of the Northern Quarter, the fact that Hoorn and Enkhuizen took turns as the site of the Admiralty Board was a strong reason for maintaining facilities in both towns.\(^{74}\) None of the two possessed its own wharf, and even the storage

\(^{74}\) Thurkow, Westfriese admiraliteit.
Chart 3.1  Warships built at the Amsterdam Admiralty shipyard, 1661-1780

Source: NA, Admiraliteitscolleges XXXII, Pieter van Bleiswijk 1690-1787, no. 10. ‘Lyst der Oorlogscheepen & Fregatten, gebouwd door het collegie ter Admiraliteit van Amsterdam zeedert Ao 1654 tot den Jaaren 1780’.

Note on charts 3.1 and 3.2: Both charts only contain the larger ships built at the shipyards, not the small yachts and challoys. The VOC list also does not include four small mail ships, or ships that were built for other users than the VOC. The subdivision in categories is the one used in DAS, and is based on estimated tonnage. Category 1 are the largest ships of over 1000 tons, category 2 ships of 800-1000 tons, category 3 of 500-800 tons and category 4 the smaller ships of less than 500 tons. These categories do not neatly match the division in charters used for warships, based on numbers of cannons rather than tonnage. Since no tonnage was available for the ships built at the Admiralty wharf, an approximation was used based on the dimensions of the ships. Of course this does not give tonnage figures, since for this the square dimensions (length x weight x height, or $l \times w \times h$) have to be adapted for the form of the hull. However, since the aim here is only to make a comparison with the large categories applied to VOC ships in DAS, also based on a simple adaptation of $l \times w \times h$, this very rough measure for calculation suffices. Based on the dimensions of a selection of VOC ships for each category, the division used to categorize Admiralty ships was: Category 1: $(l \times w \times h) > 105,000$ cubic ft, category 2: $105,000$ cubic ft $> (l \times w \times h) > 80,000$ cubic ft, category 3: $80,000$ cubic ft $> (l \times w \times h) > 50,000$ cubic ft, category 4: $(l \times w \times h) < 50,000$ cubic ft.
facilities were rather limited. So little maintenance work took place there that the Admiralty Board reported in 1751 that the naval storehouses were practically empty. Any new plans for building would have to be fulfilled by contracting private yards.\(^{75}\) In Zeeland, the political influence in the Admiralty Board of competing towns allowed Vlissingen, Veere, Middelburg and Zierikzee each to hold on to their own slice of equipping ships. For practical reasons, the building and maintenance of larger ships took place primarily in Veere and Vlissingen, and for most of the eighteenth century only in the latter.\(^{76}\) The advantage of Vlissingen over the other Zeeland harbors was due to a large and costly modernization undertaken at the end of the seventeenth century. From 1705 onwards, this town even had its own dry-dock. However, due to financial problems the building of new ships was reduced to a minimum. Between

\(^{75}\) NA, Archief Van der Hoop, no. 153. ‘Secrete Missiven’, 30 juni 1751, 100.

1714 and 1795, the Zeeland Admiralty Board only oversaw the building of nineteen ships of the line on its own wharfs.\textsuperscript{77}

The Rotterdam Admiralty Board also divided shipbuilding and maintenance over two different locations, but this had practical rather than institutional reasons. Hellevoetsluys, situated near the estuary of the Meuse, had become one of the main bases of operation of the Dutch fleet, so it was logical to maintain a large dock, storehouse, and some facilities for maintenance there. Shipbuilding was concentrated in Rotterdam where the Admiralty Board possessed a shipyard with three slides of 140-150 feet in length and 40 feet in width.\textsuperscript{78} At approximately the same time as the building of the Amsterdam storehouse, the Rotterdam Admiralty Board had built two new storehouses and a large crane to upload and unload heavy anchors. A year later a cannon foundry was built nearby.\textsuperscript{79} In 1737 the French shipwright Blaise Ollivier judged the Rotterdam facilities to be ‘peu considerables’.\textsuperscript{80} Nevertheless the Rotterdam shipyard was the second in terms of capacity, producing over a hundred warships (disregarding ships carrying less than ten pieces) between 1660 and 1790 (see table 3.4).

Lastly, the case of the Friesland Admiralty Board illustrates well what devastating effects the long eighteenth century lull in large scale shipbuilding had on the readiness of naval facilities. In order to be able to execute the large program of shipbuilding that took place between 1779 and 1785, resulting in the building of twelve ships of the line on the naval wharf, the Admiralty Board had to completely renew its shipyard and harbor. Four new slipways, a carpenter’s shed and a loft for the laying out and storage of ship moulds were erected, and the harbor and major passageway were dredged.\textsuperscript{81} Despite all effort, the passageway proved not wide enough for the two largest ships of seventy pieces. The ships never left the harbor, and finally were taken apart without ever having been used in 1792.\textsuperscript{82} Unsurprisingly, this fiasco became one of the major exhibits in the discussions on the incapacity of Dutch naval institutions outside Amsterdam and Rotterdam that raged at the end of the eighteenth century. But these failures of the smaller Admiralty Boards at the end of the seventeenth century should not distract from the huge and continuing impact of especially the Amsterdam shipyard on the landscape of production in the Dutch Republic.

\textsuperscript{77} Ibid, 83.
\textsuperscript{78} Roberts (ed), \textit{Observations made by Blaise Ollivier}, 317.
\textsuperscript{79} Gerard van Spaan, \textit{Beschrivving der Stad Rotterdam, en eenige omleggende dorpen} (Rotterdam 1738) 384-385.
\textsuperscript{80} Roberts (ed), \textit{Observations made by Blaise Ollivier}, 317.
\textsuperscript{81} Roodhuyzen-van Breda Vriesman, ‘Onfrisse Friese zaken’, 99-100.
\textsuperscript{82} Ibid, 107.
3.5 Shipyards and their workforce

Together, the Admiralty Boards and the VOC laid a large claim on the labor-market. Again, this was nowhere more true than in Amsterdam. Private shipyards in Amsterdam, the shipbuilding area of the Zaan, and Rotterdam usually employed around a hundred workers at most.\(^{83}\) The two shipyards at Kattenburg and Oostenburg were of an altogether different category. During the eighteenth century, the Amsterdam chamber of the VOC employed between 1100 and 1300 workers at their shipyard and storehouse.\(^{84}\) For the Admiralty shipyard, the figure of ‘more than thousand’ is mostly maintained.\(^{85}\) As an average, this is probably correct. But at least at one point during the eighteenth century, at the start of the Fourth Anglo-Dutch War, the Amsterdam shipyard included on its payroll almost double that number, temporarily making it the largest single employer of the Dutch Republic.

A detailed picture of the total number of workers and the internal division of the workforce can be obtained from two documents, both from the eighteenth century. The first is a report for the States General from 1751, giving extensive information on the employment at the different departments of the wharf and storehouse for the years 1733 and 1744. The second is a complete account of all the salaries and wages paid to officials and workers of the Amsterdam Admiralty Board in 1781. The extensive information on the number and different type of workers produced by these documents is summarized in table 3.5.

These figures show the great flexibility of the number of workers employed. In 1733 the size of the workforce at the Admiralty shipyard must have been approximately equal to that of the VOC. Between 1733 and 1744 the Admiralty Board laid off almost a third of its workforce, reflecting the sharp decline in output of new built ships during the 1740s. Meanwhile the VOC-wharf expanded due to a boom in shipping. In the run-up to and during the Fourth Anglo-Dutch War, when the Amsterdam Admiralty Board engaged in a major program of shipbuilding at the same time as having to manage the equipment of the existing war fleet, total employment once again rose steeply. The total size of the workforce at the

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<th></th>
<th>1733</th>
<th>1744</th>
<th>1781</th>
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<tr>
<td>Shipwrights</td>
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<td>Shipwrights' helpers</td>
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<tr>
<td>Boat makers</td>
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<td>33</td>
<td>99</td>
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<td>Wainscotters</td>
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<td>Wood workers</td>
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<tr>
<td>Mast makers</td>
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<td>Chip gatherers</td>
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<td>Wood cutters</td>
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<td><strong>Sub-total A</strong></td>
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<td><strong>B. Other craftsmen</strong></td>
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<td>Carpenters</td>
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<td>Rolling stock makers</td>
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<td>Bricklayers</td>
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<td>Compass makers</td>
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<tr>
<td>Sword makers and their helpers</td>
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<tr>
<td>Saddle makers</td>
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<tr>
<td>Sail makers</td>
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<tr>
<td>Clog makers</td>
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<tr>
<td><strong>Sub-total B</strong></td>
<td>158</td>
<td>132</td>
<td>222</td>
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### C. Other workers, mainly unskilled

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<th>Category</th>
<th>1775</th>
<th>1781</th>
<th>1788</th>
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<tr>
<td>Carriers</td>
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<td>Beer carriers</td>
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<td>Unspecified workers</td>
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<tr>
<td>Pump servants</td>
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<tr>
<td>Rowers</td>
<td>15</td>
<td>15</td>
<td>14</td>
</tr>
<tr>
<td>Skippers, boatsmen and sailors on yachts and transport ships</td>
<td>43</td>
<td>61</td>
<td>38</td>
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<td><strong>Sub-total C</strong></td>
<td><strong>352</strong></td>
<td><strong>272</strong></td>
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</table>

### D. Supervisors and guards

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<th>Category</th>
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<th>1788</th>
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<tr>
<td>Supervisors (masters, their servants, commanders, vice-commanders)</td>
<td>62</td>
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<td>73</td>
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<tr>
<td>Guards</td>
<td>56</td>
<td>52</td>
<td>42</td>
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<tr>
<td>Porters</td>
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</tr>
<tr>
<td>Other controlling personnel</td>
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</tbody>
</table>

| Total (A + B + C + D)                                                  | **1200**| **826**| **1970**|


The speed of expansion and contraction before and after war can also be gauged from the expenses on labor costs. One of the standard posts on the receiver general’s yearly accounts to the Generalty Audit Office was reserved for ‘wages of shipwrights and carriers’. These included the wages of all non-managerial personnel at the naval shipyards (shipyard managers were included under the heading of salaries, ‘tractementen’). Chart 3.3 shows the development of wage costs on the Amsterdam accounts between 1775 and 1788. From less than f 400,000 a year, they rose to just short of a million guilders in 1781 when employment at the shipyard reached its eighteenth century highpoint. This figure again affirms the large capacity of the Admiralty shipyard. In his summary of the VOC ledgers for the eighteenth century, De Korte gave the average annual wage costs as...
under half a million guilders before 1730, than rising to \( f 530,000 \text{ to } f 550,000 \) until 1780, falling back to \( f 500,000 \) a year in the 1780s. Gawronski has suggested on the basis of a different account that the wage costs during the boom years in shipbuilding of the 1740s might have been close to a million guilders for the VOC as well, but as he points out, these figures probably include all sorts of non-wage expenditures. However, the workforce of the naval shipyard was subject to much larger fluctuations than that of the VOC shipyards. During the 1780s, as soon as the war ended wage costs were brought back to their pre-war level.

In comparison to the size of the workforce of the other Admiralty Boards, the Amsterdam naval shipyard was a Moloch. The smallest numbers were employed by the Admiralty Boards of the Northern Quarter and Zeeland. The Admiralty Board of the Northern Quarter did not possess its own wharf, and even in 1680 when its role in equipping was still bigger than during the eighteenth century only employed two shipwrights, one cannon

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86 J.P. De Korte, *De jaarlijkse financiële verantwoording in de Verenigde Oostindische Compagnie* (Leiden 1984) appendix 12A and 12B.
founder and twenty-four carriers in permanent service.88 A careful estimate of the workforce of the Zeeland Admiralty Board shows that even in the peak years 1654 and 1665-1666 the different naval establishments did not employ much more than some tens of workers at their shipyards.89 This must have dropped to an absolute minimum in the course of the eighteenth century, when the Zeeland Admiralty Board often carried out hardly any shipbuilding and maintenance work. From January 1781 to July 1784, in the midst of the Fourth Anglo-Dutch War, the master of equipment of the Vlissingen shipyard noted a total of about £220,000 for ‘wages of shipwrights, blacksmiths, carriers, and other workers’, or an average of just over £60,000 per year.90 This made even the biggest Zeeland shipyard considerably smaller than the VOC shipyard in Middelburg, which employed about 600 workers in 1790.91

The Admiralty Boards of Friesland and Rotterdam employed more workers, the latter being the largest of the two. For Rotterdam, two handwritten transcriptions from the late eighteenth century survive containing both ordinary and extra-ordinary expenditure of the Rotterdam receiver general over a number of selected years. These include the early years 1642, 1668, and 1675 for which no accounts are present in the archive of the Generality Audit Office. The documents also split the wage costs for the facilities at Rotterdam and Hellevoetsluys. Table 3.6 summarizes the information on total wage costs they provide. For 1751 a report of the Admiralty Board of Rotterdam on the state of the naval shipyards provides more detailed information on the employment at the shipyards and storehouses, giving a combined total of just over 225 workers, of whom 25 were supervisors, at the two locations.92 At the start of the Fourth Anglo-Dutch War wage costs at the Rotterdam shipyards and storehouses almost quadrupled. This expansion was proportionally bigger than that of the Amsterdam shipyard during the same year. Making a rough estimate based on these available figures, it is safe to assume that all five Admiralty Boards taken together employed no more than between 1200-1500 workers during the quiet 1740s, but expanded their workforce to somewhere between 3000-3500 at the start of the Fourth Anglo-Dutch War, reducing it again quickly once the war was over.

88 NA, Archief Van der Hoop, no. 163. ‘Staet van de Tractementen, Emolumenten, Necessiteiteten, Vacatien, ende andere onkosten ten laste van het Collegie ter Admiraliteit in West-Vrieslandt ende het Noorder-Quartier, 1680’.
91 Gaastra, Dutch East India Company, 145.
### Table 3.6 Sums paid on wages by the receiver general of the Rotterdam Admiralty Board, selected years (guilders)

<table>
<thead>
<tr>
<th>Year</th>
<th>1642</th>
<th>1668</th>
<th>1675</th>
<th>1683</th>
<th>1712</th>
<th>1721</th>
<th>1750</th>
<th>1776</th>
<th>1782</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wage costs in Rotterdam</td>
<td>24,615</td>
<td>20,257</td>
<td>3,119</td>
<td>11,722</td>
<td>8,079</td>
<td>40,332</td>
<td>51,405</td>
<td>65,731</td>
<td>287,359</td>
</tr>
<tr>
<td>Wage costs in Hellevoetsluis</td>
<td>0</td>
<td>24,813</td>
<td>3,304</td>
<td>40,748</td>
<td>2,408</td>
<td>36,138</td>
<td>51,805</td>
<td>55,230</td>
<td>123,380</td>
</tr>
<tr>
<td>Wage costs at the rope factory</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>7,187</td>
<td>1,460</td>
<td>2,246</td>
<td>3,776</td>
<td>7,662</td>
</tr>
<tr>
<td>General wage costs (location unknown)</td>
<td>26,535</td>
<td>45,523</td>
<td>18,070</td>
<td>2,536</td>
<td>17,473</td>
<td>3,000</td>
<td>2,750</td>
<td>1,859</td>
<td>26,740</td>
</tr>
<tr>
<td>Total</td>
<td>51,150</td>
<td>90,593</td>
<td>24,493</td>
<td>55,006</td>
<td>35,147</td>
<td>80,930</td>
<td>108,206</td>
<td>126,596</td>
<td>445,141</td>
</tr>
</tbody>
</table>

Sources: NA, Archief Admiraltieitscolleges XXXVII, Van der Heim, nos 365-366. ‘Ordinaris en extra-ordinaris rekeningen van de Ontvanger Generaal van de Admiraliteit op de Maze, 1642-1782’.

### 3.6 Admiralty Boards and the labor market

How did the Admiralty Boards recruit these large numbers of often specialized workers? De Vries and Van der Woude have stressed the ‘modern’ nature of the Dutch labor market. As characteristics of this developed market they pointed at the strong internal segmentation, high wage levels and the combination of large scale unemployment and temporary, season-bound labor shortages, which were met by employing cheap migrant labor.\(^{93}\) Lucassen emphasized the fact that the Dutch Republic was perhaps the only country before the industrial revolution with a fully ‘free’ labor market, meaning that economic force had replaced physical force, bondage, and penal law as the main instrument in recruiting labor power. Personal arrangements between masters and servants or employers and their workforce were substituted by impersonal relations.\(^{94}\) Furthermore, recent literature showed that the

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\(^{93}\) Jan de Vries and Ad van der Woude, *First modern economy*, 654.

proliferation of guilds during the sixteenth and seventeenth centuries did not contradict or impede this development. As one of the largest manufacturing employers of the Dutch Republic, the Amsterdam naval shipyard forms an important case-study for those claims.

The number of different jobs among the shipyard’s workforce meant that it strongly reflected the existing social segmentation of the labor market. Descriptions of labor relations at the shipyards often look only at the position of shipwrights. With a daily wage of thirty stuuyvers in summer and twenty in winter, they formed the best paid section of the Admiralty workforce. However, the majority of the workforce had wages far below this level. Table 3.7 gives an impression of the internal wage differentiation among workers at the wharf. As was true for most sections of the urban working classes, nominal wages remained remarkably stable from the middle of the seventeenth century until the nineteenth century so that this table can be safely taken as an indication for the entire period under investigation. But because workers were paid per day, equal wage rates could conceal great fluctuations in income. The table gives two different calculations. The first is the income based on the maximum number of working days per year, based on a working week of six days and subtracting holidays. The second is the income calculated on the number of working days mentioned in a request of shipwrights to William IV from December 1749. Apart from Sundays and holidays, workers complained of the many days involuntarily lost because of rain or high water (45), sickness, or the lack of work (36). The actual yearly income is likely to have been somewhere between these two extremes. Together, these figures give a good impression of the high level of internal segmentation among shipyard personnel, even strengthened by the existence of a large number of intermediate scales.

For those who managed to attain permanent contracts, employment at the Admiralty yard often was a much better deal than the day rate suggests. This is due to the many hidden forms of payment that existed. A payroll of the Rotterdam Admiralty Board from March 1751

Lucassen himself pointed out, this freedom did not extend to the Dutch possessions overseas. Furthermore, sailors and soldiers frequently suffered semi-forced ways of recruitment through the practices of so-called ‘zielverkopers’ (soul-sellers), who used debt as an effective means of impressment.


Table 3.7  Wages of different categories of laborers at the naval shipyard, 1781

<table>
<thead>
<tr>
<th>Wages (summer/winter)</th>
<th>Income based on 306 (max) working days</th>
<th>Income based on 226 working days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shipwrights and other skilled craftsmen</td>
<td>30 / 20 st</td>
<td>f421</td>
</tr>
<tr>
<td>Painters, bricklayers, plumbers and other semi-skilled craftsmen</td>
<td>24 / 18 st</td>
<td>f344</td>
</tr>
<tr>
<td>Carriers and other unskilled workers</td>
<td>16 / 14 st</td>
<td>f237</td>
</tr>
<tr>
<td>Apprentices, beer carriers, etc.</td>
<td>8 / 6 st</td>
<td>f115</td>
</tr>
</tbody>
</table>


shows that many guards, though formally on daily pay, actually received this wage thirty-one days a month, plus ten stayvers for every night watch. In this way, all twenty-three guards received a monthly wage of over thirty guilders, more than many of the skilled craftsmen employed by the Admiralty Board.98 Becoming a guard for the Admiralty Board thus became a career opportunity for lower-paid workers. Cornelis van Oeveren, who was a not unsuccessful cart maker in Rotterdam before 1747, used the clout he had built around himself during the Orangist revolt of that year to attain a position as guard, and according to his own testimony fared well from it.99 Similar advantages were common in Amsterdam as well, although during the 1740s the Admiralty Board tried to limit the number of people on seven days’ pay to a small group of people who either actually remained in function the whole week, or were ‘of special knowledge and capacities’.

However, the position of these relatively well paid workers tells only half the story. This is shown by the detailed wage administration of the rope factory of the Amsterdam Admiralty Board that survived. On the upper end of the scale, the wage lists include Steven Duijm, who was already employed in a supervising position at the time when the first available list was made up in 1719, and retained this function at least until 1752. Duijm

99 Levensbeschryving van Cornelis van Oeveren, eertyds wagenmaker, en sedert hellebaardier by het Ed. Mog. Collegie ter Admiraliteit op de Maze, te Rotterdam; (...). Uitgegeven naar zyn eigen handschrift (Rotterdam s.d.. [1787])
100 NA, Archief Van der Hoop, no. 153. ‘Secrete Missiven’, 30 June 1751, 74.
received a wage of twenty *stuyvers* a day, later raised to twenty-five *stuyvers*, for 366 full days per year. This brought his yearly income at maximum at the ample sum of *f* 481.25. However, wages of most workers stood at fourteen to sixteen *stuyvers*, and there also were many on the list (probably children or apprentices) not paid more than five or six *stuyvers*. Furthermore almost all workers received pay only for the days worked, and most were not hired during the entire period that they were available for work. The 1730 wage administration, for example, shows how the ordinary worker Jan Poortman was employed during each of the thirteen pay periods, but not for the full length of each period. In total, he worked just over 250 days for sixteen *stuyvers* in summer and fourteen *stuyvers* in winter, bringing his yearly income at *f* 206. Of the seventy-nine workers on the 1730 wage list, only thirty-seven were in such ‘permanent’ employment, defined here as having some work during at least ten out of thirteen pay periods. Their average yearly income from the rope factory amounted to *f* 178 guilders. It is impossible to tell whether these workers could add to their incomes by other means, but the figures do attest to the great dependence of the Admiralty Board on low paid, temporary or even day laborers on very insecure incomes. Alternately, the fact of this continued dependence also suggests that on the developed labor market of the Republic, these low wage workers could be found with relative ease so there was no need for the Admiralty Boards to offer more stable working conditions. This situation must also have prevailed for carriers, at most times forming the largest single group of workers at the shipyard and storehouse. As a study of representations of labor in the Dutch seventeenth century notes, carriers were the ‘omnipresent stage extras’ of the Dutch Golden Age.

Several types of carrying labor, such as that of rye and peat, were organized into rather influential guilds, but carrying on the naval shipyard was done by non-guild workers. With large numbers of urban poor and recent immigrants from low wage regions, this labor was in chronic oversupply.

The existence of bonuses and internal career opportunities for a select group within the workforce must have made the Admiralty Board a relatively attractive employer. Furthermore, in binding its workforce economically it could make tactical use of the fact that it operated not one, but two recruitment systems for cheap labor: one on land, the other at sea. This became of particular importance after the 1720s when the number of ships sailing for the

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101 NA, Archief van de lijnbaan in Amsterdam 1712-1892, no. 8-10. ‘Betalingsboek spinders en draijers’, 1719-1727, 1727-1734, and 1735-1753.

102 NA, Archief van de lijnbaan in Amsterdam 1712-1892, no. 9. ‘Betalingsboek spinders en draijers’, 1727-1734.

103 Annette de Vries, Ingelijst werk. De verbeelding van arbeid en beroep in de vroegmoderne Nederlanden (Zwolle 2004) 196.
marine declined. Letting go of all experienced sailors would have been a dangerous step, given the sharp competition the naval authorities faced from the merchant fleet and the VOC in the area of recruitment of sailors. Thus, the Admiralty Board decided to establish special work gangs of carriers (so-called *vemen*) consisting solely of non-commissioned officers (NCOs). The condition for admission was that these NCOs would not refuse to sign up for the navy when the occasion arose, and would not take employment with any other company without prior knowledge of the Admiralty Board.\(^{104}\) In 1733 the same arrangement was extended to sailors who had served the marine during at least two voyages, were between eighteen and fifty years of age, and could show a declaration of good behavior from their officers. Most non-skilled jobs at the shipyard were opened for these former seafarers.\(^ {105}\) In 1744, with greater need to preserve able sailors given the Dutch implication in the War of the Austrian Succession but fewer available positions on the wharf, the directors limited access to the gangs to ‘the very best men’. They asked officers to draw up lists of their sailors in order to decide who was to be allowed jobs on shore.\(^ {106}\)

In this way, the Amsterdam Admiralty administrators could make use of internal shifts in supply and demand of labor power, using economic means to guarantee a reservoir of experienced seafarers. What they could not do, however, was using force to impress these same workers when they felt that the need arose. The unattractiveness of life on board of warships – with its high mortality rates, horrid quality of food and harsh discipline – made many NCOs decide to ignore the conditions of their employment at the wharf. In 1762 the Admiralty Board decided to start diminishing the number of officers on the yards, noting

> ‘the difficulties that have risen in making the NCOs serve on the new ships, because they often decline to do so; and though they are dismissed from the nation’s wharf, they then have often already drawn money [meaning their wages] from this wharf for years, without in the end serving the beneficial purpose of this Board.’

Signifying the relative ease with which workers moved in and out of employment, the Admiralty Board also had to order that NCOs who had been previously dismissed from the shipyard for refusing service could not be re-admitted into service at the wharf at a later stage.\(^ {107}\)

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\(^{105}\) Ibid, 36.

\(^{106}\) Ibid, 68.

\(^{107}\) UB-BC, *Extracten*. ‘Extract from the minutes of the Amsterdam Admiralty Board, 9 February 1762’.
More difficult than the securing of low- or unskilled labor was the recruitment of skilled shipwrights. According to the figures of Hart, which are based on the records for marriages and therefore incomplete, there were around a thousand skilled shipwrights in Amsterdam during the second half of the seventeenth century.\textsuperscript{108} Around the middle of the eighteenth century the shipwrights’ guild had some 1500 members, including both masters and journeymen.\textsuperscript{109} While traditionally masters and supervisors had played a big role as intermediaries in the recruitment of personnel, the appointment of set places where workers could solicit for employment signals a transition to more impersonal practices. Wagenaar described how this form of recruitment worked:

‘Shipwrights who are looking for employment must gather in the morning half an hour before the sounding of the bell of the Admiralty wharf at the Kadyk near the Kattenburg Bridge, or at the start of the Bicker-street, and in the afternoon, between twelve and one, at the New Bridge. They are not allowed to accept employment along the way, or at any other place.’\textsuperscript{110}

However, it is well possible that this method of recruitment reflected the rather unfavorable conditions of the mid-eighteenth century, when many shipwrights at the Admiralty wharf had lost employment due to recent reduction of the workforce. The large demand of the two big shipyards and the limited number of skilled workers meant that at other times the Admiralty Board and the VOC had to engage in serious competition with the private shipyards. These yards paid higher day wages, and often added better possibilities to achieve bonuses. Support from the town government in part helped to shield the big wharfs from this competition, often at the cost of their workers. Private shipyards were prohibited to hire unemployed shipwrights from the VOC or Admiralty yards as long as shipwrights who used to work on private yards were available. If this was not the case, former VOC or Admiralty workers were allowed to work for selected masters only, and on the condition that they could be rehired by the two ‘principle wharfs’ as soon as this would be considered necessary.\textsuperscript{111} Furthermore, the Admiralty Board and VOC were exempted from the rule that new ships could only be built by


\textsuperscript{110} Ibid, 460.

\textsuperscript{111} Idem.
workers that were members of the guilds. This exemption was strongly contested by guild members since wages for non-guild workers were lower than for guild workers, but without success.\textsuperscript{112} In 1781 the Amsterdam Admiralty Board employed 281 non-guild shipwrights, alongside the 367 members of the guild.\textsuperscript{113}

Finding enough skilled workers to work at the yards at times of war could prove very hard indeed. Both the Amsterdam and Rotterdam Admiralty Boards blamed their slowness in building new warships in the run up to the Fourth Anglo-Dutch War on a lack of skilled personnel. According to the Amsterdam Admiralty Board, building could have been taken to hand at full speed

‘if the lack of shipwrights in the years 1777, 1778, 1779, and 1780, caused by the many merchant ships that were built and repaired, would not have hindered us; a problem which, despite of all attempts of and orders to our master shipwright to recruit more laborers, we could not remedy.’

Only when commercial shipping declined because of the arrival of war, leading to the layoff of many workers at the private shipyards, the Amsterdam Admiralty Board managed to find enough workers to start its building program at full speed.\textsuperscript{114} This suggests that the Admiralty Board did not have many means to manipulate the labor market before a change of conditions led to an increase in availability of skilled labor.

Problems were even greater for the Rotterdam Admiralty Board, which had to resort to a series of more drastic measures to attract shipwrights. In the quiet years since the Seven Years’ War, the Admiralty councilors alleged, the position of the Admiralty Board on the labor market had sharply deteriorated. There were rumors suggesting that many unemployed shipwrights had emigrated to the East Indies or taken employment at sea. Others had left the Admiralty Board to work for private shipyards where they could earn bonuses over and above their regular wage. The result was that when the Admiralty Board needed to expand its workforce during the second half of the 1770s, it had to offer passes for workers from outside the Republic, employ unqualified carpenters, wagon makers, and mill makers as shipwrights, and force those who were already employed by the Admiralty Board to work on Sundays and at night hours. Significantly, the Rotterdam Board offered premiums to master shipwrights, supervisors, and under-supervisors if they managed to recruit workers, showing that at the

\textsuperscript{112} NA, Archief Stadhouderlijke Secretarie, no. 467. ‘Request aan Willem IV van 6 december 1749.’
\textsuperscript{113} NA, Archief Admiralty Colleges XXXIX, J.C. van der Hoop, no. 104. ‘Dagloonen’.
\textsuperscript{114} NA, Archief Van der Hoop, no. 151. ‘Bylaagen’, 63-64.
smaller Admiralty shipyards these groups probably retained a strong role as intermediary links to the labor market. When none of this proved sufficient to solve the labor shortage, the Admiralty Board requested from the States of Holland to order the bosses at the private wharfs to yield one-fourth or one-fifth of their workers to the Admiralty shipyard, a measure that also had been in place during the war year 1747-1748. The owners of the private yards offered a compromise, promising to send one in six of their workers.\footnote{Ibid, 34-36, and 56-57.}

An interesting question is why such sharp shifts in the balance of supply and demand on the labor market did not lead to any fluctuations in the nominal wage rate. One of the possible answers lies in the exceptionally good conditions of shipwrights as compared to other workers, as Lucassen pointed out for the roughly 350 skilled workers at the VOC yard. Not only was their wage rate higher than that of most skilled workers, they also enjoyed favorable secondary conditions such as severance pay and old age provisions.\footnote{Lucassen, ‘Multinational’, 29.} In 1781 a total of seventy-two former workers at the Admiralty wharf and storehouse received such ‘pensions’. Nevertheless, with unchanging nominal wages inflation could have a serious impact on living conditions, raising the question why a relatively powerful group of workers would not try to compensate for this by demanding higher wages. Another factor should therefore be taken into account: the dampening of wage pressures by the large potential differences between wage rate and actual income due to fluctuations in the occupation rate.\footnote{The significance of this factor was already pointed out by Leo Noordegraaf and Jan Luiten van Zanden, ‘Early modern economic growth and the standard of living. Did labour benefit from Holland’s Golden Age?’, in: Davids and Lucassen (eds), \textit{A miracle mirrored}, 410-437, 425.} When high inflation coincided with an expansion of the number of days worked, a decline in real wages did not have to signify an actual decline in income. Especially for workers at the naval shipyards, it is likely that price increases and increasing labor intensity often coincided. While prices remained relatively stable during peace years well into the eighteenth century, periods of sharp inflation until that time always coincided with wars in which the Dutch Republic was involved. During these periods the Admiralty shipyards worked at full speed. Only from the 1740s onwards this pattern was broken. The combination of the policy of neutrality of the Dutch Republic and the prolonged financial distress of the Amsterdam Admiralty Board resulted in a series of sharp attacks on the secondary benefits of shipyard workers and decreasing employment, coinciding with steep inflation. It seems no coincidence that by the end of this decade shipwrights systematically started putting forward wage demands for the
first time. However, the long and severe depression in the manufacturing sector during the second half of the eighteenth century did not prove conducive for winning their demands.

Overall, the recruitment and employment of workers by the Amsterdam Admiralty Board accords well with the ‘modern’ characteristics of the Dutch labor market as listed at the start of this section. Both because of its size and because of its backing by the state the Admiralty Boards could and did try to manipulate the supply and demand of labor, often at the cost of the freedom of movement of their workers. But despite the apparent rigidity of the wage system, it did so primarily by economic means. Large differences in internal wage scales, the use or restriction of bonuses, promising long-term employment or effectively using the threat of unemployment, and the existence of possibilities for internal replacement of labor helped to stabilize the Admiralty workforce, despite major fluctuations in the level of production at the wharf. Where the state did intervene, it was by granting the Admiralty Board and VOC to circumvent guild regulations for employment. Both institutions could thus make use of the dampening effect of the guild’s system for mutual aid on labor unrest, while hardly suffering restrictions on their own use of non-guild labor.

Important aspects on the use of labor at the Amsterdam naval shipyard still remain to be investigated, such as gender divisions, child labor, and the role of foreign recruitment. The Amsterdam Admiralty Board must have employed many women, though probably mostly not as shipwrights. A list of persons receiving money as former workers from 1680 contains fifteen women, excluding the widows of high officers, as against thirty-seven men.\footnote{\textit{NA, Archief Van der Hoop, no. 161. ‘Notitie van Tractementen en Pensioenen, in den jare 1650 gelopen hebbende tot lasten van het Collegie ter Admiraliteyt, residerende binnen Amsterdam, en hoe die successivelijck vermindert, vernieticht, verhooght of nieuwelijcks inghevoert souden moghen zyn tot het eynde van het jaer 1680’, 14-15.}} As to migrant labor, its extensive use at the VOC shipyard makes it most likely that it formed an important source for workers for the Admiralty Board as well.\footnote{\textit{Research on the far more complete lists of workers of the VOC shows that a high percentage of the craftsmen who lived and worked in the quarter of Kattenburg and Oostenburg were in fact of foreign origin. Edward Oppo, \textit{Dutch East India Company artisans in the early eighteenth century}, unpublished dissertation, Indiana University 1975, 114ff.}} During the sharp labor shortage in the run up to the Fourth Anglo-Dutch War, Admiralty administrators indeed actively sought to recruit foreign workers, using agents abroad to solicit for shipwrights. Further research on such issues is likely to strengthen the image of the Amsterdam shipyard as operating a highly flexible and differentiated system of recruitment, reflecting the early capitalist structure of Dutch Republican labor relations.
3.7 Combination, coordination, and control

The prominent role of naval institutions in the development of labor relations was not restricted to their position on the labor market. In his study of shipbuilders at the Venetian Arsenal, Robert C. Davis has rightly stressed their importance for the history of the organization of work itself:

‘Seemingly defined by bureaucratic and military structures and operating largely independently of the workings of profit and the marketplace, such large, state-run shipyards have generally not appeared especially central to the key social and economic determinates of the industrializing process. Nevertheless, the massive, concentrated workforces of large manufactories like the Arsenal presented for the first time kinds of management and labor problems that would be much more typical of the industrial factory than of the putting-out system: the disciplines of wages and time, the need for coordinated work gangs, and the formation of specialized and uniform “company towns” on the fringes of the workplace.’

In this sense the Amsterdam naval shipyard was as advanced as the famous Arsenal. Between 1650 and 1795 important changes took place in the organization of shipbuilding, the relations between master craftsmen and ordinary workers, and the enforcement of labor discipline. However, there were large differences with the operation of modern factories as well. The most significant of those probably was the subordinated role of machinery, technology, and technological change. Van Dillen described the structure of early modern shipbuilding as that of ‘manufacture or the non-mechanized enterprise’, and this feature of work at the naval shipyards remained basically unchallenged throughout the period under examination. Attempts to gain in speed and cost-efficiency thus seem to have remained focused on the triad of combination, coordination, and control of labor, rather than the systematic introduction of labor-saving devices.

One of the most important leaps in efficiency undoubtedly was the result of the move to Kattenburg itself. Apart from allowing all equipment to be gathered at one place, reducing storage and transportation costs and enhancing the precision of administration, the new, much larger naval terrain also made it possible to concentrate and combine all sorts of secondary

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120 Davis, Shipbuilders, 7.
121 Van Dillen, Rijkdom en Regenten, 400. On the lack of technological change in shipbuilding after the first half of the seventeenth century, see Unger, Dutch shipbuilding, 41 and 86.
122 The main exception being the use of wind power in sawing, an innovation that stemmed already from an earlier date. Ibid, 7.
functions of shipbuilding in one location. The process of building and fully equipping a ship involved many different crafts. Tasks such as the production of tackle, anchorage and other ironwork, sails, and the making of prows and other embellishments, remained the work of small numbers of artisans and their apprentices. Most private shipbuilding companies at this time relied on independent, off yard craftsmen for these types of labor. In the Amsterdam naval facilities, as at the VOC wharf, the different crafts were physically united with the primary functions of shipbuilding. Architect Daniel Stalpaert’s own drawings already show the inclusion of a sail makers’ shop inside the naval storehouse. The incorporation of new crafts into the naval establishments was an ongoing process. In 1650 the work of a carpenter (or carpenters), roofer, glassmaker, plumber, and coffin maker were mentioned not under general wage costs but as accidental expenditure, including both their wages and materials. In 1680 this was the case for a bricklayer and a glassmaker, but the others had disappeared from the list, suggesting their inclusion under general wage costs. In 1662 a resolution granted a wage increase of 150 guilders a year to a master carpenter, signifying that this function had already been created before that year. The lists of workers of the middle and late eighteenth century, summarized in table 3.5, show the measure of integration and internal differentiation of the Amsterdam Admiralty workforce. Only a minority of highly specialized jobs, such as the work of glassmakers, was still done off-yard at the end of the eighteenth century.

The smaller Admiralty Boards did not achieve the same heights in combining different forms of labor as the Amsterdam Board. The shipyards of Zeeland in particular never managed to lose their dependence on off-yard craftsmen for auxiliary tasks. But the dockyards at Rotterdam and Hellevoetsluis did see some development in this direction. In 1655 the States General had ruled that the Rotterdam Admiralty Board could employ not more than one sail maker for the purpose of repair. The making of new sails, rigging, anchorage, tackle, and carpenters’ work, as well as any large repairs on ships should be tendered to contractors. But by the middle of the eighteenth century, the same institution employed several sail makers, carpenters, coopers, a master blacksmith with nine servants in Rotterdam and three blacksmiths in Hellevoetsluis, block makers, and a master painter with an apprentice and four

123 Van Kampen, Particuliere scheepsbouw, 155 ff.
126 Ibid, 4.
127 The 1781 account of the Amsterdam receiver general include a payment of €1218 for glasswork to Benjamin van Oort. NA, Archief Generaliteitsrekenkamer, no. 592. ‘xve ordinaris Rekening van Mr Joan Graafland de Jonge’.
128 Recueil II (The Hague 1701) 392 vso.
servants. The fact that they seized to operate as independent craftsmen and were now in full service of the Admiralty Board also appears from the ruling that prohibited the master painter from doing work for any off-yard clients.\textsuperscript{129}

The drawing of all these different functions of production into one single institution, separated both physically and symbolically from the outside world by its walls, set the stage for new approaches to the organization and supervision of production. Amsterdam again provides the clearest example. There important changes in the internal hierarchy took place at the same time as the move to new facilities and the increase in shipbuilding at the Admiralty wharf. The highest official working on the naval shipyard was the master of equipment. Before the move to the new facilities he had received \( f\) 400 above his regular salary of \( f\) 2400 for the renting of a house. But from 1656 onwards the master of equipment lived on a house on the shipyard itself, enhancing his ability for control. In 1662, around the time that shipbuilding at the naval yard took off on a large scale, his salary was raised with 600 guilders a year to the ample sum of \( f\) 3000. This was motivated by ‘the growth of equipment and the big change of this Board since a few years, by which his task had become noticeably enlarged’.\textsuperscript{130} In February of the same year, two sub masters of equipment, an accountant for the naval storehouse, and one for the shipyard were added to the payroll at a yearly salary of \( f\) 1095.\textsuperscript{131}

Through the master and sub-masters of equipment, the Admiralty Boards gained far greater control over the entire process of production than they had had previously. The description of the functioning of the smaller Rotterdam shipyards in the eighteenth century makes clear how far-reaching the ideal of supervision went:

‘The storehouses and dockyards of Rotterdam and Hellevoetsluis, which are entrusted to the care of the Admiralty Board of the Meuse, are in the first place and immediately governed by the Board itself, outside whose knowledge the servants are hardly allowed to do anything, except small repair’.\textsuperscript{132}

The master of equipment was to implement this strict control by his permanent presence on the naval facilities:

\textsuperscript{129} NA, Archief Van der Hoop, no. 153. ‘Secrete missiven’, 30 June 1751’, 17.
\textsuperscript{130} NA, Archief Van der Hoop, no. 161. ‘Notitie van Tractementen en Pensioenen Amsterdam’, 1.
\textsuperscript{131} Ibid.
\textsuperscript{132} NA, Archief Van der Hoop, no. 153, ‘Secrete missiven’, 30 June 1751’, 11.
‘[H]e must be at the wharf or storehouse daily, in order to advance the equipment and shipwrights’ work, and to make sure that the bosses and workers keep to their duties, and if he discovers any disorders, or finds anyone disobedient, he has to immediately notify the Board.’

Of course, certainly at the Amsterdam shipyard, control over the entire workforce could not be gained by a staff of one master of equipment and two sub-masters. Accountants, supervisors, and guards all had a function in restructuring the hierarchy of work. One of the main changes in this area was the elevation of the position of the master shipwright to a level far above that of ordinary workers. Before the move to Kattenburg the master shipwright had received a day wage of fifty stuyvers (f 2.5) in summer and winter. This was about double the wage earned by ordinary shipwrights, but the fact that the master was still paid for a days’ work shows how similar their positions still were. In 1654 a gratification of f 200 per year was granted for ‘ordinary and extraordinary services’, increasing the social difference. But the real change came in October 1661, when the master shipwright was granted a yearly tractement (the term itself marking the difference with a worker’s wage) of f 1800. Such an income, about six times as high as that of an ordinary worker, put him far above the shop floor in social terms. From that moment on master shipwrights had joined the ranks of the higher management of the shipyard. This process of differentiation continued during the eighteenth century. By 1781 the salary of the master shipwright stood at f 2500, supplemented by an allowance for the rent of his house, several gratifications, and a reward for every ship built at the wharf. His staff joined in this advance. Before 1733 the first journeyman, the oldest journeyman, and the ordinary journeyman all earned approximately one and a half times as much as ordinary shipwrights, while his clerk earned a workers’ wage. By the end of the century the first journeyman earned more than f 1100 (including gratifications) and lived in a house free of rent at the shipyard, while the others received salaries of f 730, about twice the amount of an ordinary shipwright.

While those master craftsmen who managed to move up in the chain of command and obtain controlling positions over the work process as a whole saw structural improvement in their salaries, those who became mere supervisors or coordinators often faced a decline in status and income. This is particularly true of the shipwright’s bosses or commandeurs.

133 Ibid, 14.
Table 3.8 Yearly income of bosses at the Amsterdam naval shipyard in the eighteenth century
(based on 226 working days)

<table>
<thead>
<tr>
<th></th>
<th>1733</th>
<th>After 1733</th>
<th>1781</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blacksmith’s boss</td>
<td>531</td>
<td>664</td>
<td>797</td>
</tr>
<tr>
<td>Mast makers’ boss</td>
<td>593</td>
<td>531</td>
<td>531</td>
</tr>
<tr>
<td>Sail makers’ boss</td>
<td>478</td>
<td>611</td>
<td>531</td>
</tr>
<tr>
<td>Boat makers’ boss</td>
<td>445</td>
<td>664</td>
<td>505</td>
</tr>
<tr>
<td>Shipwright’s boss</td>
<td>445</td>
<td>531</td>
<td>478</td>
</tr>
<tr>
<td>Carpenter’s boss</td>
<td>478</td>
<td>478</td>
<td>478</td>
</tr>
<tr>
<td>Block makers’ boss</td>
<td>624</td>
<td>478</td>
<td>398</td>
</tr>
<tr>
<td>Carrier’s boss</td>
<td>n.a.</td>
<td>n.a.</td>
<td>318</td>
</tr>
</tbody>
</table>


Master shipwrights who owned their own yards often held a social position that was more akin to that of well-to-do citizens than to that of ordinary craftsmen.135 But in the course of the seventeenth century on the larger shipyards, including large private shipyards, they started to leave direct control over the workforce to their journeymen. These functioned more as gang leaders than as traditional craftsmen, a functional shift signified by the use of the term commandeur. Sub-bosses were called Javanen (Javanese), possibly reflecting strongly held perceptions of harsh Asiatic labor discipline. With forty-four workers per boss in 1733 and fifty-eight in 1781, the commandeurs at the naval shipyard controlled a workforce that was akin to that of a large or medium sized shipyard. But with thirty-six stuyvers in summer and twenty-six in winter (after 1733 raised to thirty-eight and thirty stuyvers respectively), their wage stood much closer to that of the ordinary workers below them, and at the same level as that of guild members on private wharfs.

Table 3.8 shows the fluctuations of income of a number of bosses in other crafts, ranked according to their 1781 income. As can be seen from this table only the blacksmith’s boss, sail makers’ boss, and boat makers’ boss made considerable gains over the course of the eighteenth century, maybe due to the fact that their workshops always remained more or less

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separate islands within the shipyard organization. Some, such as the bosses of mast makers, block makers, and painters, suffered a marked decline in income. The others had incomes from wage that were the same or only slightly higher at the end of the eighteenth century than at the start, around one and a half times that of their subordinates.

Probably as significant for their income position as their formal wage was the attack on bonuses and gratifications that took place from the 1730s onward. The spike of most commandeurs’ incomes after 1733 is due to the fact that before that time many bosses and some selected workers had received gratifications in the form of firewood or candles. The regulation of 1733 ruled that the gratification in firewood would be replaced by a sum in money, varying from twenty to fifty guilders, but it is likely that these sums were often below the actual value of the previous rewards in kind. The right to receive candles would be ‘mortified’, meaning that it was kept in place for those who already possessed this right but not for their successors.\footnote{136 NA, Archief Van der Hoop, no. 153. ‘Secrete missiven’, 30 June 1751’, 41, and 54-56.} New regulations introduced in 1744 limited the entitlement to a monetary compensation for firewood to a select group of managers, consisting of the master and sub-master of equipment, the master shipwright and his oldest apprentice, the clerk (commis) of the wharf, one skipper, and the controller of the nail shed.\footnote{137 Ibid, 74-76.} For commandeurs the taking away of their entitlement to firewood signified a real shift. They had gradually been degraded from specialized craftsmen to high-paid workers in supervising positions. In August 1748, when workers of the shipyards marched through Amsterdam in support of the Orangist revolt against the city governors, one observer notes the presence of ‘all the masters of the wharfs’.\footnote{138 L.Fuks (ed), De zeven provinciën in beroering. Hoofdstukken uit een Jiddische kroniek over de jaren 1740-1752 van Abraham Chaim Braathard (Amsterdam 1960) 79.} Earlier that year, the directors of the naval shipyard had found it necessary to summon all commandeurs and read them the States General’s declaration against seditious movements, to which they added their own ‘serious threats’.\footnote{139 Adolf Ypey, De beroerten in de Vereenigde Nederlanden. Van den jaare 1300 tot op den tegenwoordigen tyd. Volume XI (Amsterdam / Harlingen 1789) 142.} It is hard to imagine that the semi-proletarization of those most directly responsible for the coordination and control of work would not have played a role in the radicalization of the shipyard workforce.
3.8 Of time, theft, and chips

The restructuring of labor relations on the shipyards did not go completely unchallenged, all the more because it raised both wage issues and powerful notions of the ‘ancient rights’ of guild workers. On 6 February 1749 between six and seven in the evening, lieutenant admiral Cornelis Schrijver faced an uncommon adversary. Schrijver was a highly respected naval officer, though posterity remembers him better for his achievements behind an administrator’s desk than for his deeds at sea.140 In this particular mission, the Amsterdam Admiralty Board had again called on him more for his diplomatic than for his martial capacities. In the charged atmosphere that held the Republic in its grip since the stormy, protest ridden advent of William IV to the Stadtholderate in 1747 – especially in Amsterdam where a popular Orangist revolt had led to the abdication of part of the city council in the late summer of 1748 – Schrijver had to convince the shipwrights of the Admiralty shipyard that there was no room to give in to their demands. To add to his discomfort, the shipwrights had in their turn sent a hero of their own, Jan Martini, to head their delegation of six. Martini was not a shipwright, but had been one of the leaders of the radical fraction of the Revolt the previous year. He had even led a demonstration of two thousand Admiralty and VOC workers through Amsterdam, dressed in traditional shipwrights’ garb, to the great distress of defenders of law and order on both sides of the main political dividing line.141 As could be expected from such a firebrand, when the delegation had come to Schrijver’s house at the fifth of February to list the shipwrights’ demands, ‘aforementioned Martini absolutely refused to listen to anything, no matter what persuasive reasons the undersigned brought forward.’142 When his persuasive reasons did not seem to impress his adversary, Schrijver took resort to open threats. The Admiralty Board and the VOC, he explained, could not be forced into granting demands either by the shipwrights, or even by city government ‘which had power only over its citizens (...), but not in any way over the Admiralty Board and the Company’. Higher wages, in this case two stuivers a day for guild members, would lead to instant ruin, causing ‘the wharf to come to a standstill, for lack of the necessary funds to buy wood and pay the carpenters their day wages; particularly when the Admiralty Board would further be burdened (...) if the

141 Vervolg op de korte schets of dag-verhaal van het tegenwoordige gedrag der burgeren van Amsterdam (s.l. 1748) 107, 111, and P. Geyl, Revolutiedagen te Amsterdam (Augustus-September 1748) (The Hague 1936) 56 and 95.
142 NA, Familiearchief Fagel. no. 1099, ‘Raport van den Luijtenant Admiraal Cornelis Schrijver omtrent zijn wedervaren met de clouwers van het scheepstimmermans gilden’. 
shipwrights would gain the upper hand, and came to carry through their demands by force and violence.’ And so, the next day, a group of fifty or sixty shipwrights led by Martini returned to Schrijver’s house,

‘shouting out in a violent way, with swearing, raging and the most unmentionable curses and threats: yelling that undersigned [Schrijver] had no business engaging himself with their guilds. And having lit a fire of wood curls, they burned a printed plan that was written by undersigned to make them and their heirs forever happy.’

Unable to bring together their diverging views on eternal happiness and the two stuyvers wage raise, the shipwrights later that year turned directly to the stadtholder. In December 1749 they presented him with a request complaining about wage levels that were considerably lower than those among private sector shipwrights, exemptions that allowed the Admiralty Board to employ non-guild labor, irregular payment, and the low quality of beer served during work. However, unlike Martini and his delegation, William IV did have an ear for Schrijver’s persuasiveness, and only admonished the Admiralty Board to comply with the demands on beer and regular payment. As far as the wage raise was concerned, he explained that ‘his Highness was not unwilling to take favorable reflection on it when times get better’.

Day rates of Amsterdam shipwrights remained unchanged until the second half of the nineteenth century.

The disciplining of the workforce at the naval shipyards according to the requirements of large scale manufacture was a long and uneven process. It did not only involve the introduction of new hierarchies, but also the challenging of long-held perceptions of the nature of work, time, leisure, property, and consumption on the job. Resistance ranged from the most individual methods, such as absenteeism and theft, to collective action in the form of strikes and involvement in political protest. Such themes play a large role in the historiography of the ‘making of the working class’, but have hardly been researched for the early modern Dutch Republic. The typical approach for the Netherlands remains the one recently summed up by Jan de Vries, who agrees that eighteenth century labor patterns underwent revolutionary changes, but criticizes what he sees as the ‘pessimist’ view, instead insisting that workers benefited from these changes even when they had to be enforced:

143 Idem.
144 NA, Archief Stadhouderlijke Secretarie, no. 467. ‘Request aan Willem IV van 6 december 1749’.
the manner of Ulysses requesting to be tied to the mast of his ship as it sailed past the sirens, factory discipline forced workers to do what they wanted to do but could not do unaided." \[146\] However, it is hard to read this repressed urge for discipline from the actions of the laborers involved. During the eighteenth century, shipwrights gained a name for themselves as the most unruly section of the Amsterdam population. While much attention is given in Dutch historiography to the ideological component of this radicalization, stressing the role of shipwrights in the ‘Orange revolutions’ of 1748 and 1787, the fact that the naval and VOC shipyards were at the same time in the forefront of abolishing craft practices and replacing them by more developed forms of collective labor discipline has been virtually overlooked.

The transformation that took place in the position of shipyard workers can be summarized along the lines of a threefold shift, involving the introduction of new forms of time management, strong measures against practices that management defined as theft, and the loss of the laborer’s control over tools and other materials used in production. As E.P. Thompson noted, the development of new notions of labor time was intimately connected with the development of manufacture on a large scale.

‘Attention to time in labour depends in large degree upon the need for the synchronization of labour. But in so far as manufacturing industry remained conducted upon a domestic or small workshop scale, without intricate subdivision of processes, the degree of synchronization demanded was slight, and task-orientation was still prevalent.’ \[147\]

Not surprisingly, given their size and the level of combination and internal coordination, the Amsterdam naval and VOC shipyards pioneered a system of strict time management. Symbolic for this was the inclusion of a large clock above the gate to the shipyard. Before the move to Kattenburg, no clock setter is mentioned in the account of personnel, but in 1680 a clock setter was employed for the yearly fee of f 80. \[148\] From that time onward, strict rules applied for the exact length of the working day. Jan de Vries has calculated that between the sixteenth century and the 1650s, the number of working hours for manual laborers in general increased by twenty percent, from 3,100 to 3,700 working hours per year. \[149\] One surviving copy of the rules for work at the shipyard, from the rather late date of 1788, stated exactly the hours at which a bell should ring to mark the start and end of the workday, the morning break

\[148\] NA, Archief Van der Hoop, no. 161. ‘Notitie van Tractementen en Pensioenen’, 6 and 11.
\[149\] De Vries, *Industrious revolution*, 89.
of half an hour and a break at noon of an hour. The length of the workday, excluding breaks, varied from 8 hours in January (at winter wage) to 11 ½ hours from April to the end of September (at summer wage). Incidentally, this means that for all workers except for a skilled ‘elite’, wages per hour were much lower in summer than in winter. With large clocks at the entrances of the naval shipyard, the VOC shipyard, and at the tower of the church that was built right in between the two in the late 1660s, the daily passage of workers as well as their supervisors was always marked by the time.

One indication of the success in demarcating the labor day, as well as the exceptional nature of this achievement, is a remark in a request of skippers from 1731:

‘[T]hat at the naval and company yards there is observed a good order in arriving at work and quitting, as well as in the timing of breaks, while the journeymen at the [private] yards at which the suppliants are forced to have their ships built, come and go and have their breaks as long and protracted as they please’.

How deeply notions of time and discipline had become ingrained in the mind of the shipyard workers appears from a strike in Rotterdam in 1784. On March 8, the birthday of Stadtholder William V, they staged a rowdy celebration involving lots of drink on the yard. After wrestling involuntary ‘gifts’ from a number of the bosses and the master shipwright, the crowd was granted leave at three in the afternoon. They then marched to the adjoining VOC yard and proceeded to the private shipyards in another part of town, while shouting ‘it strikes’ (meaning ‘the clock strikes for leaving work’). After that, some young workers broke into the Schiedam gate, where they sounded the bells.

Usually resistance against strict enforcement of labor time took a less frivolous and more individualized form. Unannounced absenteeism remained one of the great concerns of shipyard administrators. This was very clear during the 1730s and 1740s, when over-employment and the low level of work caused many workers to skip days, while still demanding their full pay. The commandeurs had the task of carefully administering the exact number of days worked, for which they used a so-called ‘checkers-board’. This was a square on which they could mark the days for each laborer with crosses. Apparently, however, there

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151 Quoted in Van Kampen, Particuliere Scheepsbouw, 174n.
152 Ibid, 175-177.
were reasons not to trust the accuracy with which the bosses carried out this task, since in 1733, new rules for work at the shipyard demanded an oath from them stating:

‘[T]hat I will not mark anyone as having worked on the naval yard, apart from those who effectively have worked there in the service of the nation during the complete prescribed time, and in the same function as is expressed on this list. That if I discover any mistakes in this work, I will immediately give notice of this to the proper authority, and further behave as a loyal commandeur is supposed to.’

The checkers-boards had to be handed over to the master shipwright or the sub-masters of equipment for control. 153

Apart from absenteeism, theft was a major issue in eighteenth century labor relations. As Peter Linebaugh showed for England, this was not only a result of pilfering being an easy way to supplement low wages, but also of colliding views on the nature of property itself. Waste materials such as unusable pieces of wood (chips or curls) often were seen as rightfully belonging to the craftsmen. This encouraged the bad handling of materials, since all spoiled pieces of wood could be appropriated by the shipwrights for their own use. The ‘battle over chips’ took management at the English shipyards the entire eighteenth century – in 1768 even leading to clashes between workers and marines. 154 Naval administrators in the Dutch Republic were far more successful on this account than their English counterparts. Already in 1671, former Amsterdam Admiralty councilor Nicolas Witsen could write about the great economy attained on Dutch wharfs, compared to the wastefulness in other countries. In his then famous manual for shipbuilding, he ascribed this particularity to the frugal mentality of Dutch laborers:

‘From which follows, that even if a stranger would keep in mind all rules for building, they could not serve him, (...) unless he would see chance to equal the nature of the people, with which he has to work, to the thrifty and clean disposition of the Hollander, which cannot be done.’ 155

This attitude of the worker was at least partly the result of the tighter administration and greater care in the storage of raw materials, semi-finished products and excess equipment that was introduced with the move to Kattenburg.

155 Nicolaes Witsen, Aloude en hedendaegsche scheeps-bouw en bestier (Amsterdam 1671) introduction.
Order was a powerful weapon for management in the fight against workers’ appropriation of part of the stock. It is noticeable that in 1733, when the entitlement to firewood was replaced by a gratification in money, this right was already limited to a small section of the workforce, and the distribution was administered according to set rates that varied according to one’s position in the shipyard hierarchy. The anarchic practices at English shipyards, where workers at one point were able to carry out on their backs forty percent of all wood ordered for the building of a third rate ship, were absent in Amsterdam. Instead, a special category of workers (called spaanderrapers or chip reapers) belonging to the lowest paid section of the workforce was appointed to collect chips. Set amounts of firewood divided into a schuitje (worth about twenty guilders), roodgat (about thirty guilders), or boot (about fifty guilders) were distributed among 165 members of the personnel, mainly belonging to the administrative cadre or the workmen’s bosses at the wharf. The only sections of workers entitled to firewood were guards, privileged servants of the staff, and a small group of workers such as cooks and firemakers who could probably have easily taken firewood for themselves anyhow. The total costs of these gratifications came at about £4000. In 1744, when the right to gather chips was restricted to a small section of higher management, it was also decided that the Admiralty Board would no longer buy any firewood but instead would only use waste from the wharf. Shipyard waste was now officially turned into a commodity, in a ruling stating that

‘even the chips and waste of the wharf will be sold, as it is, without cleaving either the chips or the blocks, but that both in the boardroom and the departments, as well as in the Admiralty residence in The Hague, only the best chips and waste of the wharf will be burned’.  

Apparently this ruling was applied with success. Yeoman Lott, an English naval administrator who visited Holland in the 1750s, admiringly wrote about the ‘peculiar attention’ paid at the Amsterdam shipyard to waste management ‘prohibiting any Kind of Wood whatever, or Stores of any Kind, to be carried out of their Dock Yards by the Workmen, under the Perquisite of Chips, &c.’

Control against the mishandling or unlicensed appropriation of shipyard’s goods was also extended or strengthened in other areas. During the 1730s and 1740s many rules were

156 Linebaugh, London hanged, 380.
158 Ibid, 76-77.
159 Yeoman Lott, An account of proposals made for the benefit of His Majesty’s naval service (London 1777) 5.
introduced for the supervision and precise administration of goods that were not in current use. In 1748, for example, a shipwright was appointed for every ship that lay in the docks, with a duty to remain on this ship from the sounding of the bell in the morning to the closing of the yard in the evening. One of his tasks was

‘to take care that nothing is stolen or gone missing from this ship, to which aim a proper inventory will be made of all goods that are present on this ship in the dock. And of this inventory one copy will remain in the possession of the master of equipment, and one of the shipwright on this ship.’\(^{160}\)

Similar rules were introduced for the unloading and offloading of victuals and equipment.\(^{161}\)

Of particular interest are the attempts to limit workers’ access to those goods that were traditionally seen as belonging to them only. One was the beer consumed during work, the other the simple tools that were used. As a compensation for the absolute prohibition of smoking on shipyards, guild rules from the seventeenth century onwards had provided the workers with free access to beer as a ‘refreshment beverage’. Given the physical character of shipwrights’ labor, usually taking place in the open air, unlimited access to beer was seen as an essential right. However, already at the end of the seventeenth century Van Yk’s manual for shipbuilding had advised:

‘[N]ot to allow that any beer will be carried along the wharf or around the place of work in jugs, but rather to summon everyone to drink in front of the barrel; because in this way, he [the master shipwright] will not only spare the wage of beer carriers, but also much beer, since most will be ashamed to walk away from their work too often under the eyes of the master.’\(^{162}\)

The naval and VOC shipyards had found an even easier solution to the problem of excessive drinking during work: providing beer that was undrinkable. In their request to William IV of December 1749 workers complained about the low quality of their ‘refreshment drink’, ‘being for a long time so bad that it cannot be used, and having given many deceases and inconveniences to those who for excessive thirst were nonetheless forced to drink it.’\(^{163}\)

Conceding to their complaint, the stadtholder summoned the shipyard administrators to make sure that from that moment on, good quality beer was provided to the workers. Interestingly


\(^{161}\) Ibid, extracts from the minutes of the Amsterdam Admiralty Board, 21 April 1734 and 29 August 1749.

\(^{162}\) Cornelis van Yk, *De Nederlandsche scheeps-bouw-konst open gestelt* (Amsterdam 1697) 24.

\(^{163}\) NA, Archief Stadhouderlijke Secretarie, no. 467. ‘Request aan Willem IV van 6 december 1749’.

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enough, the list of workers of 1781 shows the employment of twenty-five ‘jug-fillers’
(kantappers), which had not been present at the wharf around the time of the workers’
complaint.\textsuperscript{164} This could point in two very different directions. One possibility is that on the
issue of drink, workers’ protest had resulted in a return to the seventeenth century practices
that Van Yk had denounced. But it is also possible that the opposite happened, and
management had used the introduction of better quality beer as an excuse for rationing.
Unfortunately, the sources do not provide an answer on this matter.

More straightforward is the introduction of twelve lappen or guards of the tools around
the same time. With a day wage at the same rate as shipwrights, these were considerably
better paid than ordinary guards who received no more than sixteen stuyvers a day in summer
and fourteen in winter. The introduction of this group of well-paid supervisors must have
signified a lessening of control of the workforce over the tools they used. Traditionally, the
smaller tools that shipwrights worked with had been in their own possession, while the larger
tools were supplied at the wharf.\textsuperscript{165} How freely the shipwrights, or ‘axes’ (bijltjes) as they
were popularly called, had previously commanded these simple tools appears from their role
in the Orangist revolt of 1748. At several strategic turning points, the dividing line between
moderates and radicals had been drawn at the question whether the ‘axes’ should demonstrate
with or without their axe.\textsuperscript{166} But the employment of a number of specified ‘toolmakers’
among the Admiralty workforce after 1744 signifies that tools at an increasing rate were
supplied by the shipyard and considered its property.

By the end of the eighteenth century there was no other sector of industry in the Dutch
Republic where craft practices in production had so successfully been challenged and
replaced by new conceptions of time management, property, hierarchy and control as at the
large naval shipyards. While shipwrights’ manuals from the seventeenth century show that
shipyard managers could start this transformation from a more advantageous position than
their English counterparts, the crucial years in the transition were centered around the 1730s
and 1740s, or the so-called ‘quiet years’. The financial crisis that beset the Admiralty Boards
was a strong motivation for naval bureaucrats to challenge practices that they considered
wasteful and costly. They did so with a vigor that they never managed to muster in reviewing
other potentially costly and wasteful areas of naval production, such as the costs of the

\textsuperscript{164} Given their wage of 5 to 7 stuyvers a day possibly children.
\textsuperscript{165} Unger, Dutch shipbuilding, 61.
\textsuperscript{166} E.g. Het ontroerd Holland (Harderwijk s.d. [ca.1750]) 148-149. A year earlier, shipwrights in Zierikzee had
turned out for an Orangist protest ‘with their axes at their shoulder’. J. de Kanter, Chronijk van Zierikzee
(Zierikzee 1795) 176.
shipyard bureaucracy itself, and with considerably more success.\textsuperscript{167} The 1740s low in naval shipbuilding must have further strengthened the position of management vis-à-vis the shipyard workforce. When in September 1749 the shipwrights rallying in front of Schrijver’s house cried out that he should respect their rights as guild workers, this was much more than the rehearsal of a well-known theme.\textsuperscript{168} It also referred to a whole catalogue of recent defeats, which the shipyard workers hoped but ultimately failed to redress.

3.9 Neptune’s trident and Athena’s gifts

An influential thesis on the industrial revolution in England focuses on the ‘gifts of Athena’, the emergence of a specifically British combination between theoretical science and practical, experimental knowledge at the point of production. According to this theory, around 1750 an ‘industrial enlightenment’ started to bridge the two and provided the intellectual background to the ensuing sway of inventions.\textsuperscript{169} Though less significant than the changes in the organization of labor relations, the slowly changing attitudes to the practical application of science and experimentation of the master shipwrights at the Amsterdam and Rotterdam Admiralty Boards suggest that the basic elements of this fusion were available in the Dutch Republic, even in a period of industrial retardation.

Compared to the situation after the industrial revolution, innovation in early modern shipbuilding was a slow process. As a means of increasing productivity, technological change and the application of new scientific knowledge were of less significance than the changes in the organization of the labor process that have been examined in the previous sections.\textsuperscript{170} During the seventeenth century, the Admiralty shipyards benefited from the advanced nature of Dutch shipbuilding in general. However, most of these advances had been made already before the 1630s.\textsuperscript{171} In the eighteenth century innovation in shipbuilding slowed down

\textsuperscript{167} Bruijn, Admiraliteit van Amsterdam, 62.
\textsuperscript{168} Rudolf Dekker, Holland in beroering. Oproeren in de 17\textsuperscript{de} en 18\textsuperscript{de} eeuw (Baarn 1982) 79, and Deurloo, ‘Bijltjes en klouwers’, 56ff.
markedly. This resulted in heated debates on the relative merits of English and French shipbuilding methods in comparison to the long-established Dutch practices, in particular after the employment of three English shipwrights at the Amsterdam Admiralty shipyard in 1727. Most of these debates concentrated on the use of ‘ship drawings’ and the application of advanced scientific theories, in particular mathematics, in ship design. The intensity of the controversy, pitting administrators and master shipwrights of the Amsterdam and Rotterdam Admiralty Boards against each other, has caused this aspect of shipbuilding to be the subject of a long line of historiography. This section will summarize some of the outcomes of these investigations, but also try to broaden the subject to a number of other, related areas of technological change and the application of science.

The principal instrument employed in shipbuilding throughout the early modern period remained the human body itself, ‘a poor engine’ as Braudel put it. According to Cornelis van Yk:

‘[A]mong all forms of manual labor, I do not know of any in which the human body is exercised and trained in so many ways as in ship carpenting; since one has to work sometimes standing, sometimes sitting or crawling, and even lying down; now carrying heavy wood on the shoulders; than lifting things under hand, in front of the body. Furthermore, heaving, tallying, pulling, hauling, climbing, clambering, sowing, cutting, knocking bolts, wringing, wrestling, and applying force in uncountable ways, is the content of daily work. So that the clothes are torn from the limbs, and by this strong training, the complete body becomes hollow from head to toe’.

The central role of the shipwrights and their individual capacities in production was connected to the nature of the production process of the wooden ship. Until the arrival of English masters in 1727, Amsterdam shipbuilders had used the ‘shell-first’ method. The main characteristic of this method was that the hull was built from the ground up, using a set of simple rules of thumb to determine the exact shape and proportions. Such simple rules, reproduced in manuals, only provided for a more or less unspecified standard ship. To determine the precise characteristics of the ship, for example to distinguish between a bulky

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172 Unger, *Dutch shipbuilding*, 41 and 86.
174 See in particular Hoving and Lemmers, *In tekening gebracht*.
175 See idem for a summary of the historiographic debate.
merchant ship and a fast sailing man-of-war, these rules of thumb were adjusted according to
the individual tastes of the master shipwright during the building of the ship itself.\footnote{179} Experience and craftsmanship decided whether this was done with success, and adaptations of
the design still took place during the fitting of the available pieces of wood for the hull,
making great demands on the judgment and precision of individual workers and their
supervisors. Many tools that were used were specifically geared towards this process of on-
the-spot adaptation, a practice that was developed to a high level of perfection in the Dutch
Republic. Blaise Ollivier, the French naval official who visited the Dutch shipyards in 1737,
was surprised to find instruments for the hauling and setting of planks that he had never seen
in France, and in his eyes were also preferable to similar instruments used in England.\footnote{180}

Some important laborsaving devices could be easily integrated into this form of
production. This is particularly the case for the use of sawing mills and cranes, innovations
that were introduced in private shipbuilding in the Dutch Republic long before they became
common in other countries.\footnote{181} The VOC and Admiralty shipyards took over these
developments from the private sector, and could use their far larger capital outlays to apply
them on an even larger scale. Dutch success in combining these elementary machines and the
merits of craftsmanship made Dutch shipwrights much sought-after among their seventeenth
century competitors.\footnote{182} However, a century of technological leadership also fostered attitudes
to shipbuilding based on the time-tested centrality of the master shipwright and his
experience, and a strong hostility to any practice that would diminish their role. The elevation
of master shipwrights to high bureaucratic positions that has already been examined in section
3.7 further strengthened their personal influence on the shipbuilding process. A gradual loss
in leadership occurred, that gained strong influence on popular consciousness by the long
eighteenth century debate on ship drawings.

The issue of mathematic design in shipbuilding is so important, because it signifies a
major step in the mutual integration of science and experience (instead of their traditional
opposition) as factors in the production process. Building according to design also allows for
a way of preserving and adapting knowledge from one ship to the next, opening up a whole
new space for long-term innovation. Thirdly, once designs become the property of the owners
or directors of an institution rather than the master craftsmen, this structurally alters the power

\footnote{179} Hoving and Lemmers, In tekening gebracht, 21-22.
\footnote{180} Roberts (ed), Observations made by Blaise Ollivier, 333-334.
\footnote{181} Unger, Dutch shipbuilding, 7.
relationships within the enterprise.\textsuperscript{183} Both in England and in France, mathematic designs were used from the late seventeenth century onwards, a practice that was gradually improved in the following decades. According to the traditional view, debates in the Dutch Republic became polarized between the Amsterdam-based advocates of the ‘modern’ English fashion of shipbuilding, and traditionally minded masters in the rest of the country. Emblematic for this opposition became the bleak description by Cornelis Schrijver of the shipbuilding practices that were current in Amsterdam before the employment of the three English masters. The older Dutch masters had learned their trade at the private shipyards in the industrial Zaan-area, where, according to Schrijver,

‘the usual answer to the question for the reason why one ship proves to be so much better than another, is: “Yes mate! It did not want to fall from the axe in another way”’.\textsuperscript{184}

However, Hoving and Lemmers have brought important nuances into this story. First, it is not true that the use of designs was absent outside Amsterdam. Already in 1725, two years before the introduction of ‘English methods’ in Amsterdam, the master shipwright at the Rotterdam Admiralty Board Paulus van Zwyndrecht had made use of a mathematical design for one of his ships. He continued to do so in later years, and organizational changes in the shipbuilding process leading to a separation of design and building followed.\textsuperscript{185} When Blaise Ollivier visited the naval shipyards a decade later, he noted that three different approaches to shipbuilding were current on Dutch Admiralty wharfs: the English method in Amsterdam, traditional (shell-first) methods in Friesland, Zeeland and the Northern Quarter, and the ‘new method’ of Van Zwyndrecht in Rotterdam.\textsuperscript{186} The debate between Amsterdam and Rotterdam shipbuilders of the mid-eighteenth century was not so much concentrated on the question whether or not to use designs, but on which method of designing was superior. Furthermore, the actual content of the arguments shows that attitudes to the application of advanced mathematics had already changed considerably since the late seventeenth century. Van Yk still had strongly argued for experience as the only true way of establishing the proportions of a ship:

\textsuperscript{183} McGee, ‘Craftsmanship to Draftsmanship’, 222 ff, and Hoving and Lemmers, In tekening gebracht, 22 and 142.
\textsuperscript{184} NA, Familiarchief Fagel, no. 1099. Cornelis Schrijver, ‘Informatie over enige wynige pointen aangaande de scheepsbouw van slands scheepen van oorlog en het geenen daar in is voorgevallen seedert het jaar 1683 tot 1753 inclusief’, 4.
\textsuperscript{185} Hoving and Lemmers, In tekening gebracht, 77.
\textsuperscript{186} Ibid, 73, and Roberts (ed), Observations made by Blaise Ollivier, 318.
‘Just as the columns and fundaments of building a house, even when accepted by all able building masters, still have no other underlying support than only that which finds its utility from experience, and its ornament from custom; in the same way, no one will expect that in speaking of the proportions of ship parts, I will defend them with other reasons, than those that come from experience and custom.’

In contrast, in an unpublished manuscript from the late 1750s Van Zwyndrecht’s son Pieter could write about ‘the ships that are mathematical machines, and as fishes have water as their element.’ Thus,

‘It is nothing but a very thorough truth, that a master who possesses knowledge of the laws of nature and the fundamentals of mechanics, will bring the art of shipbuilding to further perfection, than one that on the contrary knows nothing about this.

The most common view among advanced Dutch shipbuilders of the second half of the eighteenth century was one that combined mathematic insights with experimentation and experience. This idea was put most elegantly by yet another member of the Van Zwyndrecht dynasty, who was master shipwright at the Rotterdam Admiralty yard from 1752 to 1764. Commenting on the recent publication in Dutch of an important French text on shipbuilding mathematics, he wrote that ‘the building of Holland’s warships is a reflective science and industrious artistic practice’.

The arguments used by the proponents of such a ‘mixed’ method were certainly not irrational. As Hoving and Lemmers explain, the specific natural properties, cost, and quality of different available pieces of wood meant that a careful process of ‘fitting in’ could well prove more efficient in terms of costs and strength of the ship than blindly following the existing designs. Also, the low state of development of mathematics and physics made it very hard for shipbuilders to balance the practical results of their calculations for different aspects of the performance of their ships. This was the essence of the argument put forward in 1757 by Udemans, the master shipwright of the Zeeland VOC wharf:


Pieter Paulus van Zwyndrecht made his career first on a private yard, than the Rotterdam VOC-yard, and finally worked from 1764-1783 as master-shipwright at the Rotterdam Admiralty shipyard. His manuscript, ‘De groote Nederlandsche scheep bouw op een proportionaale reegel voor gestelt’, is printed as an appendix to Hoving and Lemmers, *In tekening gebracht*, 181-296. Quotation from page 183.

Ibid, 188.


‘The difficulty of shipbuilding is that one finds contradictory requirements in a ship; so that one often in making one improvement and changing this or that characteristic of a ship, creates a larger deficiency on the other side. The variations of weather and wind also disable the shipbuilders, in my opinion, to make a mathematic rule for all those different requirements; leaving no safer way, than carefully examining the cause of the defects in finished ships, and improve those to the best of one’s abilities.’

Similar thoughts were formulated a quarter of a century later by the master of equipment of the Amsterdam Admiralty Board William May, the son of one of the three original English masters employed by the Admiralty Board in 1727:

‘[B]ut if one wants to prove the possibility of forming the body of a ship from mathematical rules, that is from curved lines whose equations are known or can be found, than these have to be combined with the unchangeable laws of physics in such a way that in all position of the ships they shall achieve maximum speed. I imagine that computing such a combination would even make the head of a Newton spin.’

Though such attitudes may seem like a restatement of the conservatism of earlier years, they must actually be viewed in a more positive way. None of the more advanced masters in Amsterdam and Rotterdam of the end of the eighteenth century rejected mathematics in favor of experience and craftsmanship, as had been done at the start of the century. Their remarks were much more a reflection of the limits of the available knowledge of their days. Significantly, Hoving and Lemmers allege that the thesis that English and French ships consistently out-sailed Dutch ships remains unproven.

Changing attitudes towards science and experimentation were not only observable in the area of ship design. Especially the archive of Johan Cornelis van der Hoop, the Amsterdam fiscal advocate of the 1780s and enlightened proponent of state-controlled marine reform, abounds with material on the possible introduction of new techniques. These include discussions on the best and cheapest chemical practices for the protection of the hull, connected to the major innovation of the double copper layer on the outside of the ship;

\[\text{\textsuperscript{192}}\text{Willem Udemans Jr., }Korte verhandeling van den Nederlandschen scheepsbouw, zo in theorie, als in practyk, meetkunstig vertoond (Middelburg / Amsterdam 1757) 61-62.\]
\[\text{\textsuperscript{193}}\text{NA, Archief Admiraliteitscolleges XXXIX, J.C. van der Hoop, no. 11. ‘Memorien van de Fransche of andere constructeuren over onse scheepbouw. Reflectien daarop van den equipagie mr May & anderen’}.\]
\[\text{\textsuperscript{194}}\text{Hoving and Lemmers, }In tekening gebracht, 155-156.\]
\[\text{\textsuperscript{195}}\text{NA, Archief Admiraliteitscolleges XXXIX, J.C. van der Hoop, no. 14. ‘Memorie van de wijze en bevindingen der kopere dubbelingen voorde schepen van oorlog bij het collegie van de Maze’, December 1782.}\]
proposals for the introduction of the ‘English caboose’ and new methods for distilling drinking water\textsuperscript{196}; examinations of the chain pump\textsuperscript{197}; a new type of artillery called the carronade\textsuperscript{198}; a new, cost cutting and more durable fashion of fabricating gun-carriages\textsuperscript{199}, and many more similar innovations. However, most of these were still product innovations, and even late in the eighteenth century attempts to transform the work process through the application of machines remained almost absent. Furthermore, by the end of the eighteenth century Dutch innovators relied heavily on findings imported from England and France.

Based both on the actual content of the debate between Amsterdam and Rotterdam shipbuilders, and on the evidence of widespread experimentation with new (albeit imported) techniques at the end of the eighteenth century, it seems mistaken to maintain the view that Dutch shipbuilding was fully stagnant after 1700. What is true, however, is that the changes that took place were slow and painstaking. Also, throughout the century there existed extraordinary unevenness in the application of new insights. In general, private shipbuilders were much slower in introducing developed methods of ship design than the larger yards of the Admiralty Board and VOC. The latter were much more inclined to discuss the performance of their ships in comparison to those of foreign navies and trading companies. But even among the Admiralty Boards sharp differences remained in existence over the relative merits of various shipbuilding methods, ranging from rule of thumb methods that hardly had changed from the late seventeenth century onwards to the integration of sophisticated French and English mathematical methods of ship design. This unevenness was kept in place by the institutional separation of the five Admiralty Boards, and by the still dominant position of the master shipwrights. A clear indication of the latter is that the Van Zwyndrecht family, who dominated shipbuilding in Rotterdam for a whole century, always kept their ship design in their own possession.\textsuperscript{200}

While it is hard to tell how much of it was simply an expression of the generally prevailing malaise and how much of it was real, the dominant view in public opinion during the late eighteenth century was that even in shipbuilding, once the pride and prowess of the Golden Age, the Dutch Republic had now fallen back behind its competitors. Not the absence or presence of Athena’s gifts, but social and institutional barriers to their distribution seem to

\textsuperscript{196} NA, Archief Admiraliteitscolleges XXXIX, J.C. van der Hoop, no. 23. ‘Nieuwe ijzeren Engelse scheepskombuizen’.
\textsuperscript{197} NA, Archief Admiraliteitscolleges XXXIX, J.C. van der Hoop, no. 24. ‘Brief over kettingpompen’.
\textsuperscript{198} NA, Archief Admiraliteitscolleges XXXIX, J.C. van der Hoop, no. 26. ‘Stukken over de bruikbaarheid van caronnadekanonstukken’.
\textsuperscript{199} NA, Archief Admiraliteitscolleges XXXIX, J.C. van der Hoop, no. 27. ‘Rapporten over nieuwe rolpaarden’.
\textsuperscript{200} Hoving and Lemmers, \textit{In tekening gebracht}, 144.
have been the key factor in the loss of dynamic of Dutch naval production at a moment that others started making huge strides in innovation. This fed the sense of despair that was well expressed in 1786 by one private shipbuilder in the service of the Amsterdam Admiralty Board: ‘That, while thus for some nations twilight has already arrived, and others have already seen the dawn, everything in the Netherlands still remains a dark night.”

Conclusions

Early modern naval shipyards were among the largest, if not the largest, production facilities of the early modern period. Taking care of the building and equipment of entire war fleets, they also were the focus of large scale supply. Therefore these institutions have drawn increased attention among historians interested in the development of bureaucratic management practices, the interplay between states and markets, and the evolution of labor relations. The Dutch Admiralty Boards have been characterized as exceptional for the close relations between naval administrators and local economic elites. The previous chapters have examined these close ties as resulting from structural features of Dutch early capitalism, as well as the institutional make up of the federal-brokerage state, and have explained how they shaped the use of naval power for the protection of global economic interests. This chapter examined the ways in which the same ties influenced the ‘naval economy’ at home.

The direct involvement of capitalists in the running of the early modern state has often been seen primarily as a source of corruption, and certainly opportunities for gross forms of self-enrichment abounded in the Dutch Republic. But this chapter has shown that personal favoritism in no way excluded the extensive use of market practices in order to ‘rationalize’ naval bureaucracy. In many respects, the development of both went hand in hand. Accustomed to the use of commercial means of accounting, pricing and trading, Dutch naval administrators were early in introducing highly advanced forms of standardized bookkeeping in naval administration. Their veritable obsession with calculating, comparing, and orderly management developed well before the ‘naval revolution’ of the 1650s and 1660s, but the application of these sophisticated techniques came to fruition with the concentration of naval supply and production on large centralized shipyards and storehouses. The Amsterdam naval

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201 NA, Archief Admiraliteitscolleges XXXIX, J.C. van der Hoop, no. 11. G.J. Palthe, ‘Memorie, betreffende de bouwing van oorlogschepen, ten dienste van de staten der Zeven Veréénigde Nederlanden’, Amsterdam, 1 August 1786.
storehouse and shipyard were the crown on this transformation, continuing to draw admiration from foreign visitors for their efficiency and orderliness well into the eighteenth century. The combination of the commercial mindset of naval bureaucrats, strong state finances, and the ability to draw on a highly developed economic hinterland, translated into a great variety of approaches to the market in order to obtain supplies in ways adapted to the prevailing market conditions in each sector. The most important of these was the widespread use of public tendering, not only for large contracts such as the building of ships or hulls, but also for many smaller acquisitions.

Traditionally, these attitudes have been seen as a result of the Dutch ‘Golden Age’ of the seventeenth century, while eighteenth century Admiralty management has been associated with stagnation and nepotism. However, this chapter has shown that at least for Amsterdam and Rotterdam as the most important Admiralty Boards, this approach is false. This can be seen very clearly in the area of labor relations. Far from being lethargic, Admiralty councilors energetically restructured the organization of work, especially in the face of the financial crisis of the 1730s and 1740s. This study has also demonstrated the social significance of this type of ‘efficiency’, pointing out how the advance of economic rationality went hand in hand with sharp hierarchic and income differentiation between management and the workforce, and the challenging of guild practices pushing shipwrights to become one of the most militant sections of the eighteenth century Amsterdam laboring classes. Whereas on British shipyards older practices such as the ‘right to carry chips’ were not eradicated until the nineteenth century, the completeness with which the Amsterdam shipyard was subjected to a ‘commodity regime’ in which even the smallest bits of waste were considered property of the institution testifies to the thoroughness with which the capitalist attitudes of management were followed through into the minutest details of work relations. Finally, the continued dynamism within those institutions is also apparent from the ways in which scientific progress, especially in mathematics, penetrated the shipbuilding process, although the manufactural basis of production characterizing the age of the wooden ship set firm limits to its successful application.

Overall, especially the Amsterdam shipyard in the eighteenth century proved much more dynamic than was long thought. However, there were firm limits to this dynamism as well. The most important of these was that the localism inherent in Dutch economic life and political organization to a great extent restricted the advances that were made to each Admiralty Board separately. The Admiralty Boards of Zeeland and Friesland did not profit from the same advantages in the access to well developed markets as the three Holland
Admiralty Boards, and did never receive the same political and financial backing. Even the Rotterdam Admiralty Board had greater difficulties in recruiting skilled workers than that of Amsterdam. Technological and scientific advances were not applied universally, so that Amsterdam, Rotterdam, and Zeeland at the half of the eighteenth century each built warships according to completely different conceptions of drawing and design. Overall, the federal-brokerage state allowed for easy and direct use of local resources, stimulating the interaction between capitalists and the state, but the very profitability of this interaction at a local level in part became a barrier to the development of similar interaction at the supra-provincial level.