5. INDUSTRIES, MANUFACTURING, AND LABOR

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The economic performance of any manufacturing sector is determined by a series of essentials: population size, natural resources, technological innovation, human capital, government intervention, as well as by each city's unique historical, physical, and geographical features (fig. 5.1). In the case of Fustat, early urban development was hampered by a deep demographic decline in Egypt, caused by the Justinian plague (Alston 2001). A century of plague recurrences followed the initial outbreak of 541 AD and, combined with limited Arab migration to Egypt, resulted in slow population recovery. However, as recent work has shown, the demographic shock in the Middle East also improved the economic welfare of the survivors (Pamuk and Shatzmiller 2014). High wages paid to skilled and unskilled labor allowed workers to enjoy high standards of living and use the increase in their purchasing power to generate demand for basic and non-basic manufactured goods, including literacy and literacy-related items.

This early pull of demand in the post-Justinian era drove manufacturing in the Middle East into high gear and boosted the performance of the sector. The expansion of Fustat's industrial capacity also played a role in initiating growth in related sectors of the economy. Intensive demand for raw materials stimulated agricultural productivity and exploitation of natural resources. Increased mining of precious

FIGURE 5.1. A street scene at a public fountain, Damascus, Syria, 1920 (OIM P. 7572 / N. 4012)

metals and improved minting techniques allowed monetary circulation to grow in urban centers as well as in rural areas, as documented by taxes paid in cash. The intensive growth of the urban manufacturing sector also privileged the development of markets, long-distance trade, and tools related to financial transactions.

By the tenth century, evidence ranging from chronicles, legal documents, professional manuals, and artifacts unearthed in archaeological excavations in Fustat points to the existence of urban industries and material culture not unlike those found in other cities across the Islamic Middle East. In the case of Fustat, however, in addition to the regular sources used for the history of urban labor and manufacturing, we are fortunate to also have the unique and rich coverage provided by the Judaeo-Arabic documents of the Cairo Genizah (Goitein 1967b; see *Chapter 2*). Important topics in the history of labor relations, such as partnership, an institution that would have otherwise remained largely unknown to us, are elucidated thanks to the Genizah documents. The overall analysis of medieval economic institutions has also benefitted from the mechanisms of long-distance trade of medieval Egypt and North Africa that are revealed in these documents (Greif 1993). However, this chapter focuses on the role and place of the individual in the manufacturing sector, rather than that of institutions.

MANUFACTURING INDUSTRIES OF FUSTAT

The main manufacturing industries of Islamic Fustat can be conveniently classified according to the nature of the raw material they used: textiles, food, construction, metal, wood, leather, pottery, glass, paper, and chemicals. The efficiency and productivity levels of each industry not only depended on the regular supply of raw materials, local consumption, and export needs, but also on the quality of human capital expressed in the degree of division of labor, patterns of labor organization, and human capital formation.

A widespread division of labor was a common feature of the medieval Islamic manufacturing industries. A quantitative study of Arabic trade names, each used as an occupational indicator, collected from a wide range of sources, including the Cairo Genizah, revealed the existence of 598 distinct manufacturing occupations (Shatzmiller 1994). According to this study, the textile industry had the highest division of labor in relation to all other industries in the city and textile workers were the most specialized group of the labor force. Spinners, weavers, fullers, carders, dyers, and cloth beaters specialized in working with different fibers, while others specialized in performing specific tasks, such as button makers, lace makers, makers of turbans, makers of skirts, furriers, embroiders, and makers of strings and ropes, tassels, and ribbons. Others specialized in making large items, such as tents, carpets, curtains, cushions, and bedding, while yet others were specialized according to the techniques they used, for instance, dyers of cotton, wool, silk, and linen, threads, or cloth.

The methodology used for mapping the division of labor, "occupational classification in economic sectors," also makes it possible to estimate the size and distribution of the urban labor force in each of the industries. The textile industry retained the largest portion of the city's labor force, somewhere between 18 and 21 percent. Those specialized in making different culinary dishes and food ingredients employed a similar share of the labor force as that of the textile workers. Those who worked with metal or leather, and those who worked in construction each constituted between 8 and 16 percent of the labor force, while makers of wooden items, pottery, paper, ivory, wicker, and processors of chemical substances each constituted between 1 and 6 percent. The smallest group was the highly specialized makers of chemical substances, among them herbalists, pharmacists, and distillers of petroleum, makers of glues, dyes, paints, drugs, perfumes, metal substances, and minerals. Among the products they manufactured were distilled and extracted essential oils, varnishes, organic and inorganic pigments, and medicinal drugs, ink, lime, distilled fats, and perfumes. Some of these products were used by other industries, such as dyes, paper, glass, and leather, but were essential to the items produced by the textile industry.

The urban textile industry had another distinctive feature: it was the largest employer of women (fig. 5.2). Occupations such as embroiderers, dyers of silk garments, and thread makers, but especially spinners of every conceivable thread — flax, cotton, wool, silk — held a monopoly on the female labor force. This gender-based division of labor empowered women, Muslim and Jewish alike. It not only gave women

FIGURE 5.2. Arab woman at spinning wheel, Mosul, Iraq, 1920 (OIM P. 6846 / N. 3286)

power over the rhythm of production in the textile industry, it also improved their status within the family. As wage earners they contributed to the increase in per capita income and to the increase in the combined household income. Their economic power led to articulation of women's property rights in Islamic and Jewish law, and to its enforcement by the courts (Goitein 1967a; Shatzmiller 2007).

ORGANIZATION OF THE MANUFACTURING SECTOR

Manufacturing took place in different locations throughout the city. The self-employed artisan shop was the most common unit of production and was frequently encountered in the commercial quarters and concentrated in the neighborhood of the Friday mosque. A secondary workshop was the royal or state-organized textile workshop, the *tirāz* workshop, which manufactured luxury textile items destined for distribution to dignitaries as gifts. The *tirāz* workshop was not a common feature in all urban textile-manufacturing centers, but was prominent in Egypt due to the large scale of textile production there and its high quality. It was unique as a workshop since its products were not normally commercialized or widely circulated; nonetheless, the special techniques and manufacturing skills that were practiced or developed in the royal workshop were diffused, imitated, and shared by other artisans. In addition to these two workshops, which were staffed by males, textile-related items were also manufactured in private homes, mostly by women. This may be described as an early "output" system, given its highly organized nature. Its origins may have been in the countryside, where weavers supplied orders for urban markets, but later, with the rise of division of labor in urban centers, the system began operating on a regular basis. Led by commercial agents, male and female entrepreneurs placed orders for threads or cloth, provided the raw material (fig. 5.3), paid for the job, sometimes ahead of collecting the finished items, sold them to customers, and paid the government taxes on labor and sales (Shatzmiller 2000).

The Islamic law of hire, *ijāra*, provided a limited number of legal provisions for the regulation of labor relations. Grouped under four headings in the legal

FIGURE 5.3. Wooden spindle whorl, early 20th century. Purchased in Turkey by the Alishar Hüyük expedition. OIM A73085 (OIM D. 27341)

manuals, they were the general *ijāra*, namely the hire of an artisan or an unskilled laborer, which was done mostly orally without a written contract; the *istināʿ*, the hire of a specific manufacturing skill, for instance that of a well digger or a wet nurse, which required a written contract; the *tamīn al-sunnāʾ*, the legal protection given to a hired laborer working with raw material provided by the customer; and the *sharīka*, the labor partnership, permitting two or more artisans to associate under the law for the purpose of investment, manufacturing, and division of profits and losses (Udovitch 1967, 1970). The Genizah documents from Fustat provide an extensive view of the size and variety of such partnership investments. They include partnerships in dyeing, minting, weaving, lead working, tailoring, baking, glasswork, winemaking, pharmaceutics, carpet weaving, melting, silk work, silversmithing, sugar making, leather tanning, and cheese making.

TRANSMISSION OF MANUFACTURING TECHNIQUES

The fine division of labor as well as the premium placed on professional skills in the organization of the manufacturing sector reflects a high quality of human capital in the sector, yet the institutions usually responsible for human capital formation are missing (fig. 5.4). It is now clear that professional guilds, the institution that regulated apprenticeship in Europe, did not exist in the medieval Islamic city, since there is no Arabic term corresponding to a professional guild and no description of its functions. Neither the hiring of an apprentice nor his legal status, or that of child labor, for that matter, were determined by the law. In their absence elements of human capital formation, literacy and numeracy skills, individual professional and technical skills acquisition, generational transmission of manufacturing techniques have occurred differently (Shatzmiller 2013). An apprenticeship system in the artisan shop developed, displaying professional hierarchy of masters (*muʿallims*), workers (*ʿummālūn*), and apprentices (*mutaʿallimūn*). Youths were apprenticed to masters and, with or without a contract or official diploma, could rise to the rank of a master. Sons frequently learned the trade from their father, inheriting his title of *muʿallim*. The Genizah documents provide one example of an apprenticeship contract, but it is unclear how common such contracts were. This document, signed in 1027 in Fustat, is a contract between a father who is hiring out his son to a weaver for four months, in return for a monthly payment of 15 dirhams, which would then be changed to the regular wages of workman.

Much more significant, not only to the question of transmission of manufacturing techniques, but also to the entire question of human capital and that of the standards of literacy in the Islamic city, is the evidence provided by the written professional manuals. These were composed as early as the ninth century, first for bureaucrats in the court administration, then as tools for teaching reading and writing and other literacy and numeracy skills, manifesting the standardization of the Arabic language. For instance, manuals for Qurʾan readers specified rules for pronunciation and punctuation, and the reader (*muqriʾ*) was given a chart of all the variant readings, which he consulted when his memory lapsed. Manuals were written for tax collectors and bookkeepers, for workers in the royal mint, secretaries, market inspectors, notaries, bookbinders, soap makers, ink makers, drugs makers, arms makers, cooks, construction workers, brokers, and middlemen (*samāsira*). The translation movement generated works of applied sciences including manuals for physicians, astronomers, mathematicians, and navigators. The content

of these manuals, written by artisans for artisans, ranged from the highly technical with no literary sections, to mostly literary sections and very few technical ones, but most were rich in technical details. A manual for water carriers was uniquely intended for a non-literate audience, as a mnemonic tool to help the water carrier memorize the pious verses related to his services. Equally intriguing are the manuals written for agricultural practices, crop cultivation, fertilization of the soil, and irrigation techniques such as the digging of *qanats* (irrigation wells and tunnels). Agricultural calendars specified crops and practices for monthly applications. The content of the manuals implies the existence of a literate workforce in the medieval Islamic city.

Other mechanisms used in the transmission of manufacturing techniques were manifested by the way ethnic groups practiced, preserved, and transmitted artistic decoration techniques (fig. 5.5). For instance, Copts preserved and transmitted the techniques of ivory carving, while polychromatic incrustation and mosaic work were a monopoly of Christians in both the Middle East and Spain. Islamic metalwork produced in Syria in the mid-thirteenth century contains many Christian symbols and details from Christ's life, an indication that Christian artisans and Christian motifs were tolerated in the Islamic city. Jews dominated silk dyeing and the manufacture of metal and glass items. *Qanat* digging was a highly specialized skill that was passed on among members of tribal groups, such as the *moqanis* of Baluchistan, which were all Afghans of the Ghilzai tribe, or the *qanat* diggers of southern Morocco, who came from the Todgha inhabitants of the oases. Other examples include rock crystal carving, which was perfected in Sasanian Iran, and later successfully transferred to Islamic cities

The movement of artisans, which frequently accompanied the building of new cities, also played a role in the transmission of techniques. Whether moved by force or coming voluntarily to the construction site, artisans often brought new or alternative techniques and technologies with them. Contemporaries observed the movement of techniques across the borders: al-Jahiz, the ninth-century author, reported hydraulic engineers, expert agronomists, and marble workers coming to Baghdad from China. The tenth-century author al-Hamadani reported

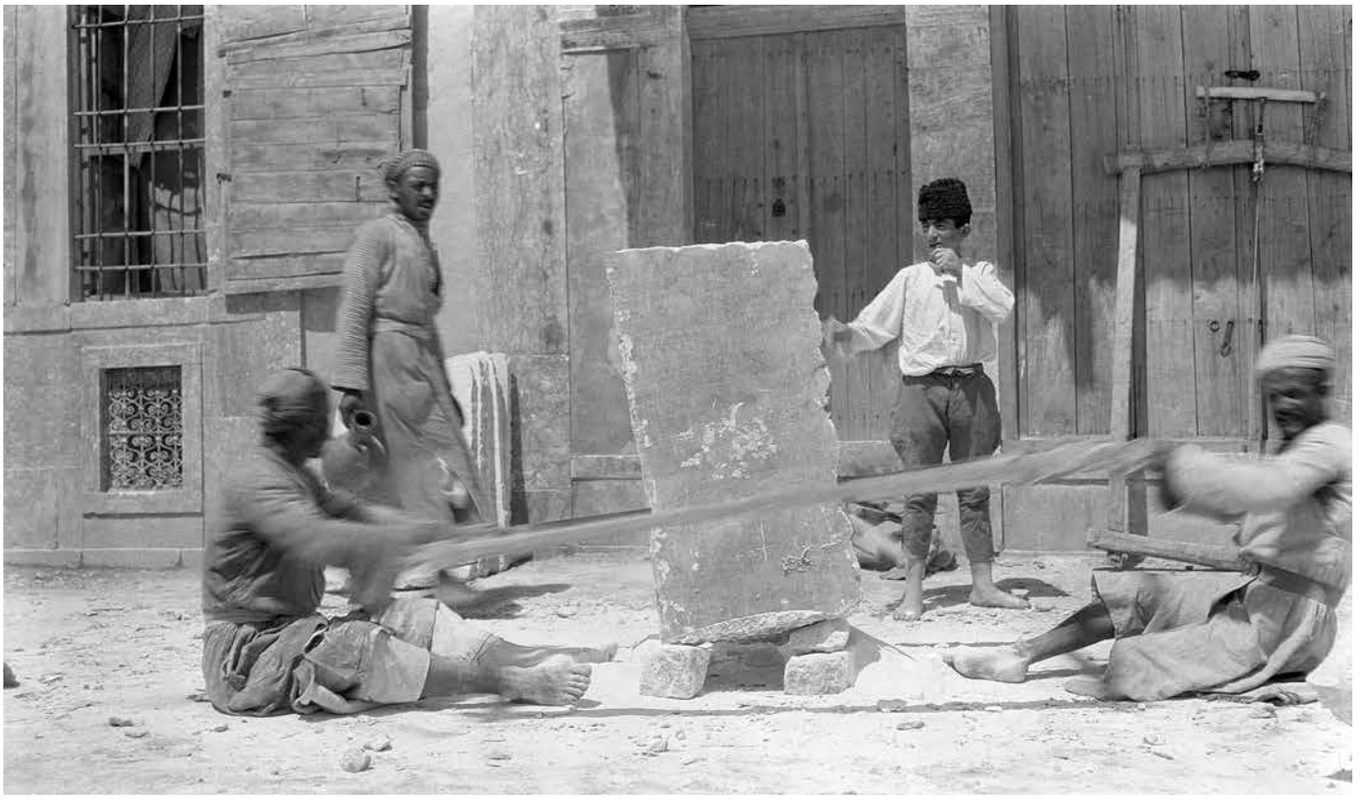

FIGURE 5.4. Stonecutters at work in Mosul, Iraq, 1920 (OIM P. 6841 / N. 3281)

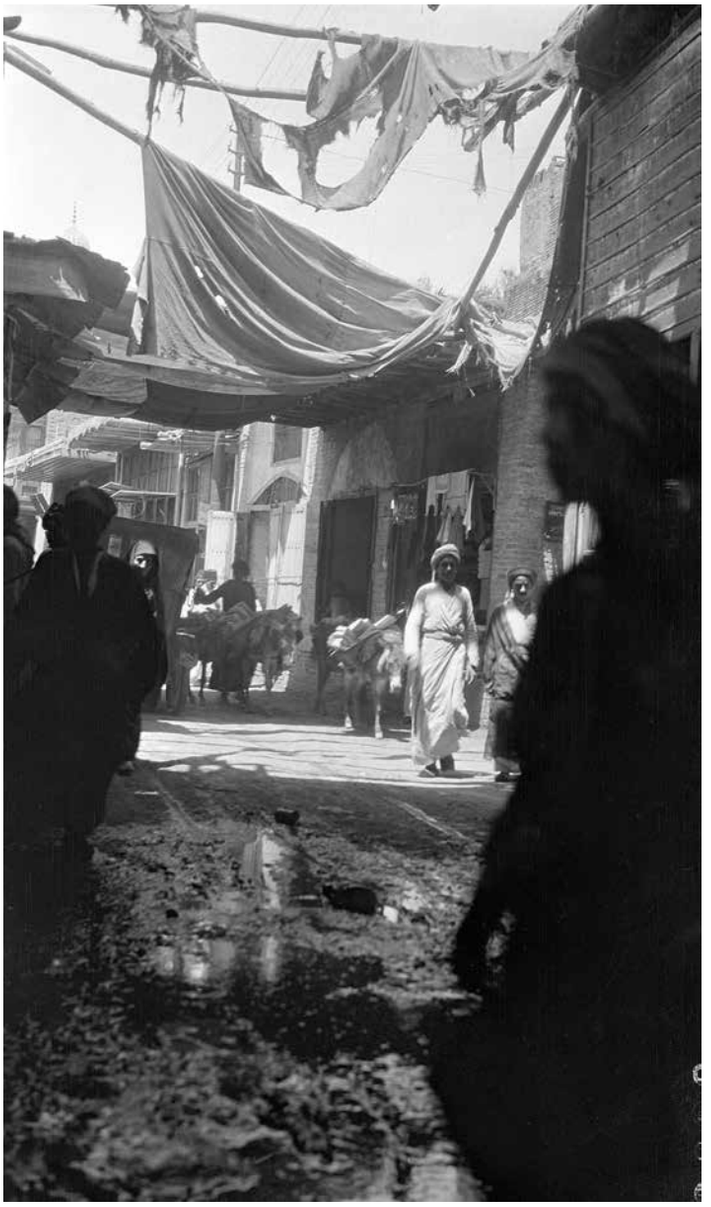

FIGURE 5.5. Bazaar with goods for sale in Baghdad, Iraq, 1920 (OIM P. 7258 / N. 3698)

thousands of Persians who brought gold- and silver-mining techniques to the Yemen. Architects designed buildings in cities away from the place where they lived, or traveled distances to install their designs. The Egyptian carpenter Abu Bakr ibn Yusuf made the components for the minbar in his atelier and traveled with them to Mecca to install them. The migration of Muslim artisans from North Africa to Spain helped transfer papermaking and textile-making techniques. Builders brought the use of wooden ceiling beams to Egypt from the Maghreb in Fatimid days while the inhabitants of the city of Sfax (in modern Tunisia) imitated the textile fabrication techniques and style used in Alexandria. The names of the city gates of Marrakesh suggest that in the eleventh century leather artisans from Aghmat chose to settle in the new capital. Finally, the forced movement of artisans after Baghdad fell to the Mongols in 1253 brought sophisticated manufacturing techniques to Central Asia (Shatzmiller 2012).

In literature investigating economic growth in pre-modern societies the point has been made that technological innovation will not occur in a society that is "malnourished, superstitious or extremely traditional with tight social constraints preventing it from being open to diversity and tolerance" (Mokyr 1990, p. 12). Medieval Islamic societies exhibited none of the above. On the contrary, the evidence shows that economic performance benefitted from an overall high degree of diversity. The existence of an ethnic and religious mix, a variety of languages and traditions, and openness to new ideas, intellectual stimulus, and ways of doing things, created a climate conducive to invention and innovation. In return, early Islamic societies benefitted from high standards of living, special groups, and ethnic and religious minorities who were able not only to integrate socially and economically but also to contribute, participate, and benefit from the vibrant economy they helped to create.

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