Manufacturing in the Roman world

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If the fourth century AD *Expositio Totius Mundi et Gentium* (Description of the world and its people) is anything to go by, cities and regions throughout the Roman world could be identified by what they produced: page after page, the anonymous author of the text highlights the locally manufactured consumer goods – particularly textiles – for which the regions of the empire were renowned.[1] As a text, the *expositio* is unique, but it stands in a firm Hellenistic and Roman tradition. Laodicea on the Lycus in Phrygia, which was highlighted as a centre for textile manufacturing in the *expositio*, was routinely praised for its wool production by authors from the Roman imperial period, as were cities like Tarentum and Mutina in Italy.[2] People, both groups and individuals, could freely be identified (or self-identify) as craftsmen – and not to their detriment. According to Dio Chrysostom, the lower classes at Tarsos were colloquially known as the 'weavers', though they were not necessarily all involved in textile production.[3] In Ephesos, the urban community erected a statue for a famous athlete from Alexandria who was nicknamed, as the inscription says, 'the fuller'.[4] Manufacturing, it seems, was a central part of the everyday experience in the Roman world, and could play a central role in thinking about the identity of places and people alike.

Nevertheless, for most of the nineteenth and twentieth centuries, the craftsman remained a marginal figure in the historiography of the Roman world: deemed economically irrelevant, and socially peripheral, few scholars were prepared to study the fragmentary and biased literary sources, or to sit down with the vast, but complex epigraphic or papyrological evidence, while the interpretative possibilities of the archaeological record were long underestimated by archaeologists and ancient historians alike.[5] This all began to change, slowly, from the 1960s onwards, but it was not until the late 1990s that a true debate on Roman crafts and manufacturing began to

1 *Drexhage, H.-J.*, Die *Expositio Totius Mundi et Gentium*. Eine Handelsgeographie aus dem 4. Jahrhundert n. Chr., in: MBAH, 2/1, 1983, 3–41.

2 On these textile centres see *Flohr, M.*, The Wool Economy of Roman Italy, in: *Dross-Krüpe, K./Nösch, M.-L. (eds.)*, Textiles, Trade and Theories. From the Ancient Near East to the Mediterranean, Karum – Emporion – Forum. Beiträge zur Wirtschafts-, Rechts- und Sozialgeschichte des Östlichen Mittelmeerraums und Altvorderasiens. Ugarit/Münster 2016, 49–62; *id.*, Textiles, Trade and the Urban Economies of Roman Asia Minor, in: *Piesker, K. (ed.)*, Wirtschaft als Machtbasis. Vormoderne Wirtschaftssysteme in Anatolien. Byzas (DAI Abteilung Istanbul) Berlin 2017, 21–41.

3 Dion Chrys. 34, 21–23.

4 SEG 37, 888.

5 For historical overviews of these debates see *Flohr, M./Wilson, A.*, Roman Craftsmen and Traders. Towards an Intellectual History, in: *idd. (eds.)*, Urban Craftsmen and Traders in the Roman World. (Oxford Studies on the Roman Economy) Oxford, 2016, 23–54.

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emerge.[6] Since then, however, studies of previously unexplored sets of evidence, and more theoretically informed approaches to the traditional sources, have essentially completely transformed the field, and have resulted in a substantial revaluation of both the role of crafts and manufacturing within the economy, and their potential for economic historians to assess developments in the structure and performance of the Roman economy: even if the Roman economy remained firmly rooted in agriculture, and was profoundly shaped by Rome's overarching political structure rather than by anything else, the emergence of a highly visible and profoundly professionalized manufacturing economy presents a key historical development that sets the Roman economy apart from its immediate Mediterranean predecessors and successors. At the same time, the rich and varied evidence for the scale and organization of a range of manufacturing industries from the Roman period offers unique possibilities for assessing the functioning of a complex, pre-modern economy outside the traditional interpretative cocoon of Medieval and Early Modern Europe.

In the light of these discussions, the present chapter aims to offer a concise overview of the economic history of crafts in the Roman world. It will focus particularly on four aspects of everyday manufacturing practice. The first section of the chapter serves to put manufacturing practice in its immediate economic context, by assessing the relation between production and consumption. Then, focus will be on the knowledge and skills involved in making consumer goods, and on the practical organization of the production process in workshops. The final section, then, will address the social contexts in which the production process was embedded. In discussing these issues, it is of course impossible to do justice to the immense variation that characterized the Roman world, and inevitably, implicit focus will be on those areas and regions in the Mediterranean from which most of the evidence comes. These, as is well known, were the more densely urbanized, wealthier, and economically well-integrated parts of the Roman world, and as such, they cannot be considered representative of the Roman world at large. However, they also were the regions where increased economic integration and emerging urban consumer cultures created the circumstances underlying key developments in the economic history of manufacturing in the Roman world.

I Manufacturing and Consumption

There is no intrinsic need, in human society, for a class of people spending their professional lives making specialized subsets of goods for others: many of society's

6 See esp. *Mattingly, D. J./Salmon, J.*, Economies beyond Agriculture in the Classical World. London 2000; *Wilson, A.*, Urban Production in the Roman World. The View from North Africa, in: Papers of the British School at Rome, 70, 2002, 231–74.

more urgent everyday material needs can be made by non-specialists, within households: there is no need for trained professionals to produce the basic kitchenware necessary to do the everyday cooking; making textiles from wool (or flax) has been a primarily domestic task since the fourth millennium BC.[7] Obviously, specialized and experienced craftsmen can make such objects faster, and can produce according to higher quality standards, but having a substantial sector of professional craftsmen is not intrinsically necessary even for fairly complex human societies. On the one hand, thus, the sheer fact *that* the Roman world saw the emergence of substantial numbers of professional craftsmen producing a wide range of goods already is a highly fundamental aspect of its economic history; on the other hand, this professionalization should be understood against the background of considerable, and continuing craft production in domestic contexts, away from market exchange – particularly in the less densely urbanized regions of the Roman world: professionalization was a variable, not a constant.

1 Roman Imperial Consumer Cultures

Nevertheless, compared to the Greek and Hellenistic periods, the archaeological record leaves little doubt that the Roman period was, throughout the Mediterranean and in Roman Europe, more materially wealthy, both in terms of the quantity of consumer goods circulating, and in terms of their increased variation and complexity.[8] This is particularly clear from the perspective of domestic consumer goods. While less painted display pottery was produced than in the heydays of Greek vase-painting – its role was presumably taken over by decorated vases in precious metals – the last century BC saw the emergence of a refined type of table pottery with a glossy red slip. This so-called *terra sigillata* quickly became (and long remained) immensely popular throughout the Roman world, and was accessible for large groups of people, in the Mediterranean and in Roman Europe. Available in a large variety of forms, including plates, cups and bowls, it offered a comfortable material basis for everyday tabling.[9] Around the same period, the Roman world saw the emergence and spread of blown glass, which equally came to enrich the everyday lives of many people, rich and poor, throughout the Roman empire.[10] At the same time, there also appears to

7 On the early history of weaving see *Barber, E. J. W.*, Prehistoric Textiles: The Development of Cloth in the Neolithic and Bronze Ages with Special Reference to the Aegean. Princeton 1991.

8 See e.g. *Jongman, W.*, The Early Roman Empire: Consumption in: *Scheidel, W./Morris, I./Saller, R. (eds.)*, The Cambridge Economic History of the Greco-Roman World. Cambridge 2007, 592–618.

9 On terra sigillata see *Fülle, G.*, The Internal Organization of the Arretine Terra Sigillata Industry: Problems of Evidence and Interpretation, in: JRS, 87, 1997, 111–55.

10 For glass see *Stern, E. M.*, Roman Glassblowing in a Cultural Context, in: AJA, 103, 1999, 441–84; *Larson, K. A.*, Cheap, Fast, Good: The Roman Glassblowing Revolution Reconsidered, in: JRA, 32, 2019, 7–22.

have been a much larger distribution of bronze consumer goods, and these appear to have been more complex, and more finely crafted than earlier bronzewares.[11] Even if developments in the nature and spread of wooden objects elude us, it is clear that Roman houses presented a fundamentally different consumer reality from their Greek predecessors. This is further supported by the fact that so many houses, including those of people belonging to middling groups, appear to have had decorated walls, figurative mosaics, or both, and that quite a few also had gardens with smaller or larger sculpture collections.

The body was another focal point of Rome's imperial consumer culture, and this not only expressed itself in the spread of bathing over the entire Roman empire, but also in a flourishing dress economy. While wool and flax remained the two dominant raw materials in clothing production, there is an emergence of higher-quality fibers that became renowned (and used) throughout the Roman world, such as black wool from Phrygia, and white wool from Mutina.[12] At the same time, there appears to have been an increasing variation in the range of garments worn, and private wardrobes, such as those reported in several Egyptian pawnbroker's records, seem both substantial, and varied, and there is a substantial intensification in industries of clothes maintenance like fulling and mending.[13] Moreover, following the invention and spread of tanning, the imperial period saw the emergence of true leather, which led to the appearance of a rich and varied foot-ware economy.[14] While neither leather nor textiles have been preserved in substantial quantities, the evidence suggests that dress consumption in the Roman world was both richer and more varied than it had been in earlier periods.

If the Roman world consumed more, more had to be produced, and this inevitably led to demand from the people making all these products for instruments and installations needed in their production process: no clothes were made, no leather was cut, and no bronze was shaped into its final form without blacksmiths producing scissors, shears, knives or hammers. At the same time, as many of these production processes used specialized fire installations, there was a clear market for craftsmen with expertise in making (and maintaining) these. The same is true for wooden installations like looms, and, in the food industry, olive- and wine-presses – not to mention

11 Metal consumer goods remain badly studied, but see *Brown, D.*, Bronze and Pewter, in: *Strong, D.*/*Brown, D. (eds.)*, Roman Crafts. London 1976, 25–42; S*herlock, D.*, Silver and Silversmithing, in: *Strong, D.*/*Brown, D. (eds.)*, Roman Crafts. London 1976, 11–24.

12 *Flohr*, Wool Economy; *id.*, Textiles.

13 See esp. *Flohr, M.*, The World of the Fullo. Work, Economy and Society in Roman Italy. (Oxford Studies on the Roman Economy) Oxford 2013.

14 *Van Driel-Murray, C.*, Fashionable Footwear: Craftsmen and Consumers in the North-West Provinces of the Roman Empire, in: *Wilson, A.*/*Flohr, M. (eds.)*, Urban Craftsmen and Traders in the Roman World. (Oxford Studies on the Roman Economy) Oxford 2016, 132–52; *id.*, Tanning and Leather, in: *Oleson, J. P. (ed.)*, Oxford Handbook of Engineering and Technology in the Classical World. Oxford 2008, 483–95.

flour mills. Moreover, it is clear, both from the demographic geography of the Roman world, and from the archaeological record, that many consumer goods, including foodstuffs, were consumed rather far away from where they were produced, indicating a need for containers allowing for their transportation, both overland, and overseas. There was an almost continuous need for sacks, barrels, and transport amphorae, which were made in large numbers and in highly standardized shapes, so that they could be easily stacked in storage facilities and in ships and handled by those involved in transport. Amphorae had specialized forms, with particular types used for particular foodstuffs; while the amphora itself emerged in the first millennium BC, if not before, the Roman world saw an explosion in their production, and both increased standardization and variation in forms.[15] As these *amphorae* make clear, there was, underlying the imperial consumer cultures of the Roman world, an entire range of manufacturing practices that supported crafts and trade.

2 Manufacturing and Trade

Not only food was transported over longer distances in large quantities than had been the case in the Greek and Hellenistic worlds: it is clear that many everyday consumer goods, including pottery, glass, metal wares and textiles, were consumed, in substantial numbers, at places far away from where they had been produced. The extent of this movement is most dramatically visible in the case of late-Republican and early imperial red-slipped pottery tableware, where a few production regions saw their wares exported over large areas. For instance, Southern Gaulish Ware, produced in the first century CE in large production centres such as La Graufesenque and Lezoux, was exported throughout Roman Europe, serving both the legions on the Rhine and Roman Britain (for mass production and trade, see also Kap. 27 Spickerman).[16] Later on, by the mid-imperial period, the entire western Mediterranean market, including that of the Italian peninsula, was dominated by so-called African Red Slip Ware, which may have spread over the Mediterranean as a by-product of the transport of foodstuffs, such as grain and olive oil, from Roman North Africa to Rome.[17]

15 On amphorae see *Peacock, D./Williams, D. F.*, Amphorae and the Roman Economy: An Introductory Guide. London 1986.

16 See e.g. *Fulford, M.*, Procurators' Business? Gallo-Roman Sigillata in Britain in the Second and Third Centuries AD, in: *Wilson, A./Bowman, A. (eds.)*, Trade, Commerce, and the State in the Roman World. (Oxford Studies on the Roman Economy) Oxford 2018, 301–25, with references. See also *Wallace-Hadrill, A.*, Rome's Cultural Revolution. Cambridge 2008, 407–421.

17 *Bonifay, M.*, The Distribution of African Pottery under the Roman Empire, in: *Wilson, A./Bowman, A. (eds.)*, Trade, Commerce, and the State in the Roman World. (Oxford Studies on the Roman Economy) Oxford 2018, 335–41.

Other goods, however, also are known to have circulated over larger distances. Literary sources occasionally hint at this in rather explicit terms. Cato, for instance, advised the readers of his guide to agriculture to collect their implements in specific places in central Italy – for each implement, he lists one or several cities where it could be found.[18] Diodorus Siculus sketches a system in which iron won at Elba was refined and worked into all kinds of metal tools in Puteoli and other harbor towns, and from there was sent to places all over the known world.[19] Strabo highlights how the city of Patavium sent large quantities of finished textiles to Rome.[20] Clement of Alexandria emphasizes how, in his days, Alexandrians were clothed in linens from Cilicia.[21] While the link between place of production and place of consumption archaeologically rarely is as explicit as it is in the case of pottery, objects of glass and metal occasionally can be shown to have travelled quite substantially. One well-known example are the inscribed bronze cauldrons made in Campania, which have been found not only in places like Pompeii, but also along the Rhine Limes, and even in Danish peat bogs.[22]

The Roman World, thus, was a world of consumer goods on the move. At the same time, this picture should not be exaggerated: at any given moment, most properties of most people would be fairly local in origin, and there were entire categories of craft products that, by their very nature, did not move – including the decorations on the walls and floors of houses. Moreover, the movement of portable consumer goods over larger distances was no radical new phenomenon of the Roman imperial period: refined pottery from the Aegean had been circulating over the western Mediterranean from at least the Archaic Period onwards.[23] Still, the scale of movement, the range of goods transported, and particularly the distances involved increased substantially in the Roman world.

Nevertheless, while the picture on the macro-scale may be relatively clear, it is much harder to translate this to the micro-scale. That is to say, it is one thing to suggest that a city was involved in export-oriented production in one good or another, but it is quite another thing to understand how this worked in everyday practice for craftsmen and traders: were goods produced for middlemen specializing in this export-oriented transport, or were they bought up by traders? There is very little direct evidence for this, though particularly in the case of textiles, there is some evidence for specialized traders buying up products in one place, and selling them in another place – we know of a *vestiarius* from *Narbonensis* working in Rome, and one from

18 Cato agr. 22.
19 Diod. 5, 13.
20 Strab. 5, 1, 7.
21 Clem. Al. Paedagogus 2, 11.
22 *Wallace-Hadrill*, Rome's Cultural Revolution, 404–6.
23 *Boardman, J.*, The Athenian Pottery Trade. The Classical Period, in: Expedition, 21/4, 1979, 33–39; *Osborne, R.*, Pots, Trade and the Archaic Greek Economy, in: Antiquity, 70, 1995, 31–46.

Rome working in Mutina.[24] Still, it remains generally unclear as to whether these traders went to the producer's workshop to buy their clothes, or went to a local market. In several cities in Roman North Africa, there is epigraphic evidence for a specialized cloth market, but it is unclear whether these markets were import- or export-related.[25] Yet the emergence of *fora* (marketplaces) on the countryside, and the commercialization of *fora* and *agorai* in many cities suggests that local market squares offered a readily available infrastructure for craftsmen to sell their products.[26]

3 Craftsmen and Retailers

While the relation between craftsmen and traders can only rarely be identified in the evidence, there is ample evidence for the extent to which manufacturing establishments were involved in direct retail, and that evidence overwhelmingly points to a practice in which it was pretty much the norm for most categories of craftsmen to have some form of direct contact with the people buying their products. First and foremost, this has to do with the fact that the most commonly available accommodation for workshops in urban contexts had a direct connection with the public sphere and was designed to facilitate both manufacturing and retail. For instance, at Pompeii, about half of all identifiable workshops occupied a *taberna*, and no less than two thirds was in some way or another internally connected to one: even the larger workshops, which were often situated in the back parts of houses, generally retained a connection with a shop; at Herculaneum, the picture was similar.[27] In the well-excavated *vicus* of Oberwinterthur in Switzerland, many of the narrow strip-houses lining the main road of the settlement appear to have had a workshop directly on the street, with living quarters further to the back.[28] The archaeology of workshops, in other words, clearly suggests an architectural formalization of the relation between manu-

24 CIL 6, 9662; CIL 11, 868. There also is a number of inscriptions referring to transalpine traders. Cf. *Rice, C.*, Mercantile Specialization and Trading Communities: Economic Strategies in Roman Maritime Trade, in: *Wilson, A./Flohr, M. (eds.)*, Urban Craftsmen and Traders in the Roman World. (Oxford Studies on the Roman Economy) Oxford 2016, 99.

25 See esp. *Wilson, A.*, Timgad and Textile Production, in: *Mattingly, D. J./Salmon, J. (eds.)*, Economies beyond Agriculture in the Classical World. London 2000, 271–296.

26 See on this issue *Flohr, M.*, Fora and Commerce in Roman Italy, in: *id. (ed.)*, Urban Space and Urban History in the Roman World. (Studies in Roman Space and Urbanism) London 2020, 198–220.

27 *Flohr, M.*, *Nec Quicquam Ingenuum Habere Potest Officina*? Spatial Contexts of Urban Production at Pompeii, AD 79, in: BABesch, 82/1, 2007, 129–48; *Monteix, N.*, Les Lieux de Métier: Boutiques et Ateliers d'Herculanum, in: Collection Du Centre Jean Bérard. Rome 2010.

28 *Jauch, V./Roth, M.*, Römisches Handwerk in Oberwinterthur/Vitudurum, in: Archäologie der Schweiz, 27/1, 2004, 40–45.

facturing and retail, even though some of the largest known workshops of the ancient world, at Ostia and Rome, appear to have had no retail facilities at all.[29]

The close connection between manufacturing and retail also is apparent from iconographic evidence. Depictions of craftsmen at work not only show the practicalities of the production process, but often also interaction with customers.[30] For instance, paintings on the façade of the workshop of the textile dealer Verecundus at Pompeii show, on one side of the entrance, his feltmakers in action; on the other side, there is a selling scene with a counter and an exposition of products.[31] Similarly, the funerary relief of the blacksmith Atimetus from Rome shows, on one of the sides, the artisan at work in his smithy, and, on the other, the same person selling his ware in what seems to be a portable market stall.[32] Thus, even craftsmen who did not sell their products in the workshop itself, could be directly involved in retail on a regular, if not everyday basis. Texts referring to streets named after specific groups of artisans, or inscriptions commemorating artisans that were visibly active in a specific location – such as Pitzitus, the fuller associated with the Macellum Liviae at Rome – also suggest many artisans were profoundly implicated in direct retail.[33] Most urban artisans, thus, seem to have had relatively close connections with the final consumers of their products.

While it is perhaps likely that manufacturing in the Greek world also had been strongly oriented toward the users of their products, it seems that the presence of specialized and permanent retail facilities in direct association with workshops was a development of the later Hellenistic and Roman period and was less common in the Greek world. For instance, at Olynthos, there appears a much stronger separation between production and retail, with the former taking place in houses, and the latter on the market.[34] In many Greek cities, permanent facilities for retail were not only rare, but when attested, they also seem too small and too dark to have accommodated a workshop.[35] At the same time, there may have been many Roman artisans who worked in their own house, without a shop, and sold their ware on a regular basis to one or more traders with whom they were in frequent touch. Such a scenario may

29 *Flohr*, World of the Fullo, 78–79.

30 The best collection remains *Zimmer, G.*, Römische Berufsdarstellungen. Berlin 1982.

31 See *Flohr*, World of the Fullo, 283–84; cf. *Zimmer*, Römische Berufsdarstellungen, 128.

32 See *Hawkins, C.*, Roman Artisans and the Urban Economy. Cambridge 2016, 130–32; *Zimmer*, Römische Berufsdarstellungen, 180–82.

33 On streets named after groups of artisans see *Droß-Krüpe, K.*, Spatial Concentration and Dispersal of Roman Textile Crafts, in: *Wilson, A./Flohr, M. (eds.)*, Urban Craftsmen and Traders in the Roman World. (Oxford Studies on the Roman Economy) Oxford 2016, 334–351; *Goodman, P.*, Working Together: Clusters of Artisans in the Roman City, in: W*ilson, A./Flohr, M. (eds.)*, Urban Craftsmen and Traders in the Roman World. (Oxford Studies on the Roman Economy) Oxford 2016, 301–333. For Pitzitus see AE 1958, 273. Cf. *Flohr*, World of the Fullo, 266.

34 *Cahill, N.*, Household and City Organization at Olynthus. New Haven 2002, 236–281.

35 See below, p. XXX.

particularly have applied to rural craftsmen who operated for the supra-local market – such as the potters from the large production centres in Italy, Gaul and Germany, or rural weavers in wool-producing regions who made textiles for sale alongside their other agricultural duties.

II Knowledge and Skill

Manufacturing in the Roman world depended on the skills and technologies known and used by craftsmen, both for the quantity of output, and for the quality of the product. In the eyes of the Roman elite, specialist skills and (trained) expertise mattered more than technology, but it is relevant to note that crafts were, at the same time, also seen as *invented* knowledge: several authors, most notably the Elder Pliny, give the names of individuals – mostly from the Hellenistic world – who were thought to have invented certain crafts.[36] This suggests that three aspects of everyday manufacturing practice should be seen as indicative for the understanding of its economic history: technological innovation, transfer of knowledge, and specialization.

1 Technological innovation

For most of the twentieth century, there was a consensus that technology, particularly in crafts, remained mostly stagnant throughout classical antiquity.[37] While it is true that there are key production processes that seem to have undergone only marginal innovations, and while innovations that had a dramatic effect on productivity were not widely applied, it is clear that there were continuous developments in technological practice throughout the Mediterranean in the late Republic and Early imperial period. In most cases, these innovations improved the quality of the product rather than that they increased the quantity of the output, but that does not, of course, render them economically meaningless.

In manufacturing, the flagship innovation of the Roman world undoubtedly was the emergence of transparent, blown glass. While glass had existed since the second Millennium BCE, and was used for extremely colourful, hand-shaped vases from the classical Greek period onwards, glass-blowing was invented in the first century BCE, probably in the Levant, and subsequently developed in Italy, from where it spread, rather quickly, over the entire Roman Empire, so that by the first century CE, blown

36 Plin. nat. 7, 191–209. See also *Bartol, K.*, The Lost World of Inventors: Athenaeus' Sentimental Heurematography, in: Palamedes, 1, 2006, 85–96.

37 *Finley, M. I.*, Technical Innovation and Economic Progress in the Ancient World, in: The Economic History Review, 18/1, 1965, 29–45; *Greene, K.*, Technological Innovation and Economic Progress in the Ancient World: M. I. Finley Re-Considered, in: The Economic History Review, 53/1, 2000, 29–59.

glass vases and flasks could be found in all regions of the Roman world. It seems clear that in the quick spread of glass-blowing, and in the experiments with coloring that preceded the invention of transparent glass, consumer preferences were leading. The same pattern can be seen in innovation in pottery production, where improvements in firing technology and experiments with glazing techniques were fundamental to the changing appearance of fine tableware.[38] In textile production, several experiments with loom-design also seem to have been motivated on the basis of qualitative, rather than quantitative considerations.[39] Further, while the proliferation of metal objects was to a considerable extent related to increased levels of mining, innovations in metallurgy led to the spread of several new alloys, such as pewter, which, again, was mainly used in the consumer good economy, as a cheaper substitute for silver.[40]

One field of technology where efficiency rather than quality seems to have been the leading driver of innovation is food processing, and particularly, milling. The use of rotary power, and the development of large, animal-driven flour mills were innovations of Late Republican Italy, and increased the milling capacity of professional bakers.[41] The discovery of semi-finished flour mills of Italian lava in several Mediterranean shipwrecks highlights how this technology (but not necessarily also the stone-cutter's know-how underlying it) was exported to overseas provinces.[42] From the imperial period onwards, water power also began to be used to operate flour mills, and it is increasingly recognized that this happened on a significant scale: evidence for water-powered mills has been found throughout the Roman west, including in Roman Europe. An extreme example of the application of water-power can be found in Barbegal, near Arles, where a large flour mill operated by water-power was built at the end of a side branch of the main aqueduct that provided the city with fresh water; it is now believed to date to the second century CE.[43] Beyond the use of water-power, complex water-technology was used more broadly in manufacturing establishments. It particularly played a key role in large fulling establishments, which refined and recovered woollen garments. In the larger fulling workshops in Pompeii, Ostia and Rome, clothes were washed out in multi-basin rinsing complexes, which were organized following a principle of countercurrent exchange, where the water

38 See *Flohr, M.*, Innovation and Society in the Roman World, in: Oxford Handbooks Online. Oxford 2016.

39 On loom design see esp. *Wild, J. P.*, The Roman Horizontal Loom, in: AJA, 91/3, 1987, 459–471.

40 On pewter see *Brown*, Bronze and Pewter.

41 On the evolution of milling see *Curtis, R. I.*, Food Processing and Preparation, in: *Oleson, J. P. (ed.)*, Oxford Handbook of Engineering and Technology in the Classical World. Oxford 2008, 373–379.

42 *Peacock, D.*, The Roman Millstone Trade: A Petrological Sketch, in: World Archaeology, 12/1, 1980, 43–53.

43 *Leveau, Ph.*, Les moulins de Barbegal, les Ponts-Aqueducs du Vallonde l'arc et l'histoire naturelle de la Vallée des Baux, in: Comptes Rendus Des Séances de l'Académie Des Inscriptions et Belles-Lettres s. n. 1995, 115–144.

flowed through the complex from basin to basin in one direction, while the clothes followed the opposite direction, arriving in cleaner water each basin.[44] The system both sped up the washing out procedure, and facilitated a more efficient use of water, therefore bringing down production costs.

2 Professional knowledge

Despite what Roman authors say about skilled artisans, there is a clear and unequivocal development toward a reduced dependence on professional skills in multiple Roman crafts. The classic example is refined domestic pottery, which was no longer decorated by painting, but in relief, so that use could be made of molds. Additionally, the forms of vases became less complex, and less frequently included loose parts (like ears), so that they, too, could be more easily produced by molds, thus demanding fewer skills from the person running the potting wheel. Similar developments can be seen in domestic decoration: wall-paintings increasingly used repetitive patterns, lines, and standardized ornamental motifs.[45] In mosaics, the exceptionally complex and refined *opera vermiculata* of the last centuries BC gave way to floor mosaics using larger pieces that were less time-consuming and easier to lay.[46] It is likely that these developments were related to increased consumer demand from people outside the wealthy elite, who could now afford such products but not when they were made to the highest standards, and at the same time represented a potentially rewarding market for artisans.[47]

The archaeology of larger workshops in Roman Italy shows a similar tendency toward de-skilling. In the large bakeries of Ostia and Rome, the production process appears to have been rigidly subdivided in a number of small tasks – the milling of the flour, the mixing of the ingredients, the kneading of the dough, the shaping of the loaves and the baking of the bread – meaning that the individual workers would spend most of the time performing just a small number of relatively easy tasks, and specialist expertise could be restricted to those parts of the workshop where it was necessary – such as in operating the oven. In the large fulleries of Ostia and Rome, this division of labour is even explicitly reflected in the architecture of the workshops: a large majority of the work force spent its day in fulling installations, where textiles were treated with alkaline chemicals (such as fuller's earth and ammonia won from urine) by trampling them, scrubbing them, and wringing them out; the subsequent

44 *Flohr*, World of the Fullo.

45 See on this development e.g. *Wallace-Hadrill, A.*, Houses and Society in Pompeii and Herculaneum. Princeton 1994, 164–174.

46 On the stylistic development in mosaics see *Dunbabin, K.*, Mosaics of the Greek and Roman World. Cambridge 1999.

47 See e.g. *Mayer, E.*, The Ancient Middle Classes. Urban Life and Aesthetics in the Roman Empire 100 BCE–250 CE. Cambridge 2012, 99–212.

step in the process, was managed by the advanced water technology discussed in the previous section; typically, the most complex part of fulling in terms of skills – the brushing, shearing and polishing of the textiles – was carried out elsewhere.[48] Thus, here too, there seems to be a more efficient use of skills, and a more rigid separation between skills-intensive and unskilled tasks.

Still, of course, in many crafts, specialized skills played a central role, and the transmission of these skills was a very central aspect of the history of these crafts – and of everyday craft practice. Building upon practices developed in the Greek and Hellenistic period, craftsmen throughout the Roman world worked with apprentices, who came to their workshop for a fixed period (often, a number of years) to contribute to the work force, and pick up the essential skills in the process.[49] Series of preserved apprenticeship contracts from Oxyrhynchus in Roman Egypt show how this practice was deeply embedded into local craftsmen communities and how care was taken to secure the rights of both apprentices and craftsmen.[50] Indeed, craftsmen themselves often sent their own sons as an apprentice to other craftsmen, both within the same trade, and in other sectors of the manufacturing economy. Literary sources, epigraphic evidence, and legal texts leave little doubt that apprenticeship was a regular element in urban crafts throughout the Roman Mediterranean. As this resulted into many links between workshops, it highlights that we should think of groups of urban craftsmen as *de facto* communities of practice, within which practical knowledge about crafts could circulate relatively easily. It also seems clear that at least some apprenticeships transcended local boundaries, fostering to an exchange of knowledge between cities. While apprenticeship, as an institution, had emerged before the Roman period, it probably profited from increasing levels of urbanization, and the increased integration between urban markets, and thus contributed to relatively well-integrated webs of knowledge that in many cases appear to have covered large parts of the urbanized Mediterranean. Outside this privileged zone, however, circulation of knowledge, particularly at the supra-local level, may have been much more complex.

3 Specialization

A third key component of craft practice concerned specialization: to which extent did craftsmen or workshops begin to limit themselves to narrowly circumscribed subsets of products, or even to a subset of treatments belonging to a larger production process? This is an aspect of Roman manufacturing that has been relatively well re-

48 *Flohr*, World of the Fullo, 163–70.

49 On apprenticeship see *Tran, N., Dominus Tabernae*. Le statut de travail des artisans et des commerçans de l'occident Romain. (Bibliothèque des Écoles Françaises d'Athènes et de Rome) Rome 2013, 147–185; *Hawkins*, Roman Artisans, 232–238.

50 *Hawkins*, Roman Artisans, 178–179.

searched, and it can be discussed on several levels. First and foremost, it is clear that the Roman imperial period saw an explosion of the number of job-titles that have been epigraphically and papyrologically attested.[51] This is partially a direct product of the epigraphic habit and the resulting production of large numbers of inscriptions, and partially a result of the numbers of papyri known from the Roman imperial period. However, the sheer number of jobs recorded, and the precise circumscription they seem to give of the products involved do suggest that the epigraphic and papyrological records reflect a substantial level of specialization.[52] As far as the epigraphic record is concerned, it is however also clear that there was an enormous variation in the diversity of crafts between smaller and larger cities – indeed, a large majority of crafts, and particularly those that seem to have been more specialist in nature, are attested only in inscriptions from the Roman metropolis. From an economic perspective, this makes sense: in larger markets, it is more convenient and less risky to focus on a specific niche market, rather than producing a broader range of goods, as it both attracts customers, and brings down production costs. In smaller markets, with a more limited consumer audience, offering a broader range of goods and/or services made it easier to survive – indeed, comments by Xenophon suggests that this principle was understood as early as the fourth century BC.[53] It is therefore likely, again, that the general increase in urbanization and the increasing size of cities, created relatively favourable circumstances for specialization in at least some cities in the Roman world.

It is harder to reconstruct to which extent this increasing specialization also led to a carving up of production processes in smaller parts, though it is true that there appears to be a separation between materials preparation and object fabrication throughout the Roman economy. For instance, it is clear that there were specialized tanners turning hides into leather, but they are not generally associated with the artisans using their leather to make shoes, sacks or belts. Similarly, there appear to have been workshops involved in the production of raw glass operating independently of artisans who worked that glass into flasks, bottles and bowls; indeed, multiple shipwrecks with larger quantities of raw glass have been found in the Mediterranean.[54] In metal-working, the extraction of metal from the ore was always separated from the process of making metal objects – iron or bronze – as is attested by the

51 *Von Petrikovits, P.*, Die Spezialisierung des Römischen Handwerks, in: *Jankuhn, H. et al. (eds.)*, Das Handwerk in Vor- und Frühgeschichtlicher Zeit. Göttingen 1981, 63–132; *Joshel, S. R.*, Work, Identity and Legal Status at Rome. London 1992.

52 *Ruffing, K.*, Die Berufliche Spezialisierung in Handel und Handwerk. Untersuchungen zu ihrer Entwicklung und zu ihren Bedingungen in der Römischen Kaiserzeit im Östlichen Mittelmeerraum auf der Grundlage Griechischer Inschriften und Papyri. Rahden/Westf. 2008.

53 Xen. Kyr. 8, 2, 5.

54 See *Foy, D.*, An Overview of the Circulation of Glass in Antiquity, in: *Wilson, A./Bowman, A. (eds.)*, Trade, Commerce, and the State in the Roman World. (Oxford Studies on the Roman Economy) Oxford 2018, 267–72.

proliferation of ingots, though it seems alloy-making was mostly the business of those who made the final product. In textile production, it seems as if in the case of wool, spinning and weaving were integrated into one workshop, but optional treatments like dyeing and fulling were done by independent professionals; conversely, the Prices Edict of Diocletian (301 AD) supposes a substantial trade in linen yarn.[55] In several large centres of pottery production, such as La Graufesenque, it seems that firing was done in large kilns that were somehow shared by the wares of multiple craftsmen, suggesting that the shaping and the firing of pots were done in different workshops.[56]

III Organizing production

Roman craftsmen generally appear to have operated permanent workshops filled with specialized equipment, and the historical development of both these workshops and the equipment is fundamental to the economic history of Roman crafts, which saw a development from a world of small-scale and moveable production facilities toward a much more varied landscape, which also included rationalized work environments with larger, and more permanent equipment.

1 Production facilities

The archaeological remains of Roman workshops show considerably more remains of specialized manufacturing equipment than their Greek and Hellenistic counterparts, but this picture is partially misleading: a fundamental innovation in the layout of Roman workshops was the use of concrete-based construction techniques for production facilities, and this had a profound impact not only on the design of work-environments, but also on their archaeological visibility. To some extent, thus, we simply can see much better than in Greek or Hellenistic contexts how the production process was organized. Nevertheless, there is also evidence suggesting that workshop design itself became more complex and rationalized.

Urban workshops were, roughly, situated in three different contexts: in shops, in houses, and in purpose-built production halls. As argued above, shops were the most common accommodation for workshops in urban contexts. Generally, these spaces were large enough to accommodate a small workshop with one craftsman and a few workers, but they were too small for workshops operating on a larger scale. For medium-sized establishments, houses offered more possibilities, and in several cities

55 Ed. Diocl. 26.

56 *Wilson, A.*, Large-Scale Manufacturing, Standardization, and Trade, in: *Oleson, J. P. (ed.)*, Oxford Handbook of Engineering and Technology in the Classical World. Oxford 2008, 398.

in Italy, examples of houses giving over their *atrium* or even (parts of) their peristyle area to manufacturing have been found. Generally, they appear to have done so without losing their domestic function. At Pompeii, this is the common arrangement for the mills-bakeries of the city, and for the larger fulling-workshops and dyeworks; most of these houses seem to belong to the wealthier half of Pompeian society; a few can be associated with the city's urban elite.[57] Workshops in purpose-built production halls have thus far mostly been found in Rome and Ostia. These factory-like buildings accommodated large, proto-industrial bakeries and fulling workshops.[58] Whether this category of workshops existed more broadly remains unknown, due to our poor understanding of the archaeology of large cities like Antioch, Alexandria and Constantinople.

The design of larger workshops betrays a clear design to streamline the production process: while in small, *taberna*-sized workshops, equipment would be distributed along the walls, without necessarily a clear order, larger workshops would tend to organize their layout so that the production sequence could proceed uninterrupted. Bakeries, for instance, would have an arrangement where the flour would proceed in a linear direction from the milling room through the kneading and bread-shaping room to the oven, from which the loaves would be moved to a place where they could cool down.[59] To facilitate this, many ovens were equipped with serving hatches next to their entrance that would connect directly to the bread-shaping room and to the cooling-down room. Fulling workshops would be organized in such a way that the fulling installations were clustered close to the dirtiest basin of their rinsing complex, where the textiles began the rinsing procedure, while facilities for follow-up treatments were often clustered at the clean end of the complex, where the textiles left it.[60] Such rationalized layouts appear to have become more common and elaborate with the emergence of larger workshops, and they point to developments that, however exceptional they were, can arguably be discussed in terms of proto-industrialization. In any case, there appear to have been few historical parallels for these workshops before early modern Europe.

2 Materials

The mechanisms through which craftsmen acquired the raw materials they needed to do their work are as important as they are badly understood. It is clear that some

57 *Monteix, N.*, Contextualizing the Operational Sequence: Pompeian Bakeries as a Case-Study, in: *Wilson, A./Flohr, M. (eds.)*, Urban Craftsmen and Traders in the Roman World. (Oxford Studies on the Roman Economy) Oxford 2016, 153–179; *Flohr, M.*, The Textile Economy of Pompeii, in: JRA, 26, 2013, 53–78.

58 See *Wilson*, Large-Scale Manufacturing; *Flohr*, World of the Fullo.

59 *Monteix*, Pompeian Bakeries.

60 *Flohr*, World of the Fullo, 156–70.

categories of craftsmen, particularly potters, often worked closely to places where their raw material could be won, but even in these circumstances, it remains unclear who owned the clay, and how it ended up in the hands of the potters.[61] Conversely, it is clear that in most other branches of manufacturing, raw materials came from further away, and were pre-processed before transport, but even in those cases it remains unknown to which extent raw materials were simply sold freely on the market, or rather circulated in more limited private networks that provided craftsmen with what they needed on a regular basis. Series of stamps on some ingots suggest these could change hands multiple times before they arrived in the hands of a craftsman, crucial details remain unknown.[62] In the textile economy, there is something to say for a scenario in which weavers acquired their wool from specialized wool merchants – *lanarii* – but it is also possible that they were provided with wool, and saw their products bought up by one the same *lanarius*. However, even in Egyptian papyri, such a putting-out system is nowhere explicitly attested, and there generally appear to have been few direct ties between the categories of craftsmen involved in the wool economy.[63]

Another fundamental aspect of Roman manufacturing economies that has until recently remained virtually unstudied, is the impact of the continuous demand of many urban workshops for fuel.[64] This demand for fuel was substantial, and was not limited to artisans: all cities, independent of their size, offered a substantial market for professionals supplying fuel. While multiple substances could be used, wood and, particularly, charcoal, were leading the market, and even if many cities could fuel their manufacturing economy from within their own territory, particularly in more densely urbanized regions, local supply was not unlimited. While there is no explicit evidence for trade in either burning wood or charcoal, it is clear that all workshops that used ovens or furnaces had to maintain continuous economic ties with people supplying their everyday fuel.

Finally, several types of workshops would have needed to acquire, on a regular basis, the chemical agents used in their production process. For instance, fullers needed fullers' earth and ammonia; dyers needed alum and whatever dyestuffs they would want to use; tanners needed oak. The snippets of information that have been preserved suggest that the supply economies of some of these agents were fairly complex

61 See, e.g. *Poblome, J.*, The Potters of Ancient Sagalassos Revisited, in: *Wilson, A./Flohr, M. (eds.)*, Urban Craftsmen and Traders in the Roman World. (Oxford Studies on the Roman Economy) Oxford 2016, 377–404.

62 See on one of these ingots *Monteix, N.*, Les Lingots de Plomb de l'atelier VI, 12 d'Herculanum et Leur Usage, in: *Lehoërff, A. (ed.)*, L'artisanat Métallurgique Dans Les Sociétés Anciennes En Méditerranée Occidentale. Techniques, Lieux et Formes de Production. Rome 2004, 365–78.

63 *Droß-Krüpe, K.*, Wolle – Weber – Wirtschaft: Die Textilproduktion der römischen Kaiserzeit im Spiegel der papyrologischen Überlieferung. Wiesbaden 2011, 170–190.

64 *Wilson, A.*, Raw Materials and Energy, in: *Scheidel, W. (ed.)*, The Cambridge Companion to the Roman Economy. Cambridge 2012, 149–151.

and institutionalized. Several papyri record that transport of alum to and from oases in Egypt was in fact taxed, and some of the archaeological evidence suggests an alum trade that used its own specific type of amphora.[65] Pliny comments elaborately on the various types of fuller's earth that could be used by fullers, indicating their diverse origins; at the same time, chemical analysis of fuller's earth from Pompeii has indicated it had been imported from beyond the Bay of Naples area.[66] In the case of some of the pigments used in dyeing wool, it is even clear that their local availability was a key factor in the local clustering of workshops. For instance, Hierapolis in Phrygia was the only place where wool could be dyed in a certain type of red, leading to the emergence of quite a substantial export-oriented textile economy.[67] Similarly, the local availability of *murex* shells was the key reason why several coastal regions developed into renowned centers of purple dyeing. Even if the overall growth of Roman consumer economies meant that the overall demand for these chemical agents rose substantially over time, not all of these chemicals would typically be regularly available locally in the less densely populated parts of the Roman World. In combination with a relative absence of consumer demand, this may, in some places, have presented a disincentive for local entrepreneurs to invest in certain workshop types.

3 Labor

Obviously, it was a key concern for any workshop to have enough workers on the shop floor with the right sets of skills and expertise. In terms of economic risk, labor is a complicated factor for artisans, particularly in situations where they had to deal with significant fluctuations in productivity – either because of the seasonal rhythm of the production cycle, or because of the unpredictability of consumer demand. On the one hand, having a permanently employed work force – whatever the precise construction – could be a liability when a business faced a period of low productivity; on the other hand, having a very flexible work force had disadvantages in terms of skill and work-flow. As some have argued recently, it has to be assumed that in many branches of the manufacturing economy, fluctuations in productivity were part of the everyday workshop economy, and not all of these were predictable.[68]

As far as the social composition of workshops can be traced in the textual and archaeological evidence, the overwhelming majority of workshops was organized

65 P. Col. 6, 228. On *alum amphorae* discovered at Pompeii see *Borgard et al.*, Recherches sur les productions artisanales à Pompéi et Herculanum.

66 *Flohr*, World of the Fullo, 171–72.

67 *Ruffing, K.*, Driving Forces for Specialization: Market, Location Factors, Productivity Improvements, in: *Wilson, A./Flohr, M. (eds.)*, Urban Craftsmen and Traders in the Roman World. (Oxford Studies on the Roman Economy) Oxford 2016, 126–27.

68 *Hawkins*, Roman Artisans, 23–65.

around a household.[69] Some of these households could be very big, but most were fairly small and, in composition, resembled a modern nuclear family, including a man, a woman, and children. Obviously, such households have a natural life cycle, and their internal labor capacity varied over time, though it is clear that in many cases both men and women participated in operating the workshop – albeit in different roles. Iconographic evidence suggests that women would often be involved in retail, perhaps alongside running the household, while their husbands would be the expert craftsmen running the production process.[70] Some tombstones and inscriptions even depict workshops as if they were two-person affairs, with no other people involved than the couple in charge of it, and throughout the Roman world, particularly in smaller settlements, this may have been the most common model. Nevertheless, it is clear that in many workshops, a larger number of people were involved.

If a household was unable to provide all the labor needed to keep the workshop running, there were several options. The most flexible way to acquire the additional labor, from the craftsman's perspective, would be to hire it, and it seems clear that, by the imperial period, wage labor had become a widespread practice in large parts of the Roman world: the Prices Edict of Diocletian highlights the maximum wages that laborers could ask for a day's work.[71] A disadvantage of flexible wage labor is that, in principle, it does not come with the specific skills needed for the more difficult tasks of the production process: hiring labor on a temporary basis is easier for unskilled work than it is for skilled work. In many cases such flexibility would not be needed of course, so that craftsmen may look for more durable professional relations. One important, and well-documented way to create additional labor capacity for a longer period without paying a high price in terms of wages was to have apprentices who could contribute to the production process while learning the craft in its full complexity.[72]

In the case of larger households investing in manufacturing, one option would be to set some of the slaves belonging to the family to work in the workshop, or to acquire one or more slaves specifically for the purpose. In some of the houses with workshops at Pompeii, the work rooms appear to have been closely associated with a zone of domestic service facilities, including the kitchen, suggesting the two were run by the same group of people – presumably slaves belonging to the household.[73] The large funerary monuments for the domestic servants of several wealthy senatorial families of Rome included a range of people who were commemorated for their profession; while these craftsmen may primarily have worked to satisfy the internal needs of the household, several have been thought to have been involved in market-

69 Cf. *Hawkins*, Roman Artisans, 192–95.
70 See e.g. *Kampen, N.*, Image and Status: Roman Working Women in Ostia. Berlin 1981.
71 See Ed. Diocl. 7.
72 See above, p. 730.
73 Cf. *Flohr*, Urban Poduction at Pompeii, 141.

oriented production as well.[74] Some inscriptions refer to craftsmen manumitting their own slave workers.[75] Still, slave labor should not a priori be seen as universal or pervasive – slaves were expensive and not necessarily easily available, and therefore beyond the reach of many modest craftsmen households. At the same time, it has been suggested that for the large production halls in Rome and Ostia, which were not associated with private households, wage-labor rather than slavery would seem the more logical *modus operandi*.[76]

IV Entourage and Networks

A crucial aspect of the economic history of manufacturing in the Roman world lies in the ways in which craftsmen were embedded in their social contexts, and how the social networks and power relations in which they were entangled contributed to the economic performance of their workshops. All craftsmen by necessity entertained a wide range of social ties within their urban communities, not in the last place those with their customers and those with the people commonly spending their day in the direct urban environment of their shops and workshops – many of these were craftsmen themselves. However, from an economic perspective, two categories of social ties seem especially relevant. First, inevitably, craftsmen and entrepreneurs were somehow embedded into networks of patronage that conditioned their access to financial resources. Second, as a group, many groups of urban craftsmen appear to have been united in local professional associations.

1 Patronage

If patronage was a central phenomenon in Roman society, many workshops must have participated in networks dominated by the social superiors of their owner or manager. Unfortunately, in our evidence, such networks tend to remain almost completely invisible, and even where they are visible, the evidence offers very little information about their nature and functioning.

One context where it is relatively straightforward to reconstruct direct social ties between a workshop and what may vaguely be called social superiors is in the case of workshops that were physically associated with larger houses, but not internally connected to them. At Pompeii, several large elite houses appear to have had intimate structural relations with adjacent workshops, even though these were structurally

74 On the epigraphy from Rome see *Joshel*, Work, Identity and Legal Status at Rome.
75 *Hawkins*, Roman Artisans, 130–132.
76 *Flohr*, World of the Fullo, 270–272.

independent and had their own living accommodation. Indeed, several of these houses can be associated with multiple of such workshops. One example is a small fullery along the Via Stabiana at Pompeii, which was part of the large House of the Citer Player.[77] The workshop had a large, decorated back room with a *triclinium* offering living accommodation; along the walls of the workshop ran the water pipe feeding the private baths of the adjacent house indicating the close connection between the two. Undoubtedly, the owner of this elite villa played some role in the lives of the craftsmen operating the workshop, as he would have had a direct financial interest in the economic success and continuity of the fullery: when a workshop was part of a larger domestic complex, it is extremely likely that its owner or manager had easy and regular access to someone with a good social and economic position, and at least had a theoretical opportunity to take economic advantage of this connection. At the same time, many workshops were much more independently set up. In such cases, patronage networks remain invisible in the archaeological evidence, though this does not imply that they did not exist.

A specific category of patronage ties that has some visibility in the epigraphic record concerns the ties between freedmen and their former owners. Particularly in the city of Rome, and in the Italian peninsula, inscriptions set up by or commemorating craftsmen allude to their freedmen status, suggesting they retained the ties with their former owner as a vivid part of their social identity. In Interamna Lirenas, the *pistor* (baker) and *sevir augustalis* M. Orbius Princeps, a freedman, set up a tomb for three people, two of which were also related to his former owner.[78] At Spoletium, a group of late Republican *magistri quinquennales* of the local association of *fullones* that set up an altar to Minerva consisted of three *liberti* and one slave – the active use of their freedmen identity suggests that these fullers entertained lasting ties with the local elite households to which they once (or in one case still) belonged, and it is possible that these households had had some influence on the fact that these four fullers had become *magistri quinquennalis* of the local association.[79] Still, the precise nature of these ties, and their economic relevance on an everyday basis remains implicit. Moreover, there also is substantial evidence in the epigraphic record for craftsmen from Roman Italy that did *not* advertise such ties – because they never had them. For instance, C. Atilius Iustus, a second century CE *sutor caligiarius* building a funerary tomb for himself and his wife in Mediolanum, makes clear in the inscription on the tomb that he was freeborn.[80] Outside Italy, epigraphic discourse remains mostly tacit about the legal status of craftsmen.

Essentially, therefore, the role of individual patronage in the everyday lives of craftsmen remains badly understood. One has to assume that many craftsmen had a

77 Workshop I 4, 7. Cf. *Flohr*, World of the Fullo, 297.
78 CIL 10, 5346.
79 CIL 11, 4771.
80 CIL 5, 5919.

direct interest in maintaining close ties of patronage whenever they were available, as these ties could be decisive for the economic success of their workshops: many artisans would have been dependent on others for at least some of their practical economic needs, particularly when they needed loans or other forms of financial support for the maintenance or extension of their workshop, or for the purchase of expensive work installations. For instance, given the high prices of looms recorded in papyri, it is likely that starting weavers had difficulty buying one; indeed, it is attested that at least some Egyptian weavers periodically paid rent for their loom.[81] In these cases, it is clear that outside actors – patrons or businessmen – could be fundamental to the economic success of craftsmen. What can be argued is that in the more densely urbanized regions of the Roman world, the existence of increasingly wealthy, locally rooted urban elites made that such ties were more readily available, thus potentially making it easier for craftsmen to invest in workshops on a slightly larger scale.

2 Professional Associations

Yet even if many craftsmen may have had their own personal ties to patrons, many also appear to have had ties to a more-or-less formalized network of peers through their membership of a local professional association. The existence of such associations is particularly well-attested for Roman Italy, Asia Minor, and Egypt, but the evidence suggests that it was a common phenomenon in urban contexts throughout the Roman world, perhaps with the exception of Roman North Africa. The nature of associations varied somewhat according to the size of the city. For instance, many smaller cities in Roman Italy had simply *collegia* of *fabri* and *centonarii*, both of which in reality may have been umbrellas for a wider range of specialized craftsmen which were locally present in small numbers.[82] In larger cities professional organizations appear to have been more strongly specialized.

There has been considerable debate as to the nature of these professional associations, particularly concerning their economic impact.[83] Most direct evidence for professional associations is related to the civic and religious activities in which they were involved, and may be taken to suggest that they performed social rather than economic functions – *collegia* can be seen honoring their benefactors, burying their deceased members, and erecting altars for the gods, and evidence from Asia Minor shows how certain professional associations had their own reserved places in the local theatre

81 *Droß-Krüpe*, Wolle – Weber – Wirtschaft, 187.

82 See, on the *centonarii*, *Liu, J., Collegia Centonariorum:* The Guilds of Textile Dealers in the Roman West. Leiden/Boston 2009, 57–96.

83 On this debate see *Verboven*, Professional *Collegia*, 187–195 with references. Cf. v*an Nijf, O. M.*, The Civic World of Professional Associations in the Roman East. Amsterdam 1997, 12–18.

or stadium.[84] A limited number of sources, however, makes explicitly clear that professional associations could also be used to defend the financial interests of their members. An Egyptian papyrus from mid-second century records a guild of fullers and dyers in the Arsenoite nome litigating against a tax official who has made them pay too much tax.[85] Several other papyri indicate that professional associations were more broadly used as a channel through which craftsmen paid their taxes.[86] Given this paucity of evidence, it remains unclear how often professional associations used their collective power to advance a collective economic cause.

Nevertheless, there can be no doubt that, because of their sheer existence, professional associations presented craftsmen with a meaningful instrument in negotiating their collective and individual economic well-being. In Italy, there is ample evidence that local elites maintained close ties with leading professional associations in their town, often acting as benefactor or patron of one or even multiple *collegia*. For instance, at Aquileia, the former *quattuorvir* C. Valerius Eusebes became patron of the *collegium* of *centonarii*, while C. Pettius Phitatus ended up as *patronus* of the *collegia* of *fabri* and *centonarii*.[87] Even if contacts between a collegium and its patron were incidental rather than daily in nature, it is clear that *collegia* as a collective, and, therefore, at least some of their individual members as well, had regular access to the highest circles in urban society. This, in fact, created circumstances under which local elites could easily play a role in financing investment in manufacturing even if they did not personally have a lot of craftsmen in their personal patronage networks – if they wanted too.

At the same time, as the example of the fullers and dyers from Egypt makes clear, professional associations could, and did, represent groups of craftsmen vis-à-vis the urban authorities, and thus stave off collective economic threats, or negotiate settlements in the case of conflicts. While the evidence offers few straightforward examples of this, the so-called *lis fullonum* about the payment of rent for the premises of a collegium in third century CE Rome makes clear that organizations of craftsmen could defend their interests successfully, even against powerful opponents.[88] Arguably, as an institution professional associations offered craftsmen an infrastructure that made it easier for them to exert collective influence on forces that would be beyond the social reach of individual craftsmen, and could protect their interests when necessary. This does not mean that they did so continuously: their everyday character may very well have been primarily social, though this, too, strengthened the economic ties between craftsmen and thus offered economic advantages. The proliferation of epi-

84 See esp. *van Nijf*, Professional Associations, 209–240.

85 P. Tebt. 287.

86 See, e.g. *Bagnall, R./Worp, K.*, Two Nominations of Goldsmiths to Collect Taxes, in: ZPE, 59, 1985, 67–70. See also P. Mich 5, 245.

87 CIL 5, 1012; CIL 5, 749.

88 See *Tran, N.*, Le 'Procès des Foulons': L'occupation litigieuse d'un espace vicinal par des artisans romains, in: Mélanges de l'École Française de Rome: Antiquité, 119/2, 2007, 597–611.

graphic evidence for professional associations throughout the Roman world suggests that local craftsmen were ready to act upon these social and economic opportunities.

III Discussion

In many places, practices and contexts of manufacturing in the Roman world may have resembled those in the Greek and Hellenistic worlds. As has been argued in this chapter, part of the story about craft production in the Roman world is that it is simply much more explicitly visible in the evidence. Many craftsmen had small workshops, which they operated on the basis of their acquired skills, with limited means, and with a small, household-based work force, and they often would sell their products on the spot, or on the local market square. There is no question that in many places small-scale, consumer-oriented production in many branches of the manufacturing economy continued to present the norm. In this sense, the Roman manufacturing economy remained a typically non-industrial phenomenon. Yet this should not be seen as the leading narrative in the economic history of manufacturing in the Roman world.

Much more important than what stayed the same is what appears to have changed. More than its Greek and Hellenistic predecessors, Roman manufacturing economies can occasionally be seen to operate on a larger scale, both in their integration over larger distances, and in the dimensions of investment. Urbanization, and the emergence of urban consumer cultures in which there was a substantial and continuous demand for high quality consumer goods, changed the dynamics of the manufacturing economy: these developments in several places, particularly in the Mediterranean, created scope for investment on a larger scale and fostered many craftsmen to rationalize the operation of their workshop, and favor good-looking products that were relatively easy to make over finely crafted products that may have been of higher quality but required a higher input of skilled labor, which was not always easily available.

Thus, if the Roman manufacturing economy operated within the limits of what was possible in a non-industrial society, it did so in a very specific way that is different, qualitatively and quantitatively, from Late Medieval and Early Modern Europe, but can neither be put on a par with Classical and Hellenistic Greece – not in structure, and not in performance. Roman manufacturing economies were not necessarily on average considerably more advanced than their predecessors, but they were, arguably, more varied, and included a broader spectrum of phenomena and institutions that made it possible for craftsmen and investors to make more money, and serve a broader consumer base. More than anything else, these developments, some of which have been highlighted in this chapters, should constitute the leading narrative of the economic history of manufacturing in the Roman world.

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