The lifecycle of casks: the production, use, and repurposing of casks in the Netherlands (1300–1800)

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4. Production of casks in the Netherlands

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4.1 Introduction

This chapter investigates the multifaceted history of cask production in the Netherlands in the Late Middle Ages and Early Modern period (Figure 4.1). It examines the development of this artisanal craft in relation to broad urban, economic, and technological transformations. Through an analysis of guild structures, production processes, and pricing mechanisms, the diachronic development of cask production and its shifting role within urban economies is explored.

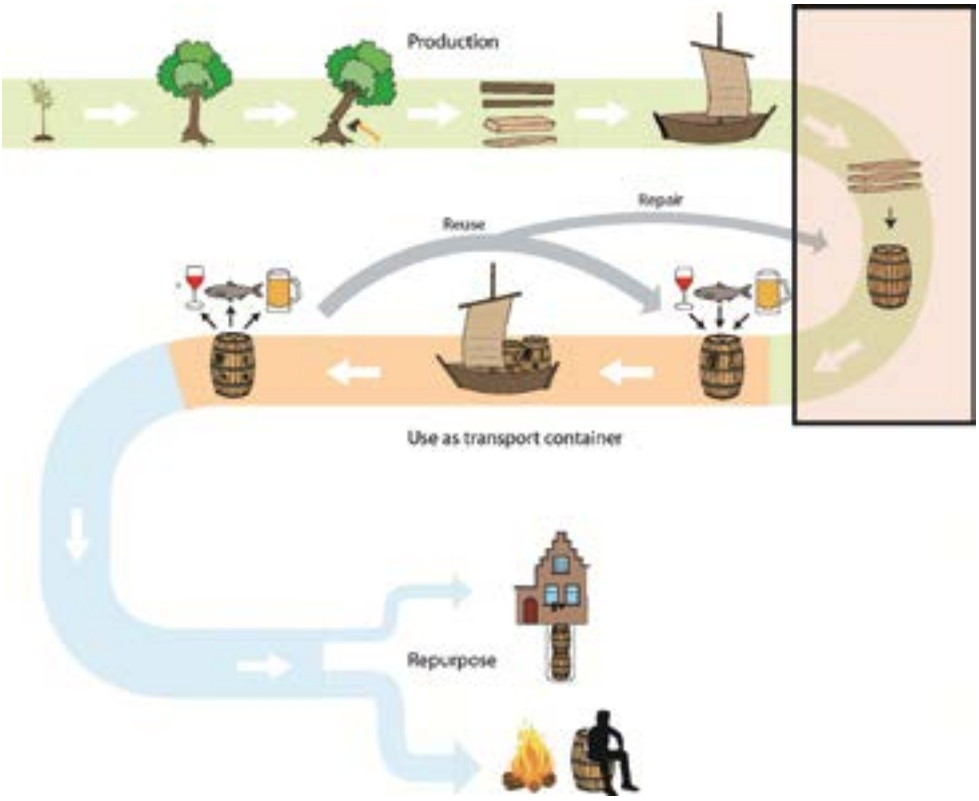

Figure 4.1: Schematic overview of the lifecycle of a cask. Production phase – green; its use as a transport container – orange; repurposing – blue. The frame highlights the part of the casks' lifecycle that is discussed in this chapter.

An examination of the rise of craft guilds shows how they served not only as regulatory bodies for standardization and membership but also signaled an increasing urban economic maturity. This development paralleled a significant shift in economic dominance, from Flanders to Brabant in the High Middle Ages, and by the Early Modern period, to Zeeland and finally Holland.

As economic activity gradually shifted northward, the coopers' trade also expanded as it adapted to the needs and structures of emerging urban centres. The formation of coopers' guilds in these regions not only met the practical demand for standardized and high-quality casks but also indicated where there was significant need for casks, used as they were to store important local products such as herring and beer. This chapter also focusses on the internal structure of coopers' guilds, with their roles of apprentice, journeyman, and master, which is significant for an understanding of cask production.

This chapter also investigates the processes of cask production. Detailed descriptions of traditional cooperage methods exist from the second half of the 20th century, while informative, though less detailed, accounts exist from the 19th century. However, documentation of production methods dating from the Late Middle Ages and Early Modern period is lacking. What does survive from these earlier periods is iconographic material, such as depictions of working cooperages, which offer insight into practices in these periods.

To investigate the development of cask production, a series of 3D scans was made of casks from different periods. The tool marks and general evidence of construction techniques visible on these artifacts can potentially identify diachronic changes in production methods that are not recorded in written sources.

Knowing how casks were priced helps to understand the economic role of cooperage. Pricing is closely related to the relationships between raw material costs, labour, and profit margins. In this chapter, archival sources are used to trace the evolution of cask prices over time and across regions, revealing the commercial positioning of coopers and the economic pressures that shaped their craft.

Bringing these several strands together, this chapter addresses the question: how cask production in the Netherlands developed diachronically in terms of organization, production technique, and pricing in the Late Middle Ages and Early Modern period. By combining data from written sources, archaeology, and 3D scans, a comprehensive understanding of cask production in pre-industrial Europe emerges.

4.2 Craft guilds

The function of craft guilds in the Low Countries

Between 1300 and 1800, there were approximately 2,000 craft guilds in the Low Countries.[110] These institutions emerged as formal associations of crafters within a particular trade or craft, with the approval and oversight of urban authorities. The primary objective of these guilds was the protection and promotion of the collective economic interests of their members.[111] In addition, guilds played a crucial role in structuring and preserving the transmission of craft knowledge and technical skills. This was facilitated through a standardized hierarchical framework consisting of apprentices, journeymen, and masters, within which expertise and practices were passed on through regulated training and professional competence.

Besides their economic function, craft guilds were of considerable social and civic importance. They often served as semi-public institutions that mediated between urban populations and local governments. In many towns and cities, guild members had political influence, particularly in matters of taxation, urban finance, and policy formation.[112] Furthermore, guilds frequently took on responsibilities in areas of public welfare and urban order, for example, contributing to fire prevention, dispute resolution, care for the poor, and even the defense of city walls in times of conflict.

Older and well-established guilds, particularly those founded before c. 1400, often had substantial political influence in addition to their economic authority. In contrast, guilds established in later periods, particularly after the rise of the Burgundian state, operated within a context of an increasing power of central authorities that limited their capacity for political leverage. Thus, the nature and influence of guilds varied considerably over time due to broad shifts in governance and state formation across the Low Countries in the Late Middle Ages and Early Modern period.[113]

The beginnings of craft guilds

Craft guilds began to emerge in the Low Countries in the second half of the 13th century.[114] Their appearance is closely linked to the growth of the trade economy during this period, which led to increased demand for specialized goods. The resulting occupational diversification and the increase of artisans made the formation of craft guilds viable and beneficial. The emergence of guilds correlates

110 Lourens & Lucassen, 1997, 44; De Munck et al., 2006.

111 Lourens & Lucassen, 1997, 43.

112 Blonk-van der Bercken, 2020, 237.

113 Lourens & Lucassen, 1997.

114 De Waard, 2002, 14.

strongly with the increase of urbanization in certain regions; there was a marked development of guild activity in Northern Italy, Switzerland, Southern Germany, the Rhineland, and the Low Countries.[115]

In the Low Countries, the founding dates of craft guilds in cities[116] are recorded in the Database Dutch Craft Guilds.[117] For the area of present-day Netherlands, this inventory was compiled under the direction of Jan Lucassen and Piet Lourens. It was first published in the early 1990s[118] and was later expanded. The database contains information on guilds from their foundation until their abolition in 1798 and is an important resource for studying the institutional, economic, and social roles of guilds in pre-industrial society.

This database shows that in economically dominant Flanders, 149 guilds were founded between 1100 and 1399, more than in any other region (Table 4.1). Between 1400 and 1559, Brabant became more prominent, with 120 new guilds established. From 1400 onwards, the northern Low Countries rose in prominence with 478 guilds founded (1400–1559). During this period, the regions of Zeeland and Holland became prominent, with Holland holding a dominant economic position in the Low Countries by the end of the 16th century. This shift is clearly reflected in the distribution of craft guilds established during the period, with 776 out of a total of 1,374 founded in what is now the Netherlands, forming a large cluster of guilds in the whole of the region.

Table 4.1: Overview of the founding period of craft guilds in the Low Countries, by region (data derived from Database Dutch Craft Guilds, 2012).

Region	1100-1399	1400-1559	1560-1669	1670-1784	unknown	total
Flanders	149	86	43	40	>95	413
Brabant	129	120	24	19	>64	356
Total	**278**	**206**	**67**	**59**	**159**	**769**
% of total number of Belgian guilds	**36%**	**27%**	**9%**	**8%**	**20%**	**100%**
North Brabant and Limburg	31	87	56	31	3	208
Holland and Zeeland	41	272	324	138	1	776
Overijssel, Gelderland, and Utrecht	33	85	121	24	0	263

115 Lis & Soly, 2006, 30.

116 The term cities refers to settlements with more than 2,500 inhabitants in the year 1784.

117 Database Dutch Craft Guilds, 2012.

118 Lourens & Lucassen, 1994.

Region	1100-1399	1400-1559	1560-1669	1670-1784	unknown	total
Groningen, Drenthe, and Friesland	4	34	60	29	0	127
Total	**109**	**478**	**561**	**222**	**4**	**1374**
% of total number of Dutch guilds	**8%**	**35%**	**41%**	**16%**	**>1%**	**100%**

4.3 Coopers' guilds

Function of coopers' guilds in the Netherlands

Like other craft guilds, coopers' guilds were officially sanctioned by local authorities and served as associations of crafters who joined forces primarily to promote their shared economic interests, while also taking the public good into account.[119] Over time, these guilds evolved into formal institutions that regulated the trade of relevant goods, set standards for craftsmanship, provided training in cooperage, controlled access to the craft, and safeguarded the economic position of their members.[120]

The foundation of a guild was typically formalized through a *gildebrief* (guild charter), issued by local authorities. The *gildebrief* granted a monopoly to the guild within city limits, and it also codified the rules, governance, and functions of the guild. The *gildebrief* of Amsterdam coopers (1542) detailed the structure of the guild leadership, outlined a *meesterproef* (rules for the masters' examination), penalties for violations, procedures for quality inspection, and mutual aid practices, such as mandatory attendance at the funerals of deceased members.[121] Article one of the *gildebrief* ensured the guilds' monopoly; only *burghurs* (residents) of the city who had passed the masters' exam and were members of the guild were allowed to manufacture or assemble casks.[122]

The production of casks was most likely centered in urban areas. Cooperage, like other forms of artisanal labour, was typically regulated through city-based coopers' guilds.[123] These guilds functioned as urban institutions and, in addition to organizing trade, they protected their members from external competition. This was possible because urban jurisdiction extended beyond the immediate city boundaries, and because the trade in specific products was conducted in urban markets, thereby placing it firmly within the city's legal domain. Thus, guilds can be viewed as a mechanism to safeguard their members from the growing economic activity in the surrounding countryside.[124] No evidence has survived documenting

119 Tump, 2012, 35.
120 De Kerf, 2013, 21.
121 De Waard, 2002, 15.
122 Van Dillen, 1929, 152.
123 Remmerswaal, 2006, 12.
124 Remmerswaal, 2006, 22.

cooperages outside urban centres. Little is known about the production and repair of casks in rural settings during this period.

The founding and location of coopers' guilds

In total, 38 coopers' guilds were established within the present-day borders of the Netherlands (Figure 3.6). These guilds were predominantly located in the coastal zone, with a notable concentration in Zeeland (six guilds).The majority of coastal zone guilds, however, were founded in Holland, which accounts for 18 guilds in total (Figure 4.2).

Figure 4.2: The location of coopers' guilds within present-day Netherlands, organized by century of their founding (projected on the Nieuwe kaart van de XVII Nederlandsche Provincien, 1715–1737. Vrije Universiteit Amsterdam, The Netherlands, https://digitalecollecties.vu.nl/digital/collection/krt/id/2592/).

A clear diachronic pattern can be seen in the establishment of coopers' guilds, corresponding closely to geographic location. The earliest guilds were founded in the proximity of the dominant economic centres of the time, with a noticeable northward expansion over the centuries. The earliest known coopers' guild was established in Sluis in 1397, near the key commercial hubs of Flanders.
During the fifteenth century, most coopers' guilds were established on the island of Walcheren or in other Zeeland towns, with the key commercial hubs of Brabant located in their immediate hinterland. In the same period, guilds were also

established in some of Holland's most prominent cities. In Dordrecht, for example, a coopers' guild was founded in 1437. Other cities where the booming beer industry created a strong demand for casks followed suit, for example, Gouda, in which a guild was established in 1453.[125]

In the 16th century there was a further expansion of guilds across major urban centres in Holland: Delft (1536), Leiden (1549), and Rotterdam (1553). Amsterdam joined this trend in 1542. During this period, the guild system also began to take form outside the coastal zone. Inland towns with access to major waterways, essential for trade and transport, also established coopers' guilds, for example, Breda in 1561 and Deventer in 1585.

By the 17th and 18th centuries, the spread of coopers' guilds expanded, with new guilds begun in the southern and northern parts of Holland. In the south, guilds were founded in Schiedam (1607) and Vlaardingen (1613), and the northern cities of Enkhuizen (1614) and Hoorn (1617) soon thereafter. In this period, guilds were also founded further inland, including in Leeuwarden (1601), Amersfoort (1617), Zaltbommel (1631), and Zwolle (1661).

Coopers' guilds and associated crafts

In many instances, coopers' guilds did not originate as independent organizations. Instead, they developed out of broader craft guilds encompassing multiple crafts, which, as cities expanded, were increasingly divided along occupational lines. Once the number of artisans in a specific trade, such as coopering, reached a sufficient scale, the establishment of a separate guild became viable.[126] The process of guild formation was thus closely tied to urban growth and the evolving structure of local economies.

In the cities of Dordrecht, Amersfoort, and Breda, coopers' guilds emerged from *timmerlieden* (carpenters') guilds. The co-existence of carpenters and coopers in one guild is understandable since the trades have woodworking in common. In Zierikzee, c. 1600, the St. Matthias Guild comprised coopers, *barbiers* (barbers), *wagenmakers* (cartwrights), and *viswijven* (fishwives),[127] the several crafts sharing a common patron saint, which may well have been the reason they formed a single guild. Even after the Reformation in the northern part of the Low Countries, many craft guilds that had formed around a patron saint retained their saint. In time, however, the significance of the patron saint gradually diminished, both socially and symbolically.[128] In Goes, several crafts were organized as a single guild, including *metselaars* (masons), *schrijnwerkers* (joiners), coopers, cartwrights, and

125 Yntema, 1992, 52.

126 Lourens & Lucassen, 1997, 127–128.

127 Remmerswaal, 2006, 31.

128 Lis & Soly, 2006, 28.

scheeps- en huistimmerlieden (ship and house builders).[129] Unlike in other cities, however, the coopers in Goes never established their own guild.

In other cities, coopers were not grouped on the basis of the materials they used or their craft techniques but rather according to the types of goods their product serviced. In Amsterdam, for example, the coopers' guild was established in 1542, following a split from the blacksmiths' guild (St. Eloy's Guild). However, the Amsterdam coopers kept their association with the wine merchants in the *kuipers- en wijnverlatersgilde* (Coopers' and Wine Merchants' Guild, Figure 5.4). This combined guild had exclusive rights to transfer wine between casks and to handle the loading and unloading of wet goods.[130]

The association of several trades in one guild may also have offered members certain economic advantages. Some wine merchants, for example, became master coopers, thus avoiding the cost of hiring an independent master cooper by employing a journeyman at a lower cost.[131] As a result, wine traders who were members of the Coopers' and Wine Merchants' Guild could reduce expenses and gain greater control over the production, maintenance, and inventory of casks, essential aspects of their business.

The production of casks was not necessarily tied within craft guilds but rather to the urban markets they serviced. High-volume goods like beer and herring, which were stored in casks, generated substantial demand. Between 1543 and 1545 alone, the nine major beer-producing cities in Holland, including Delft, Gouda, and Haarlem, used approximately 950,000 beer casks. In the early 17th century, casks used in herring ports like Rotterdam, Brielle, and Enkhuizen accounted for a yearly demand of 350,000 casks (Section 1.2).

A major hub of the herring fishery was located in Zeeland, but the primary hub was in Holland.[132] Beer production was based primarily in Holland,[133] although nearby cities such as Utrecht and Amersfoort also played important roles in brewing.[134] The distribution of coopers' guilds shows a concentration of guilds in both Zeeland and Holland (Figure 4.2). Looking at guilds specifically in beer production or fisheries, and the trades related to them, a notable correlation can be observed between these guilds and the presence of coopers' guilds in the same cities.
Of the 175 Dutch towns and cities inventoried in the Database Dutch Craft Guilds, 38 (21.7%) had a coopers' guild. A comparison with guilds related to the production or trade of beer shows that it was relatively common for a coopers'

129 Remmerswaal, 2006, 31.

130 De Waard, 2002, 36.

131 De Kerf, 2013, 34.

132 Van Bochove, 2004.

133 Yntema, 1992, 3.

134 Alberts, 2017.

guilds to be present in the same city. Thus, there were brewers' guilds in 62.1% of the cities that had coopers' guilds, and beer traders' guilds in 50% (Table 4.2).

Additionally, 40% of all fishermens' guilds were located in cities with coopers' guilds, and in more than half of these cases, a fishmongers' guild was also present, suggesting a moderate overlap between these trades. Similarly, shipmasters' guilds were found in 29, that is, 34.1%, of the 85 cities where coopers' guilds existed (Table 4.2). In other words, about one-third of the shipmasters' guilds were in the vicinity of coopers' guilds, indicating a notable, though somewhat weaker, association compared to some of the beer-related guilds.

Table 4.2: Overview of the number of guilds related to beer production or trade, and guilds related to fisheries and their commerce, in the 38 Dutch cities where coopers' guilds existed (Database Craft Guild, 2012).

Name of guild	**Name of guild (Dutch)**	**Number of guilds in cities with a coopers' guild**	**Number of guilds in the 175 Dutch cities inventoried for guild presence**	**% presence in city with coopers' guild**
Brewers' guild	*Brouwersgilde*	18	29	62.1%
Beer traders' guild	*Bierstekersgilde*	2	4	50.0%
Fishermens' guild	*Vissersgilde*	10	25	40.0%
Fishmongers' guild	*Viskopersgilde*	8	15	53.3%
Shipmasters' guild	*(Groot) Schippers-gilde*	29	85	34.1%

Membership numbers of coopers' guilds

The number of members in a coopers' guild varied between different cities, within individual guilds, and over time. For 21 of the 38 coopers' guilds that existed within the present-day borders of the Netherlands, membership data is available for at least one year. These figures give the number of coopers, masters, and cooperages, but exclude additional personnel such as apprentices and labourers. The data provides a focused view of the formally recognized members within the guild structure rather than a picture of all individuals involved in the craft.

For several coopers' guilds, most notably the one in Gouda, membership numbers have been preserved for a relatively short but continuous period (1632 to 1745). For this period, the guild records reveal a relatively stable number of members. From 1632 to 1720, the guilds' membership remained especially constant, with only minor fluctuations. Beginning in 1732, however, there was a downward trend in membership numbers. It is likely that the number of coopers in Gouda was significantly higher during the Late Middle Ages and the early sixteenth century. The decline is probably linked to the collapse of their primary market, the city's beer breweries. Between 1518 and 1616, the number of

breweries in Gouda plummeted from 154 to just 14.[135] The sharp decrease in demand for casks undoubtedly contributed to the decline of the coopers' trade in the city.

A particularly noteworthy case of a high number of members is the Amsterdam coopers' guild. In 1688 it had an exceptionally high number of members, 362 individuals, all officially registered as masters.[136] Unlike in most other cities, the coopers in Amsterdam were part of a joint guild with the city's wine merchants, officially known as the Coopers' and Wine Merchants' Guild. Because this arrangement did not exist in other cities, the list may have included people engaged in wine trading or related activities thus inflating the apparent number of coopers. Even taking this into account, a membership of 362 is, nevertheless, much higher than that of other urban coopers' guilds. In fact, of the guilds for which membership data is available, the Amsterdam guild was larger than all other 17th-century coopers' guilds within the present-day border of the Netherlands combined (Table 4.3).

Labor force of the cooperage sector in the Netherlands

To estimate the total labor force within the cooperage sector in the Netherlands, key production figures were used as benchmarks. Between 1543 and 1545, the nine major beer-producing cities required approximately 950,000 beer casks, averaging around 315,000 per year. [137] In the early seventeenth century, annual demand for herring casks was roughly 350,000.[138] For the purposes of this analysis, an average production figure of 350,000 casks is used.

Labor requirements per cask are estimated at 8.75 hours, based on the cost calculation for salted-fish casks presented in Figure 4.11. Using this benchmark, producing 70 casks required a total labor cost of *f* 51"18"0, equivalent to 1,038 *stuivers*, or roughly 14.83 *stuivers* per cask. Given a daily wage of 18 *stuivers* for an unskilled laborer[139], this translates to approximately 8.75 hours of labor per cask.

Extrapolating to the production of 350,000 casks, each requiring 8.75 hours of labor, yields a total labor requirement of 3,062,500 hours. Assuming an annual work contribution of 2,500 hours per cooper[140], this implies a workforce of approximately 1,225 coopers. It is important to note that this figure refers exclusively to the production of casks for a single product, such as beer or herring. Including casks for other goods, as well as repairs of existing casks, would substantially increase the total labor requirement.

135 Abels et al., 2002, 343.

136 De Waard, 2002, 25.

137 Yntema, 1992, 61.

138 Oosterbaan, 2023, 104.

139 De Vries, 1984, 155; Van Zanden, 1991, 565–566.

140 This calculation assumes a workday of 10 hours, over approximately 250 working days per year.

When compared with recorded membership of cooper guilds in the Netherlands during 1601–1700 (Table 4.3), the total number of coopers amounted to only 656 members. This number of members includes only one entry per city and covers merely 8 of the 38 existing cooper guilds for which membership data are available. The total number of active members of cooper guilds in the Netherlands was likely substantially higher than the recorded figure of 656.

These benchmarks also allow estimation of the maximum production capacity of individual cooper guilds. For example, the Amsterdam Coopers' and Wine Merchants' Guild had 362 members in 1688. Assuming full engagement in cask production, this workforce could collectively contribute 905,000 work hours per year, theoretically producing up to 103,500 casks annually. By contrast, the cooper guild in Veere, with only nine members in 1660, could produce a maximum of approximately 2,500 casks per year.

Table 4.3: Overview of the number of members (master coopers) and cooperages in coopers' guilds, with corresponding year, by city and century (Database Dutch Craft Guilds, 2012).

Location	1300-1400	1401-1500	1501-1600	1601-1700	1701-1800	1801-1900
Alkmaar						11 (1811)
Amsterdam			150 (1570)	362 (1688)	220 (1750)	202 (1811)
Breda					6 (1752) 4 (1798)	
Dordrecht			63 (1558)	80 (1661)		14 (1811)
Enkhuizen					54 (1788)	17 (1811)
Gorinchem						4 (1811)
Gouda				39 (1632) 46 (1641) 58 (1647) 57 (1654) 49 (1669) 39 (1699)	42 (1715) 40 (1716) 32 (1717) 42 (1720) 32 (1732) 20 (1744) 22 (1745)	
Groningen						24 (1811)
Haarlem						16 (1811)
Hoorn						8 (1811)
Leiden		28 (1498)	37 (1581)		19 (1749) 25 (1788)	46 (1811)
Rotterdam			17 (1600)	24 (1643)		138 (1811)
's-Gravenhage			128 (1587)		15 (1796)	
Sluis	21 (1394)				2 (1794)	
Utrecht				52 (1650)		14 (1811)

Location	1300-1400	1401-1500	1501-1600	1601-1700	1701-1800	1801-1900
Veere				27 (1620) 21 (1640) 9 (1660)	11 (1798)	
Vlaardingen					98 (1798)	
Vlissingen					16 (1780)	
Weesp					5 (1798)	3 (1810) 4 (1811)
Zierikzee				33 (1640) 50 (1660)		15 (1803)
Zwolle				18 (1639)	14 (1747) 14 (1748) 16 (1785) 13 (1795)	15 (1806) 19 (1811)

Organizational structure of coopers' guilds

Little is known about the organizational structure of coopers' guilds in the Netherlands before the 16th century. Written sources are scarce for that period, but this changes for the 16th century. Thus, in 1542 the organizational structure of the Amsterdam coopers' guild is detailed in its charter, issued by urban authorities. The charter includes the composition of the guilds' masters, the administration of the required masters' exam, as well as a code of conduct and inspection guidelines to ensure the quality of the casks.

The organizational structures of coopers' guilds within the region under study were uniform and stable, with a hierarchy in which roles and functions were clearly defined. The organizational structure of the Amsterdam coopers' guild remained unchanged until its dissolution in 1811,[141] and this stability was mirrored in other coopers' guilds, for example, in Haarlem and Rotterdam.[142] Even significant political changes had little effect on guild governance. When the coastal cities of the Netherlands joined the Republic at the end of the 16th century, the authority of the sovereign was replaced by that of the *Staten Generaal*. However, the cities retained a high degree of autonomy, including control over local institutions like craft guilds, allowing coopers' guilds to continue operating under their established internal regulations.[143]

Guild masters

The board of a coopers' guild typically consisted of four members, known as *overlieden* or *dekens* (guild masters). In Amsterdam, the Coopers and Wine

141 De Waard, 2002, 15.

142 Tump, 2012.

143 Tump, 2012, 40, 46.

Merchants' Guild was governed by four *overlieden* (Figure 5.4), appointed for two-year terms. They were selected by the urban authorities from a list of qualified candidates nominated by the guild board.[144] Despite these parameters, in practice the office appears to have been open to a select group. Between 1704 and 1794, only 44 individuals held the position, averaging over four terms each, suggesting an elite and recurring leadership circle.[145]

The guild masters were responsible for a wide range of duties. They managed the guilds' finances and registers, collected dues, enforced rules, in some cases oversaw the master examinations, mediated disputes, and represented the guild in petitions or consultations with the urban authorities.[146] The composition and organization of a coopers' guild board varied slightly between cities. In Vlissingen (1545), the coopers' guild was led by an *overdeken*, two *kerkdekens* (administrators), and two *straatdekens* (members who attended to technical matters).[147] In Rotterdam, the coopers' guild had a rotating board of four members from at least 1585, increased to five by 1666.[148]

Inspectors

The board of guild masters typically appointed *keurmeesters* or *proefmeesters* (inspectors) who supervised and evaluated the masterpiece crafted by candidates to qualify as a master cooper. These inspectors focused primarily on workshop practices, while other inspectors (*branders*) appointed by the urban authorities assessed whether casks met the required standards. These standards varied depending on the type of cask, for example, for herring or beer, but they also assessed the key components of a cask such as capacity, dimensions, number of staves and headboards, thickness of staves, and whether they were water-tight (Chapter 5). Thus, a system was established by which both the coopers' guild and the urban authorities ensured quality control.
In the mid-16th century, two *keurmeesters* (inspectors) were appointed by the guild masters of Vlissingen.[149] Similarly, two centuries later, the Amsterdam coopers' guild regulations of 1731 and 1772 state that two *keurmeesters* were to be appointed.[150] Records from the Amsterdam guild further show considerable overlap between the board of guild masters and the *keurmeesters*, suggesting an inner circle of recurring leaders.

144 De Waard, 2002, 26.
145 De Waard, 2002, 26.
146 Remmerswaal, 2006, 51.
147 De Ridder, 2004, 66.
148 Remmerswaal, 2006, 57–58.
149 De Ridder, 2004, 65–66.
150 De Waard, 2002, 29–29.

Guild members

For admission as member of a guild, candidates had to meet several requirements. First, there was an admission fee. In the Haarlem coopers' guild in 1607, this fee amounted to *f* 0.60, with *poorters* (city citizens) paying only half of that. From 1693 onwards, the fee increased to *f* 2.00 for non-*poorters* and *f* 1.50 for *poorters*.[151] Secondly, according to the *gildekeuren* (guild regulations), candidates were required to complete a minimum number of years as an apprentice before gaining membership. In the Rotterdam coopers' guild, according to the regulations of 1662 and 1720, this amounted to two years for citizens and four years for non-city citizens (i.e., outsiders). In Haarlem, the 1693 rules required four years of apprenticeship for citizens and six for non-city citizens.[152]

Upon completion of the required apprenticeship, the new journeyman could take the master examination. Passing that test granted him the status of master cooper and allowed him to open a workshop. Opening a workshop required a substantial investment and not every journeyman was able to do that. The journeyman had the option of registering with the coopers' guild as a *knecht* (assistant), for which the above-mentioned registration fee was required.[153]

The form of the master examination varied from city to city. Generally, the cooperage work required for the examination consisted of executing local practices of the craft. In other words, the casks made for the examination were to be used for local products. The coopers' guild of Amsterdam, from 1542 onwards, offered two possibilities for the master exam, one for *groot werck* (big work) and one for *cleyn werck* (small work). For the *cleyn werck* test, the candidate had to make a white-sealed meat tub, a herring cask, and a wine half-*aem* (a type of cask). For the *groot werck* test, the required pieces were a full quarter cask, an oil half-pipe, and a *sester* (specific types of casks).[154]

After successfully completing the master examination, a candidate could establish a cooperage and register as a master cooper with the coopers' guild in the city where the examination had taken place. As proof of membership, a *gildepenning* (guild token) was issued (Figure 4.3). In the northern regions of the Low Countries, the token was issued mainly to masters, although *knechten* (journeymen) did occasionally receive one.[155] The token served as proof of registration and compliance with guild requirements, and it could also be used as identification to confirm attendance at guild meetings or funerals.[156]

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151 Tump, 2012, 84.

152 Tump, 2012, 88.

153 Tump, 2012, 90–91.

154 De Waard, 2002, 16.

155 Teulings, 2019, 358.

156 Teulings, 2019, 46. The guild tokens from the 17th and 18th centuries in the Northern Netherlands have been collected in the Gildepenningen database, accessible here: https://hdl.handle.net/10622/RS4FYJ

Figure 4.3: Guild token of the Amsterdam coopers' guild from 1779, issued to master cooper Jean Chevalier Durege (Guild token of the Amsterdam coopers' guild, [Inv. no. 021877], 1779. Zuiderzee museum, Enkhuizen, The Netherlands.

Apprentices and journeymen

In cooperages, the master cooper was assisted by apprentices (*gezel*) and journeymen (*knechten*), the distinction being that apprentices were still in training, whereas journeymen were fully skilled craftsmen, though not yet masters. These two roles formed a flexible workforce, enabling cooperies to adjust labor allocation in response to year to year fluctuations in demand, depending on the demand for casks of the relevant sectors. For example, the collapse of the beer-brewing craft in Gouda between 1518 and 1616—the number of breweries dropped from 154 to just 14—significantly reduced the need for beer casks. If demand for casks was high, additional workers could be hired. The register of journeymen and apprentices from the coopers' guild in Haarlem shows a notable increase in numbers around 1685, which coincides with a time period of economic growth in Holland.[157]

Cask production was also affected by seasonal fluctuations. The supply of coopering wood and the demand for casks varied within a given year. The herring season, for example, lasted only four months, from June to September (Section 7.7.3). Cooperages could adjust their number of workers to meet seasonal needs.

157 Tump, 2012, 86.

As described above, the nature of the cooper trade made for a fluctuating workforce. In Vlissingen, for example, records from 1780 mention 16 master coopers employing a total of 150 journeymen.[158] Similar numbers are seen in Rotterdam; in 1843, 29 coopers employed 172 workers in total.[159] These ratios, however, varied significantly over time and from place to place. The guild employment records of Veere for 1618 listed 27 coopers who employed only eight apprentices. By 1659, the number of master coopers had declined to fewer than 10 in Veere, with just one apprentice remaining.[160] In Haarlem, the coopers' guild registered 428 apprentices and journeymen between 1649 and 1669.[161] While the exact number of cooperages for that period is not known, there were 16 in 1811 (Table 4.3), which would be an average of 1.3 apprentices or journeymen per cooper over the two decades. However, the numbers in coopers' guild registers may be understated, as registration was primarily intended for those who needed to document their apprenticeship years in order to qualify for the masters' examination[162] and thus not all workers in cooperages would have been recorded in the registers.

4.4 Production process

The production of casks in cooperages between 1300 and 1800 is described in various written sources, focusing on pre-industrial methods. Information from these sources is essential for our understanding of production at that time because in the Netherlands today there are very few cooperages left, and cooperages using pre-industrial methods no longer exist in the Netherlands, making the craft extinct in practice. There are, however, some cooperages in museum contexts that demonstrate pre-industrial techniques, for example, at the Zaans Museum, the Zuiderzee Museum (Figure 4.4 right), and at the workshop Kuiperij Meester in Amersfoort (Figure 4.4 left).

In what follows, the traditional process of cask making is examined step by step, relying on documents that describe artisanal techniques as they persisted into the 20th century (Section 4.4.1). To determine whether this production process reflects casks from archaeological contexts, 3D scans were made of four casks dating from the 15th to the 20th century (Table 4.4). These scans reveal tool marks and construction features as well as changes in cooperage practices over time. The findings are presented in section 4.4.2.

158 De Ridder, 2004, 69.

159 Database Dutch Craft Guilds, 2012, https://doi.org/10.34894/WYQO0Z

160 Remmerwaal, 2006, 82.

161 Tump, 2012, 84.

162 Tump, 2012, 83.

Figure 4.4: Left: the workshop of the coopery Meester, Amersfoort, right: the workshop of the coopery in the Zuiderzee Museum, Enkhuizen (author's photos).

4.4.1 Production process in written and iconographical sources

After the required wood was purchased, the staves were prepared by splitting them as efficiently as possible from logs or beams using a curved froe (*kloofmes*), usually across the grain (Figure 4.5_1). In doing so, the desired length, width, and thickness of the staves were carefully taken into account. From the 18th century onwards, splitting gradually gave way to sawing. This was faster and made more efficient use of the wood.[163] Staves made by splitting can be identified by their long, rough edges and scratch marks, which result from wedges being driven downward through the wood, unless these traces were removed during the finishing of the staves.[164] The split or sawn staves were then further dried at the cooperage, typically for a six-week period (Section 2.5).

The staves were then tapered at both ends so they could be bent to the required cur*vat*ure (Figure 4.5_2). In the 20th century, this was done with a lathe but during the research period, a coopers' axe was used. To ensure a tight fit against the hoops that would later bind the cask, the exterior of each stave was rounded (Figure 4.5_3). This was traditionally done with a hollow plane (*haalmes*). The interior surfaces of the staves, on the other hand, were hollowed using a plane with a different concave profile (*holmes*) in order to facilitate the bending of the stave.[165]

Next, the edges of the staves were shaped so they would fit together seamlessly, a process known as jointing (Figure 4.5_4). For standardized cask types that were produced in large numbers, a jointing mold was used to determine the correct bevel. In other cases, the angle was set manually using a bevel gauge. During the

163 Waelput, 2004, 69–70.

164 Manders, 1996, 18.

165 Manders, 1996, 19; Waelput, 2004, 103.

research period, the jointing was primarily done with a jointer plane or a traditional bench plane. In the 20th century, a lathe was used.[166]

The staves were then laid out side by side on a workbench to check whether the required cask circumference would be met and to determine their optimal arrangement. Small imperfections, such as knots or minor tooling errors, were interspersed among the other staves so the imperfections would not be in staves adjacent to each other. Variation in stave widths was also taken into account; wider staves were alternated with narrower ones.[167] To ensure a precise fit, a closing stave was often needed, typically a relatively narrow piece that ensured the staves were of the desired circumference. The presence of such a stave is a key distinction between handcrafted casks from the pre-industrial period and late 20th-century machine-made casks that have staves of uniform width.[168] After this step, the staves were ready to be raised into a cask.

The raising of the cask involved placing the staves into a temporary setting hoop, typically a ring made of thick metal or ash wood (Figure 4.5_7). Once all the staves were inserted, a second hoop was added, drawing the staves together at the bilge and at one end, forming a half-closed cask. At the opposite end, the staves remained splayed and had to be bent inward. To achieve this, the half-finished cask was placed over a brazier. The inner surfaces of the staves were heated and dried by the fire, while the outer surfaces remained moist or were kept wet. The difference in moisture caused the staves to bend inward. A windlass or rope clamp was then used to pull the staves further together (Figure 4.5_8). If the desired cur*vat*ure was not yet reached, the process was repeated. Finally, the head hoop was driven onto the cask, bringing the staves into a tightly bound cylindrical form.

Casks intended for certain types of products were sometimes charred, depending on the buyers' requirements. Waelput notes this practice in the 20th century for casks used in the herring industry or meat transport, to reduce the effects of wood moisture and natural acids. Charring was also done with casks for alcoholic beverages, with the aim of neutralizing acids and to enhance aromas, for example, vanilla.[169] It is not known, however, if this practice was also employed during the research period.

166 Manders, 1996, 20–21; Waelput, 2004, 114–115.

167 Waelput, 2004, 122.

168 De Groot personal communication, January 24, 2025.

169 Waelput, 2004, 143.

Figure 4.5: The assembly of casks in an 18th-century French cooperage. Figs. 1–3: Reducing and shaping the staves, Fig. 4: Jointing; Figs. 5–6: Assembling the heads, Figs. 7–8: Raising the cask. Fig. 9: Cutting the croze (Fougeroux de Bondaroy, 1777; Plate V).

Figure 4.6: Finishing casks in an 18th-century French cooperage. Fig. 1: Measuring the headboards; Figs. 2–4: Placement of the hoops; Fig. 5: Driving hoops; Figs. 6–7: Drilling holes (Fougeroux de Bondaroy, 1777; Plate VI).

The next steps were to work on the bottom rim. First, the chime was formed using an adze. An inward sloping bevel was fashioned along the lower edge of each stave (Figure 4.7). The purpose was to reduce surface contact of the cask with the ground, thereby minimizing the risk of moisture being drawn up from below. The ends were then topped to create an even surface. This was followed by chiving, a process by which the inner edges of the staves were hollowed out to provide sufficient space for inserting the cask heads into the body of the cask. The final step was to cut the croze, a groove into which the heads would be fitted (Figure 4.7).

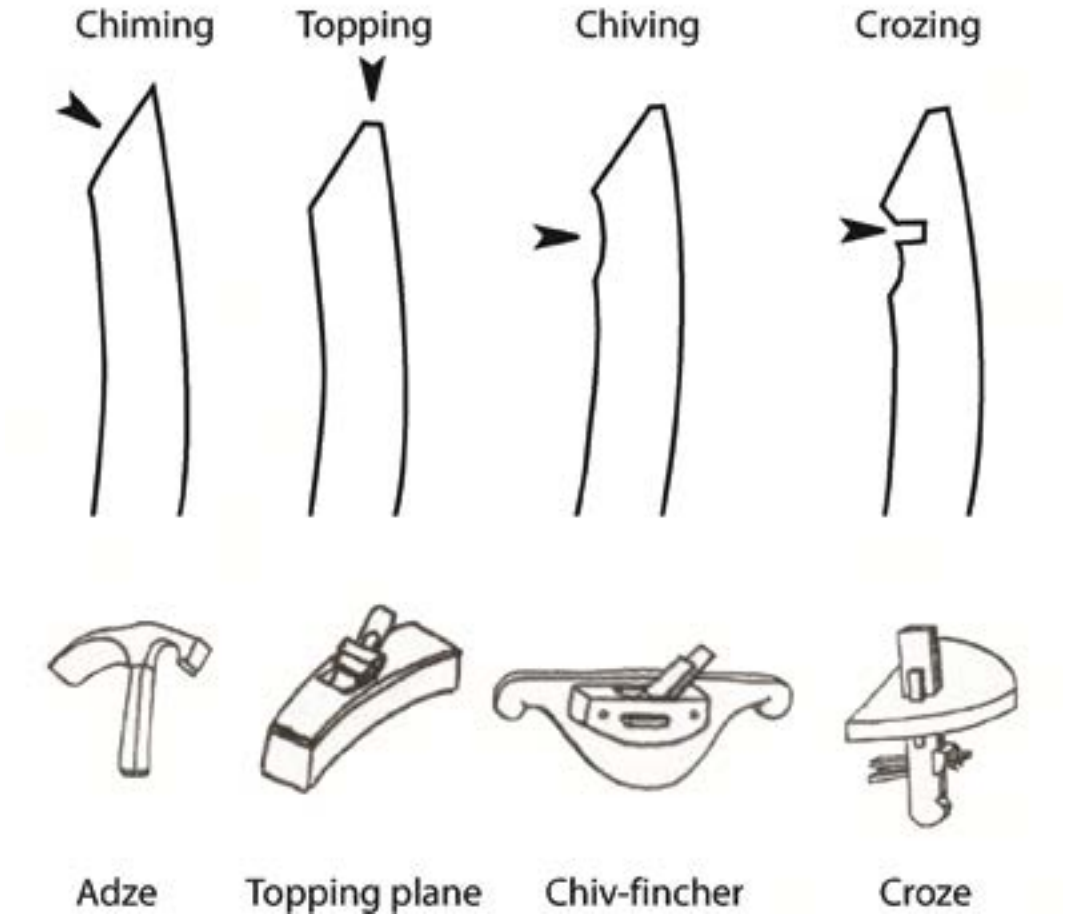

Figure 4.7: Schematic overview of the shaping techniques of the casks' bottom rim with the corresponding tools (Waelput, 2004, 149).

Heads were then made to close the cask. A compass was stepped six times around the casks' interior (Figure 4.5_5), and the required diameter was transferred onto a set of headboards. Depending on that diameter, a head could have from one to seven pieces. To prevent leakage at the joints, flax, hemp, or rushes were packed between the headboards. The head was sawn out with a bow-saw and joined with wooden pegs. The perimeter was then trued with a hollow plane. The inner edge

was beveled more sharply than the outer, allowing the head to sit easily in the croze.[170] Because heads were not always perfectly round, their rotational position inside the cask mattered for a watertight seal. Matching marks on both the head and the cask rim ensured the heads' correct orientation.

The heads were typically inserted from the inside of the cask outward into the croze. As the bilge was the widest part of the cask, this allowed the most space for maneuvering. First, the waist hoop was temporarily loosened or removed to create enough clearance for fitting the heads into the croze at both ends. Once the heads were properly positioned, the end hoops were driven back into place to secure the assemblage.

After that, the temporary hoops could be replaced with the hoops intended for the finished cask (Figure 4.6_3-5). In Dutch cooperages, these were primarily made of willow withies. Iron hoops, standard by the 20th century, were already in use during the Early Modern period. Excavations at the Behouden Huys on Nova Zembla show that metal hoops were used as early as the late 16th century.[171] Since the expedition to Nova Zembla expected harsh conditions, it is likely that the crew favoured casks bound with iron hoops. Nevertheless, throughout the Late Middle Ages and Early Modern period, willow was the most commonly used material for cask hoops.

The final step in the process was to finish the exterior of the cask by planing away surface irregularities and drilling the necessary holes (Figure 4.6_7). Depending on the intended contents, these might be a bung hole (*bomgat,* for filling and emptying the cask), a tap hole (*tapgat*, for drawing off liquid), or a vent hole (*zwikgat*, to allow air in during tapping), which were bored into the bilge or the heads. Lastly, the cask was marked by the cooper responsible for its production.

4.4.2 Production process of casks from archaeological contexts

To assess whether there are observable differences in the production process between the 15th and 20th centuries, a total of four casks were 3D scanned (Table 4.4). From an analysis of these scans, data and traces of the production process can be identified. Particular attention was given to three key aspects of production: the variation in stave width, the presence of wedge marks, and traces of hoop placement. The findings are presented below.

170 Manders, 1996, 29–30.

171 Manders, 1996, 44.

Table 4.4: The specifications of the cask found in the city of Amersfoort that were 3d scanned.

Context	Date	Height (cm)	Maximum diameter (cm)	Link to 3d data
Coopery Meester (Amersfoort)	20th century	41	26	[172]
MW'18	18-19th century	75	40	[173]
HA 4-18	16th century	105	61	[174]
Sto'16	15th century	73	53	[175]

Initial analysis focused on variation in stave width. As described in section 4.4.1, a hand-made cask, according to contemporary coopers, can be identified by the presence of a relatively narrow stave used to close the cask, the closing stave. In machine-made casks, stave widths are consistent, allowing the cask to be completed without the need for a specially fashioned narrow closing stave.

Of the 3D-scanned casks, only the example from the 20th century showed a practically uniform stave width and thus there was no clearly distinguishable closing stave. The other three casks, however, had a visible, narrow closing stave (marked with an arrow in Figure 4.8). It is likely that such a stave was added after the cooper had laid out all the staves on the workbench to see whether they formed the intended circumference. In many cases, this did not result in a perfect fit. An additional narrow closing stave was a practical solution.

Figure 4.8: Top view of the 3D-scanned casks. Arrows mark the potential presence of a narrow, closing stave.

172 https://sketchfab.com/3d-models/20th-century-barrel-e09bc4cd466843a69c71d37a1968267d.
173 https://sketchfab.com/3d-models/ton-mw18-01512dd5409e4842857ea43b7da94fd3.
174 https://sketchfab.com/3d-models/ton-ha-4-18-358b57d7abf541049f2c129cfbe03f93.
175 https://sketchfab.com/3d-models/ton-sto16-binnenzijde-170b2a296ab54c4d86749d203fb3dfa7.

The 3D scans were also examined for signs of split or sawn staves. As noted by Waelput, sawing became the predominant method from the 18th century onwards. Earlier cooperages favoured splitting the wood with wedges, and this procedure left short and transverse impressions (Section 4.4.1). The presence of wedge marks, therefore, is indicative of splitting.[176]

Only the 15th- and 16th-century casks show such wedge marks. They are visible on the inner surfaces of the staves as lines running perpendicular to the grain, usually no wider than 5 cm, appearing in multiple locations (Figure 4.9). Exterior traces may have been removed during finishing. The absence of wedge marks on 18th-, 19th-, and 20th-century casks does not conclusively indicate sawing, since any traces of splitting could have been removed in the finishing process. While this evidence agrees with a historical shift from splitting to sawing, it is not conclusive.

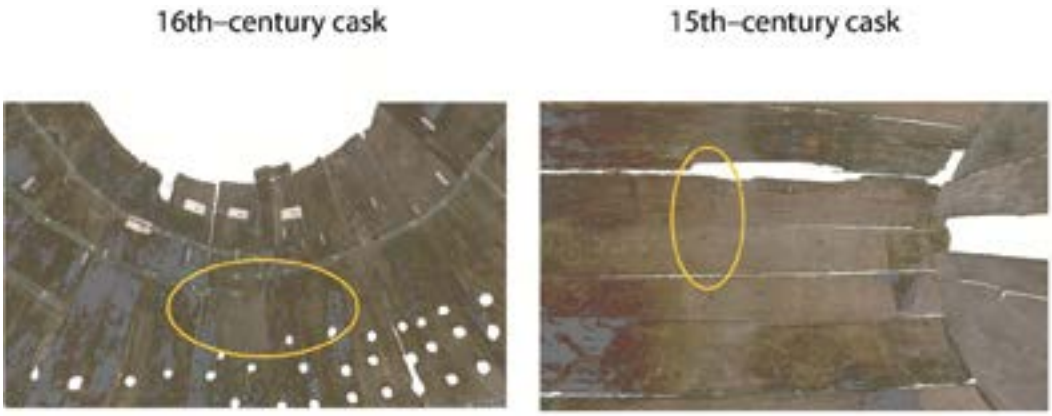

Figure 4.9: Interior view of two casks, showing traces of the wedges used to split the wood.

Many of the tool marks visible on the exterior of the casks can be linked to the placement of hoops (Figure 4.10). These traces typically appear as transverse lines running perpendicular to the stave grain, often spanning the full stave width and recurring at consistent heights across adjacent staves. In three of the four 3D-scans, the hoops themselves are no longer preserved, preventing definitive identification of the materials used. However, based on comparative data from 15th- and 16th-century casks, willow hoops were most likely used, as they were common in this period.

The marks may originate from several phases of the cooperage process: from the initial application and removal of setting hoops to the installation of permanent hoops. Alternatively, they may reflect later repairs, such as the replacement of hoops during the casks' lifespan, which could leave minor damage or pressure

176 Manders, 1996, 18.

marks. The 3D-scan data, however, does not allow for a clear distinction between production-related and use-related traces of hoop placement.

Figure 4.10: Traces of hoop placement on the exterior of the 3D-scanned casks.

4.5 Pricing of casks

To provide an overview of the prices for cooperage work, a few examples of selling prices from the mid-17th century to the end of the 18th century are presented here. Records of prices have been preserved in the archives of the coopers' guild of Dordrecht that include cask lists from between 1635 and 1640. These lists include deliveries to breweries, such as the brewery in 't Cruijs in Dordrecht, which in 1635 purchased a last of half-barrels (*halfvaten*) for 10 guilders.[177] These half-barrels, generally holding around 70 liters, were common in the beer trade.[178] Since a last typically comprised 12 barrels, the price of one half-barrel would be approximately 16 *stuivers* (*f* 0:16:1).

In another order, a last of barrels to be delivered to the brewery Den Dissel cost 18 guilders, which amounts to 1 guilder and 10 *stuivers* per barrel (*f* 1:10:0).[179] The beer casks to which this entry refers were likely larger, possibly exceeding 130 liters (Chapter 5). In the following years, the selling price of half-barrels fluctuated slightly, for example, in January, 1639, a last of half-barrels was sold for 10 guilders and 10 *stuivers* (*f* 10:10:0).[180]

Another type of cask, the half-*ankers* and *ankers*, are documented in the records of the coopers' guild of Veere in 1768 with their prices. A half-*anker* was a relatively small cask, typically holding approximately 37 or 38 liters, and was commonly used for products such as wine, vinegar, and distilled spirits.[181] The price of an empty half-*anker* is mentioned on several occasions, indicating minor fluctuations, generally between 11 and 13 *stuivers* per unit.[182] Full *ankers* were priced higher at 18 to 22 *stuivers*.[183]

177 RAD, GC, No. 505, April 18, 1635.

178 Database De oude Nederlandse maten en gewichten, n.d., https://mgw.meertens.knaw.nl/maat/304

179 RAD, GC, No. 505, November 29, 1635.

180 RAD, GC, No. 505, January 4, 1639.

181 Database De oude Nederlandse maten en gewichten, n.d., https://mgw.meertens.knaw.nl/maat/36

182 ZA, SV, No. 1901, June 18–August 12, 1768.

183 ZA, SV, No. 1901, April 10–May 26, 1773.

The value of these casks can be estimated by comparing the selling price with the typical wages of the time. In Holland between 1650 and 1805, the average daily wage was 18 *stuivers* for unskilled labour and 25 *stuivers* for skilled labour.[184] This means that an unskilled laborer could buy a half-*anker* with about a day's wages. A beer cask would cost almost two days' wages.

Calculating the selling price

In calculating the selling price of a cask, the cost of timber and hoops, labour, and profit margins were considered. The minutes and appendices of the coopers' guild archive in Vlissingen (1775–1808) include a detailed cost calculation for producing casks intended for salted fish (Figure 4.11). The document is not directly associated with any specific entry in the archival minutes and appendices of the coopers' guild, making it impossible to determine its exact date within the period 1775–1808.

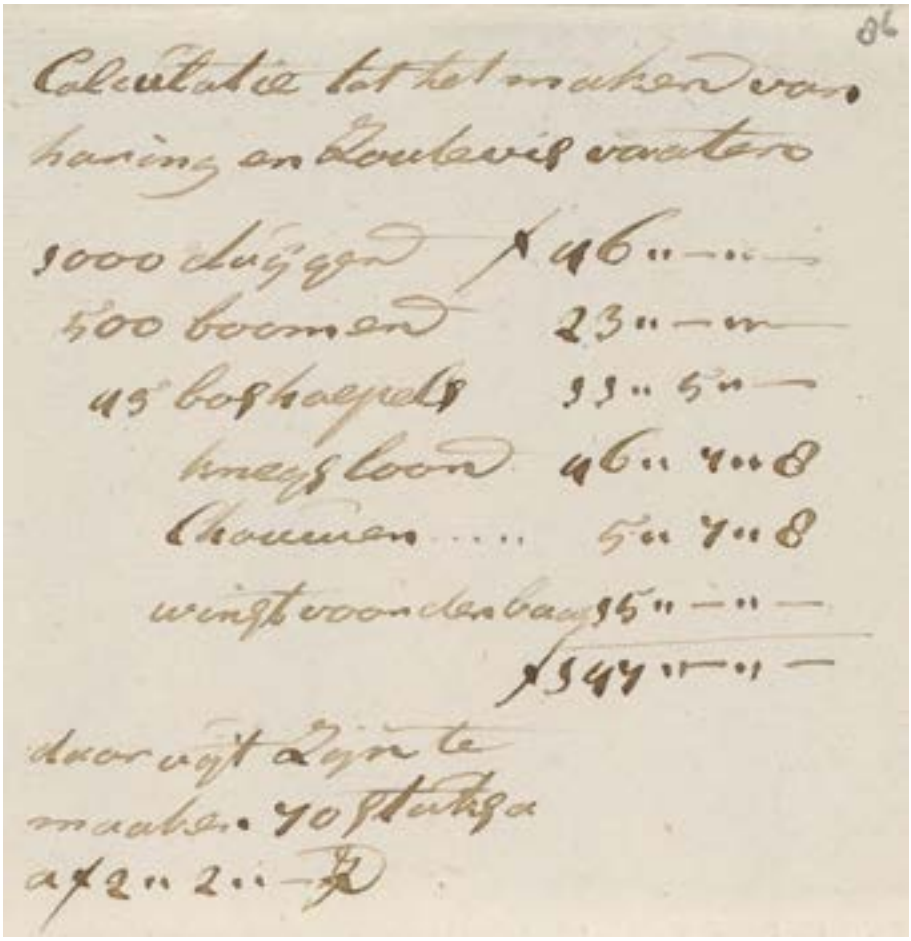

Figure 4.11: The calculation of the selling price of a cask of salted fish, found in the minutes and appendices dated between 1775 and 1808 of the archives of the coopers' guild in Vlissingen (ZA, GtV 99, folio 86).

184 De Vries, 1984, 155; Van Zanden, 1991, 565–566.

The document shown in Figure 4.11 lists the following amounts:[185]

1000 *duijgen* (staves)	*f* 46″0″0
500 *boomen* (headboards)	*f* 23″0″0
45 *bos hoepels* (bundles of hoops)	*f* 11″5″0
knegtsloon (journeyman wages)	*f* 46″7″8
Shouwen (carrying)	*f* 5″7″8
Winst voor den baas (Profit for the boss)	*f* 15″0″0
	f 147″0″0

Daarvan zijn te maaken 70 stuks á f 2″2″0 t stuk (With that, 70 casks can be made at *f* 2:2:0 each)

The calculation sheet shows that 70 casks for packing salted fish could be produced at a total cost of *f* 147:0:0, with each cask costing *f* 2:2:0. The timber and hoops alone accounted for *f* 80:5:0, roughly 55% of the total cost.[186] Hoops accounted for 16.7% of the raw material costs. This is striking since lower costs for hoops might be expected in that hoops were often locally produced from willow, in regions like the Biesbosch. The timber, on the other hand, had to be imported from the Baltic region, Poland, or the North German Plain (Chapter 3).

The labour costs related to making casks, including journeyman wages and carrying, amounted to a total of *f* 52:5:6, that is, 35% of the selling price. Interestingly, the labour costs are only those of the journeyman, not the master cooper. It is possible that the master cooper was not directly involved in the manual making of the 70 casks, and the term *den baas* (the boss) is likely a reference to the master cooper, for whom a profit margin of *f* 15:0:0 is allotted, that is, 10% of the selling price.

To estimate the value of an empty cask for salted fish, its selling price of *f* 2:2:0 can be compared to the typical daily wage of an unskilled laborer during this period, which was 18 *stuivers*. Thus the cost of a one cask was equivalent to 2 $^{1}/_{3}$ days of work.

4.6 Conclusion

This chapter investigates how cask production in the Netherlands evolved from the Late Middle Ages into the Early Modern period, examining the organization in craft guilds, production process, and pricing. Through this diachronic investigation, significant economic, social, and technological developments that shaped the production of casks are highlighted. The sub-study explores how the role of craft guilds, the methods of cask production, and market strategies were adapted in response to broad urban and economic shifts. Drawing on a wide range of sources, archival documents, iconographic materials, archaeological findings, and 3D scans

185 The amounts are listed in gulden, stuivers, and oorden (1 gulden = 20 stuivers, 1 stuiver = 4 oorden).

186 Duijgen f 46″0″0 + boomen f 23″0″0 + boshoepels f 11″5″0 = f 80″5″0.

of casks, new insights are offered towards a better understanding of the changing nature of this essential craft Late Middle Ages into the Early Modern period.

The emergence of craft guilds in the Low Countries is a crucial lens through which the socioeconomic dynamics of the period can be better understood. As formal institutions that regulated artisanal production within specific crafts and advocated for the collective interests of their members, guilds played a crucial role in defining the operations of specific crafts.

The establishment of craft guilds is symbolic of the shift in economic dominance during the transition from the late medieval to the early modern urban economy. Most urban craft guilds in the Low Countries were founded from the 12th to the 16th century. In Flanders, the majority of guilds emerged from the 12th to the 14th century, while in the Duchy of Brabant, guild formation intensified during the 15th and 16th centuries.

During this period, the provinces of Zeeland and Holland emerged as important centres of economic activity, with Holland in particular becoming the dominant center of the Low Countries by the late 16th century. This growing prominence is evident in the geographic distribution of craft guilds. Of the 1,374 registered guilds within the present-day borders of the Netherlands, 776 were established in Zeeland and Holland, underscoring the region's central position in the development of urban artisanal practice.

An investigation of the founding dates of coopers' guilds reveals a similar pattern. The earliest guilds were established near prominent economic centres, followed by a gradual northward expansion in the following centuries. The oldest known coopers' guild was founded in Sluis in 1397. Subsequent guilds were established in the rest of Zeeland and then in Holland. It was only near the end of the 16th century that coopers' guilds were founded further inland, particularly in port towns on major rivers, such as Breda (1561) and Deventer (1585).

The interaction between craft guilds and related sectors (e.g., beer brewing and the herring fishery) took place within a network of economic interdependence that was vital to the survival and development of the cooperage trade. The establishment of coopers' guilds in cities with active brewing and fishing sectors suggests a symbiotic relationship, in which the consistent demand for casks sustained the coopers' profession, stimulated specialization, and ensured its long-term viability.

The organizational structure of coopers' guilds remained relatively consistent over time. They were typically organized hierarchically, serving to implement good governance and trade regulations, and to ensure internal discipline. Concrete evidence of this structure, however, only emerges in the Early Modern period, as no written records detailing guild organization have survived from the Late Middle Ages. In surviving documentation, there is evidence that roles were clearly delineated; guild masters provided leadership, inspectors enforced quality standards, and

regular members carried out production. This structured division of responsibilities was essential in maintaining trade standards and institutional coherence.

The knowledge of the cask production process in the Netherlands during the research period cannot be drawn from still-active cooperages, as very few remain today. The few surviving coopers work primarily in museum settings. Consequently, our understanding of traditional cask-making relies mainly on written descriptions and on production marks found on casks recovered from archaeological contexts.

Crafting a cask was a complex, multi-step procedure designed to ensure functionality, durability, and watertightness. The staves were shaped by chiming, topping, chiving, and crozing. The heads were constructed by joining several headboards, beveling their edges, and fitting them into the body of the cask, a step that required temporarily loosening the hoops to allow proper placement. Once the heads were inserted, the hoops were repositioned and secured in place. Finally, the exterior surface was smoothed, bung and tap holes cut, and the coopers' mark applied.

To analyze production marks on casks, four archaeological specimens were selected and investigated. This was done with the help of 3D-scans of the casks. Each cask is of a different period, and collectively they span from the 15th to the 20th century. The analysis focused on three key aspects: variation in stave width, the presence of wedge marks, and traces of hoop placement.

Of the four casks, only the 20th-century one had a largely uniform stave width, indicating mechanized production. In contrast, the casks dating from the 15th to the 19th centuries all had at least one significantly narrower stave, typically used to seal the cask. This feature is characteristic of hand-crafted casks, confirming that these earlier examples were produced entirely with manual techniques.

The presence of wedge marks on staves has been interpreted as indicative of wood splitting. In contrast, the absence of wedge marks on staves is believed to indicate sawing, a method that likely predominated from the 18th century onwards. In the 15th- and 16th-century casks, wedge marks were observed on the inner surfaces of the staves, supporting the hypothesis of a historically earlier splitting method. The most common production traces found on the casks, however, are those resulting from the placement and removal of hoops. These marks were consistently identified diachronically on the exterior surfaces of the staves.

Pricing materials and labour illustrate the economic factors that influenced cask production. An examination of archival sources revealed the particulars of raw material costs, labour, and profit margins. Fluctuations in pricing reflect economic health in the coopers' trade and highlight the interdependence between coopers and the sectors they served. The large demand for casks in the brewing and fishing sectors underscores the vital role that coopers played in supporting these burgeoning industries.

In conclusion, this sub-study of cask production offers a nuanced understanding of the interplay between craft, economy, and society during a transformative period in the history of the Netherlands. The evolution of coopers' guilds, production techniques, and pricing mechanisms reveals a dynamic landscape shaped by urbanization, economic shifts, and technological advancements. The investigation and analysis of written sources, casks from archaeological contexts, and 3D scans, enriches our understanding of the cooperage trade and contributes to the discourse on pre-industrial craft production in Europe.