Études Turques – USHS
n°2

DONALD QUATAERT

MANUFACTURING AND TECHNOLOGY TRANSFER IN THE OTTOMAN EMPIRE 1800-1914

The Isis Press
Istanbul-Strasbourg

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To my son Eliot

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PRÉSENTATION

Éminent spécialiste de l'histoire économique et sociale de l'Empire ottoman au XIX^{e} siècle, Donald Quataert nous a fait l'amitié d'accepter, en 1989, de passer un mois à Paris en tant que directeur d'études associé à l'École des Hautes Études en Sciences Sociales. Durant ce séjour, il a prononcé, dans le cadre de notre séminaire du Centre d'Études sur l'URSS, l'Europe orientale et le domaine turc, quatre conférences sur l'industrie et les transferts de technologie en territoire ottoman. Ce sont ces textes, dûment revus et développés, qui sont regroupés dans ce volume.

Scripta manent. Il faut assurément se réjouir qu'ait été ainsi pérennisé un des temps forts de notre séminaire.

Mais il y a aussi les paroles, et celles-ci ne sont pas aussi éphémères qu'on le dit. Inauguré en novembre 1985, notre enseignement à l'ÉHÉSS a poursuivi année après année, sous un titre générique relativement vague ("De l'Empire ottoman à la Turquie actuelle. Mouvement des idées et transformations sociales"), l'exploration d'une société complexe et fort mal connue. Notre tâche a surtout consisté à susciter des questions, à créer un climat de fructueuse coopération et à coordonner les apports de tous les collègues et amis qui ont bien voulu nous faire bénéficier de leur savante complicité. Le résultat ? Grâce aux quelque 50 spécialistes qui ont déjà pris la parole à notre séminaire, grâce aussi aux nombreux étudiants qui au fil des ans n'ont cessé de manifester leur intérêt pour l'entreprise commune, la société ottomane, riche de toutes les cultures qui s'y entremêlaient, nous est désormais beaucoup plus familière que par le passé. Nous parvenons à en cerner avec une relative précision les courants idéologiques, les traits démographiques, les formes et les lieux de sociabilité, les spécificités dans le domaine du développement urbain, les transformations économiques, pour ne citer ici que les axes de recherche qui ont le plus retenu notre attention.

C'est dans le contexte de cette aventure collective qu'il convient de replacer les conférences de Donald Quataert. Celles-ci constituent quelques-unes des pièces du puzzle. Lorsque toutes les autres pièces seront mises bout à bout, nous

devrions nous trouver en présence d'une nouvelle histoire de l'Empire ottoman, une histoire attentive aux phénomènes sociaux, aux grands faits de civilisation, aux cultures minoritaires, aux données économiques.

Que le livre de Donald Quataert soit publié dans une collection du Département d'Études Turques de l'Université des Sciences Humaines de Strasbourg ne doit guère surprendre. Depuis de nombreuses années déjà, les quelques centres qui se consacrent, en France, aux recherches sur le monde turc collaborent activement. C'est en particulier grâce à cette collaboration que la revue *Turcica* a pu paraître durant 25 années sans discontinuer. C'est grâce à elle aussi que plusieurs projets collectifs de recherches ont pu être lancés. La publication à Strasbourg de conférences faites à Paris, dans le cadre d'un séminaire de l'ÉHÉSS, s'inscrit dans le sillage de cette tradition et ne constitue qu'une manifestation parmi d'autres de l'esprit d'amicale confraternité qui singularise la turcologie française.

Paul Dumont et François Georgeon

PREFACE

The present book evolved from a set of four lectures that I presented at the École des Hautes Études en Sciences Sociales, Centre d'Études sur l'U.R.S.S., l'Europe orientale et le Domaine turc during May 1989. The invitation to offer the lectures afforded me the opportunity to think about definitions of technology transfer and its success or failure.

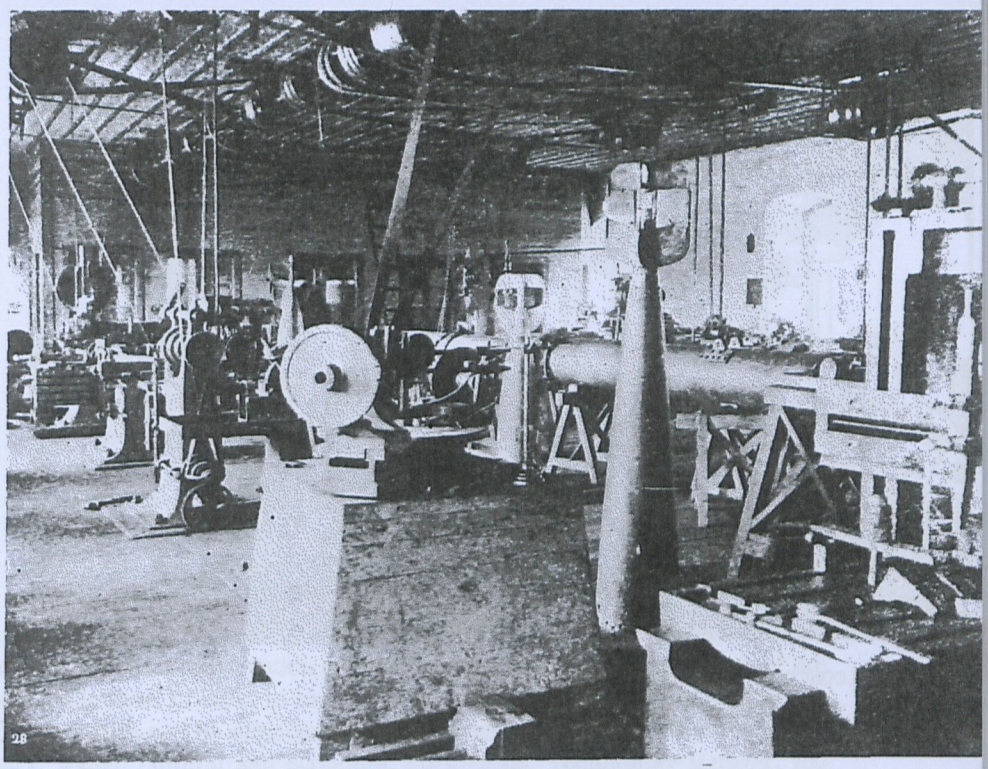
The literature on this general subject is truly vast. Much of it is present-oriented and concerned with issues of contemporary development. A major issue, for example, is whether high-tech factories should be imported lock, stock and barrel, assembled and turned on or whether more incremental steps should be employed, adopting just those technologies that seem to fit with local conditions. There is a large body of material on the historical process of technology transfer, a topic that has attracted the attention of East and Southeast Asian and Latin American as well as European specialists. Middle East devotees, for their part, can learn very much from reaching out beyond their chosen area of inquiry. But, in the end, as the reader will see, the explanations for comparative successes and failures remain elusive. Much of the rich literature really only describes how, not why, the transfers did or did not occur.

The focus of this work is on the transfer of manufacturing technology because, at the time of the lectures, I was preparing a book on textile manufacturing in the late Ottoman period. Many fascinating topics outside the manufacturing sector have remained unexplored. Two examples will suffice here to suggest additional lines of research. First, consider the diaspora communities that Philip Curtin and others discuss for their commercial prowess. Certainly the Greek and Armenian communities served as important transmitters of technology from the United States and Europe to the Ottoman regions, a process that we only glimpse at in the present book. Family histories surely would yield much useful information. Second, take the example of railroads and their appearance on the Ottoman scene. We know little about how the engineers and highly-skilled workers who came from European countries passed on their skills, as we know they did, to Ottoman subjects. Who were these Middle East innovators and how

were they recruited and trained? More generally, why did some technologies remain the domain of the foreign technician while others did not ?

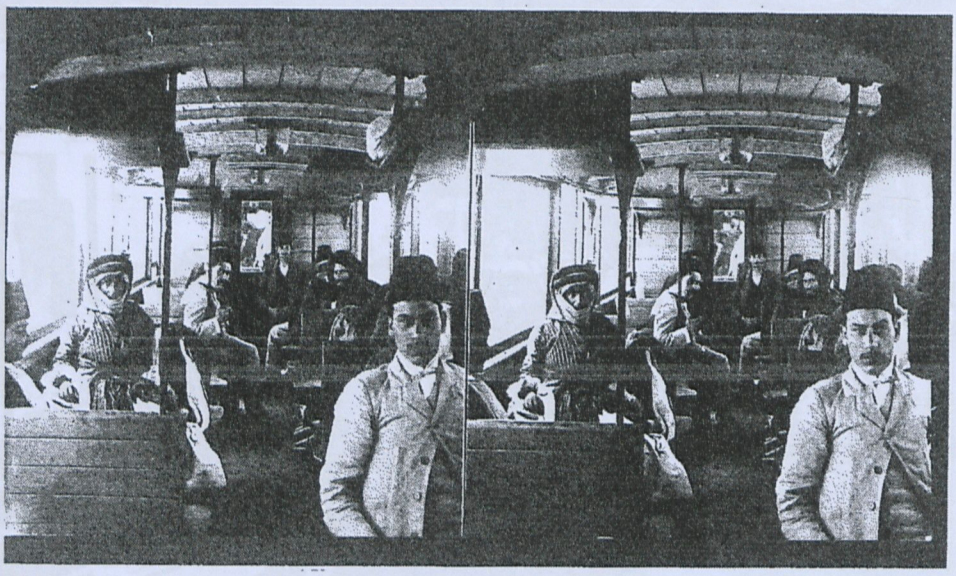
My sincere gratitude to Gilles Veinstein and other members of the École for their many kindnesses. I especially am gratefully to Paul Dumont for his countless courtesies and friendship, well beyond the requirements of collegiality. I am delighted to have this book included in the series being produced by his new institution, the Institut d'Études Turques at Strasbourg.

R.Q.



Interior view of the torpedo department in the Arsenal (*Tersane*)
Abdullah Frères

Military Academy students working on tunnel of the Haydarpasha-Ankara Railway
Fahreddin Turkan, 1891



Third class coach on the Berlin-Baghdad Railway
Stereo-Travel Company, 1908

Imperial German Cuirassé before the Dolmabahçe Palace
Abdullah Freres

I

THE CONTEXT OF TECHNOLOGY TRANSFER: MECHANISMS AND OBSTACLES

The general subject in this study is Ottoman manufacturing and how it changed during the 19th century, when a widespread series of changes connected to the processes of westernization and modernization affected every aspect of life in the Middle East. In order to survive in the new world of Western hegemony, the Ottoman state and its subjects massively borrowed from Europe, its political, military, social, cultural and economic institutions. Technology transfer, the movement of innovations from the countries of their origins to the Ottoman lands, was crucial to the success of the Ottoman westernization project and at its very heart. Historians implicitly assume and accept the validity of this notion but have largely ignored the problem of technology transfer in their studies.

The diffusion of technology took place across the entire spectrum of Ottoman life from railroads, telephones and battleships to medicine, Martini rifles and sewing machines. The transfer of military technology from the West was important and has received perhaps the most attention, usually under the rubric of "military reform". At one point during the 19th century, the Ottoman navy, thanks to technology transfer, ranked among the very top of the world's seapowers, only to fall into decay for reasons not of concern to us here. The Ottoman army, for its part, acquired some respectability and successes, for example, in the 1897 Greek War, thanks to the widespread adoption and use of Western military hardware (and tactics). Nor should we forget that technological superiority made it possible for the Ottoman state to impose its will against internal rivals, both the provincial notables and tribes. Significant transfers of technology also occurred in the arenas of Ottoman transportation and communication. The Ottomans' adoption of the telegraph and the connection of Istanbul to Europe by underground cable came early, during the 1850s; by the end of the century, a thick network of telegraph lines reached into almost every corner of the empire, including remote Arabia. Soon after their development in

the West, steamships became a familiar sight in Ottoman waters. Their rising use in the region closely paralleled the global diffusion of this technology, increasing fifteen times between the 1850s and 1890s, and nearly tripling again in the following two decades. Many Ottoman urban centers acquired tramway systems and municipal lighting systems, sometimes very late in the period. Between cities a network of railroads blossomed in the Balkan, Anatolian and Arab provinces. These transformed the countryside and sometimes brought about major increases in agricultural production. Railroads also changed the living patterns of millions of Ottoman subjects; in 1911, for example, Ottoman lines carried fourteen million passengers, creating suburban commuters and facilitating the circulation of labor, fashions and ideas throughout the empire.

The transfer of manufacturing technology is a very important subject. It is no less than an essential precondition for the successful development of the non-Western world during the 19th century and of the Third World today. Thus, to discuss technology transfer is actually to examine the entire question of development. Why have some countries developed and emerged into powerful industrial states? And what are the reasons why the others — that are the majority of the countries of the world and include the Ottoman Empire and its 20th century successor states — have not done so? Authors including Max Weber and Joseph Schumpeter and David Landes have put forward various explanations to resolve this complex and difficult problem, variously stressing religion, entrepreneurial spirit and/or natural resources. The answer is to be found, I believe, through a two-part process of investigation. We must look at each specific example, in this case, the Ottoman, to determine the mix of variables present and then try to understand how these facilitated or impeded the transfer of manufacturing technology. And we also need to examine the international economy to determine the nature and range of the contraints that were placed on the development potential of particular states. That is, the transfer of knowledge and technology and the changing structure and character of industry in the 19th century Ottoman world derived from complex combination of factors operating in the Middle East and in the international economy. It is not sufficient to examine either only the Western or the Ottoman factors. It was both the specific character of each of the two sets of variables as well as the interactions between them that determined the flow of manufacturing technology from the West to the Ottoman Empire. The interactions altered over time, shaping the particular direction of changes in manufacturing development.

There is an important, and ongoing, shift in our understanding of manufacturing in Europe and the Middle East that profoundly affects the question

of 19th century industrial technology transfer. For decades, we have seen the historical conquest of the world by European industry through the prism of the British experience with industrialization. Intensive mechanization and rise of factory-based mass production technology during the late 18th and early 19th centuries has been understood as the key, the very model of industrialization. But this model now is being overthrown by European historians. A great deal of scholarship is being published that radically alters our understanding of the nature and meaning of the Industrial Revolution in Europe and the United States.[1] This scholarship attacks the emphasis on the importance of sophisticated high technology and on big factory production. It substantially downgrades the significance of such technology in the Industrial Revolution and instead stresses the role of massive labor inputs, low-level technology, hand labor and intensification of the workpace in Western manufacturing until relatively quite late in the 19th century. In this new view, European competitiveness derived not merely from massive inputs of highly-mechanized industrial technology but from simpler improvements and a greatly-intensified pace of work that reduced production costs. Thus, it challenges the devotees of big factories and high technology such as David Landes in European history and Z.V. Hershlag and Charles Issawi in Middle Eastern studies.[2]

As European historians have changed their views of Western manufacturing, so must we alter our own regarding manufacturing in the Ottoman empire. To begin with, it now seems clear that Ottoman manufacturing, contrary to widely-held assumptions, did not decline in the 19th century. This false but cherished notion of Ottoman industrial collapse has flourished for some of same reasons that the big-factory mentality prevailed in European and United States history. Big factories were seen as an essential part of progress that inevitably would prevail. Their absence implicitly was understood as equal to the absence of industry per se. The continuation of small scale manufacturing was un-progressive and un-modern and thus, for a long time, was invisible to the

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[1]Jean H. Quataert, "The Shaping of Women's Work in Manufacturing: Guilds, Households, and the State in Central Europe, 1648-1870," *American Historical Review* (December 1985), 1122-1148; Peter Kriedte, et al, *Industrialisierung vor der Industrialisierung: Gewerbliche Warenproduktion auf dem Land in der Formationsperiode des Kapitalismus* (Gottingen, 1977); Dolores Greenberg, "Reassessing the Power Patterns of the Industrial Revolution: An Anglo-American Comparison," *American Historical Review* (December, 1982), 1237-1261.

[2]David Landes, *The Unbound Prometheus. Technological Change and Industrial Development in Western Europe from 1750 to the Present* (Cambridge, 1969). Z.V. Hershlag, *Introduction to the Modern Economic History of the Middle East,* (Leiden, 1964). Charles Issawi, for example, *The Economic History of the Middle East, 1800-1914* (Chicago, 1966). Also, Edward Clark, "The Ottoman Industrial Revolution," *International Journal of Middle East Studies* (January 1974), 65-76.

investigator. The history of Ottoman industry was not simply one of guilds in decline, a failure to imitate Manchester and of the relentless collapse of handicrafts in the face of efficient European manufacturing. Some Ottoman manufacturing sectors did collapse, but many transformed themselves and flourished until World War I. Other, new, industries emerged and grew very sharply in the 19th century. Middle East historians and observers have failed to see this vitality and creative responsiveness because they have focused on Ottoman high technology, on the big Ottoman mechanized industrial establishments that first appeared at Istanbul and much later in locations such as Salonica, İzmir, and Adana. They ignored the small workshops of the capital and most other Ottoman cities. Most damaging of all for their assessment of Ottoman industrial capacity, they disregarded the vast but scattered manufacturing networks of the rural countryside and of the smaller towns. Middle East specialists have been making the same error as European historians did when they focused on the factories of Manchester and ignored the putting-out and small-producer networks of Saxony. Because big Ottoman factories were few, the conclusion was easily but incorrectly drawn that Ottoman industry was a dying, unadaptive, unevolving sector. Instead, we need to see that Ottoman industry was vital, creative, evolving and diverse. The transfer of technology, or its failure, played a central role. Parts of Ottoman industry died, other sectors flourished. Great new putting-out networks emerged in some rural areas while, elsewhere, well-established ones faded away. Certain towns became the center of new industries while others became impoverished. While the fate of the respective sectors and manufacturing communities varied, each functioned and manoeuvered within constraints and opportunities provided by changing international and domestic forces.

The Content of Technology Transfer: Mechanisms and Obstacles.

General issues[3]

The general context within which Ottoman manufacturing evolved usually is understood to be the capitalist and industrial revolutions that originated in Europe and spread throughout the globe. It is universally agreed that the Industrial Revolution originated in the British Isles during the second half of the 18th century. The reasons for its origins in Great Britain are complex and hotly debated and are seen to be some combination of human and mineral resources, opportunity and entrepreneurship. In fact, these accounts do not explain why the industrial revolution took place in Britain, they simply describe the process by which it occurred. In any event, the new technologies fanned outward from there with considerably varying speed and success. The process was not uniform; geographical proximity or remoteness from the British sources of the technology seems unimportant. Parts of Great Britain itself remained largely unindustrialized down until our day. Across the seas, America, and still further away, Japan, adopted the industrial technology relatively quickly, in each case, under quite different conditions. Extraordinarily-abundant natural resources and readily-available British investment were present in the United States while both of these factors were lacking in Japan. Countries next to the United States and to Japan, such as Mexico on the one hand and China on the other, only adopted the technology at much later dates. Closer to the lands of origin, adjacent Ireland remained unaffected but some parts of remote Russia excelled. Within the emerging nation states of Europe, variety not uniformity best describes the pace and depth of technology transfer. In the German lands, the Ruhr districts built big factories far earlier and more extensively than did the Kingdom of Saxony that also was industrialized, but in a quite different way. The reasons for this great diversity in the patterns of technology transfer in manufacturing are complex.

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[3] I found the following to be useful. Sidney Pollard, *Peaceful Conquest: The Industrialization of Europe, 1760-1980* (Oxford, 1981). W. O. Henderson, *Britain and Industrial Europe, 1750-1870* (London, 1954 and 1965). Daniel R. Headrick, *The Tools of Empire: Technology and European Imperialism in the Nineteenth Century* (New York, 1981) and *The Tentacles of Progress. Technology Transfer in the Age of Imperialism, 1850-1940* (New York, 1988). Also see Robert E. Driscoll and Harvey W. Wallender, III, *Technology Transfer and Development: An Historical and Geographic Perspective* (New York, 1974). Jack Baranon, *Industrial Technologies for Developing Economies* (New York, 1969). Mingsoon Santikarn, *Technology Transfer: A Case Study* (Singapore, 1981). Sinbrata Ghatak, *Technology Transfer to Developing Countries: The Case of the Fertilizer Industry* (Greenwich, Ct., 1981). Everett M. Rogers, *Diffusion of Innovations,* 3rd ed. (New York, 1983).

The response to new technologies ranged from eager and successful adoption, to frustrated and unwanted failure, to resistance to total rejection. Technology transfer always was full of failures on purely technical grounds, even when involving very simple equipment. This was especially true of the initial efforts at transfer. The technological gap between Britain and the Continent began to close only in the 1860s because the first introductions always failed, even after the technology had become very well established in Britain. Hence, the many failed Ottoman experiments, for example, to found factories at Istanbul, were not at all unusual but rather were part of a recurring global pattern.

Natural resources

The role of natural resources in manufacturing and successful technology transfer is controversial. In my view, at least, it is not clear how much importance we should assign to this set of factors. All major big factory industrializers— England and the United States (and even Japan)— possessed abundant sources of water and of raw materials for its initial industrialization via textile production, cotton or wool. In the Ottoman case, the Zonguldak mines contained all the coal necessary to supply the entire Ottoman empire (its quality, however, was less than optimal). In the Ottoman Balkans, sufficient water sources, mineral deposits and textile materials were present and there we find quite successful technology transfer and industrial development, at least by Ottoman standards. The Anatolian and Arab lands had the necessary sheep and cotton. Water sources, however, were few, restricting the location of industrial concentrations.[4]

Population density

The demographic profile of the Ottoman Middle East certainly negatively affected patterns and trends in manufacturing. The Ottoman lands were sparsely populated and this scarcity limited both production and market opportunities. Labor for an industrial workforce remained in short supply for most areas while the internal market for domestically-manufactured goods was comparatively small. There appears to be a precise correlation between concentrations of Ottoman industry and relative population densities. Ottoman industry was most pervasive and important in the Balkan lands, next in the Anatolian areas and least

[4]The Ottoman lands of the late 19th century possessed few important iron ore deposits. In 1914, there was no pig iron production while steam-powered textile production was increasing sharply. Here, then we see the role of natural resources.

of all in the Arab provinces. The Balkan lands were the most densely-populated; Anatolia possessed only one-half their population density but this was twice the density in the Arab provinces. And yet, densities were not necessarily crucial. The Adana region, for example, was very thinly populated but had one of the noteworthy clusters of big factories. Here were present very abundant supplies of cotton, excellent transport, and the presence of merchant capital.[5]

The role of religion

By itself, the presence of Islam as the major religion does not explain the pattern and nature of technology transfer or the character of manufacturing. The theological tenets of the religion do not account for the fate of Middle Eastern industrialization. More generally, in my view, neither Islam (nor Christianity nor Shintoism) as a religious system, explains the success or failure of industrialization in the Ottoman Empire (Europe or Japan). Here, we search in vain, I believe, for the well-springs of capitalism, industrialization and successful or unsuccessful westernization. But, religion may have played a role in Ottoman technology transfer in another way. This has to do with the role of the so-called opinion leaders. These are persons who are the first in a region to adopt a foreign innovation and who re-invent and present it to the local populace. In the literature on technology transfer, opinion leaders are seen to play a vital role. Technological innovations by Ottoman subjects most frequently came at the hands of the *dhimmis*, the Christian and Jewish Ottomans. Most Ottoman entrepreneurs in manufacturing were Armenians and, to a lesser extent, Greeks while Jews were important in Salonica. For our present purposes, it is important to note that these Ottoman Armenians and Greeks frequently travelled to the United States and Great Britain and then returned home with the new technology. But the demonstration effect of these activities was limited because the Muslim majority was reluctant to follow these opinion leaders. This is because, according to the traditional values of Ottoman society, non-Muslims were inferior and, hence, their behavior was not worthy of imitation.

Any inclination to follow was muted since there were other new and rewarding careers opening up to Muslims during the 19th century, opportunities that drew them away from manufacturing and industrial technology. The huge increases in the military corps and in the civilian bureaucracy offered many entrepreneurial Muslims attractive alternatives to careers in manufacturing. There

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[5]Kemal H. Karpat, *Ottoman Population, 1830-1914. Demographic and Social Characteristics* (Madison, 1985).

were, for example, one-half million civil service jobs in 1900 that had not existed in 1800. The civil servant jobs were open to all Ottomans; but only Muslims in fact could rise to the top.[6] Nor were the officier posts available: the political demands of the non-Muslims and the Great Powers effectively exempted the *dhimmis* from military service. By and large, therefore, non-Muslims could not aspire to these new careers and so continued to focus on trade and manufacturing activities, reinforcing their already-won dominance in these fields. And so, there was a dominant Muslim culture that dis-esteemed non-Muslims who should have been the opinion leaders in technology transfer.

There were many Muslim entrepreneurs, in most manufacturing activities, over the whole period. How free they were to operate is an important question. The non-Muslims as a group certainly protected their interests. In the example of the silk industry of Bursa, Muslim entrepreneurs' activities often were blocked by European capital and Ottoman Christian competitors. This surely occurred in other industrial sectors as well. Anyway, enterprising Muslims could find careers as officiers and ranking bureaucrats. The situation certainly diminished the likelihood that new technologies in manufacturing would spread throughout Ottoman society.

Cultural Difference

Are, then, the cultural differences between the creators and borrowers of an innovation an important obstacle? The technological and manufacturing explosion of 19th century Japan, based on Western models, would suggest they are not vital. In a similar vein, take the following story of a Japanese warlord of the 16th century. When he first saw a cannon, aboard a Portuguese ship, he immediately summoned the local blacksmith and ordered him to take the cannon apart and *manufacture* one just like. Not buy one like it, but make one like it. The task here is to explain the behavior of the warlord by examining the mix of the international and regional factors.

Labor migration

The movement of workers from one area to another played a vital role in the diffusion of technology and in the kind of industry that took root in a

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[6]Ibid. Also, Carter Findley, "The Acid Test of Ottomanism: The Acceptance of Non-Muslims in the Late Ottoman Bureaucracy," in Benjamin Braude and Bernard Lewis, eds., *Christians and Jews in the Ottoman Empire: The Functioning of a Plural Society*, I (New York, 1982), 339-368.

particular area. European history is full of stories of British subjects who went abroad to install, demonstrate, teach and manage. An Irish entrepreneur, Mulvany, developed German mining in Westphalia between the 1850s and 1880s. He introduced the English method of mining and shaft sinking, reduced railroad rates, lowered import duty on iron, improved navigation and formed an association of corporations. British workers similarly had a major impact on the development of textiles, iron, machine building and transport in the Habsburg empire. In 1800, an Austrian bank went to England for textile machinery and workers and, by 1828, there were some 47,000 spindles in one British-run factory alone. In 1824, 1,400 British industrial workers were employed in France. Britain provided the major source of migratory industrial labor in Europe, just as it furnished most of the actual technology. The Ottoman case was somewhat different. British were joined by other European and American technicians in large numbers throughout the century, in every aspect of Ottoman manufacturing. The predominance of the British-built machinery faded with British industrial hegemony. And so, as Germany rose to technological prominence after 1870, British capital in the empire hired British workers to run the superior German machines.[7]

War

We also need to look at the role of wars in Ottoman manufacturing and technology transfer for they frequently are cited as a major impediment to successful technology transfer. For example, the War of the American Revolution delayed introduction of the Watt steam engine in the United States. The wars following the French Revolution are said to have retarded French economic growth so that France held only 200 steam engines in 1810, when England possessed 5,000. In this perspective, we should recall the incessant Ottoman warfare of the period through the end of the 1830s and the containment of Mohammed Ali Pasha. Only then could real progress be gained in the military and educational reforms that provided the security and the literacy that is so important to industrial growth. Thus, the wars postponed the establishment of a more favorable economic climate. Delay was doubly harmful in a period when technology was improving rapidly and the capital requirements for industrial investment were soaring. For example, in c. 1800, the capital needs per European industrial worker equalled c. 4-5 months of the workers' wages; in 1900 it was the equivalent of 3.5 years of wages.[8] Many theorists argue that it

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[7]Pollard (1981) and Henderson (1954 and 1965).

[8]Pollard, (1981) 221.

was easier to bridge the technological gap in the 19th century than now and easier in the earlier part of that century than later on.[9] But timing in itself does not appear to be as crucial as the fundamental relationship between the Ottoman and European economies in which the former already had become a supplier of raw materials and unprocessed foodstuffs.

State policy

The role of the state is very complex and important. Governments sometimes led growth, as in the case of 19th century Russia, while in other cases they actually made things worse. In yet other cases, governments simply went along with changes that autonomously occur.[10] In the Ottoman case, as we will see, the state both stimulated and impeded technology transfer and industrialization. It founded most of the early factories that existed before 1870 and imported hundreds of foreign technicians to run them. It also established technical and industrial schools in several locations. These (in common with the factories) first were clustered around Istanbul but, late in the period, such schools also emerged in Haifa, Jerusalem, Jaffa, Beirut and Damascus as well as in Anatolia and the European provinces. Their curricula, however, often revealed that the state's vision of industry included only furniture making, shoemaking and tailoring. The central government during the 1860s organized expositions to popularize and disseminate innovative technology, an example followed by many provincial governments at the turn of the century. It granted scores of very favorable concessions to industrial entrepreneurs; in the second half of the period, it consistently awarded tax exemptions and other privileges to encourage industry. And, it launched numerous impressive programs of industrial development at varying times, during the first third of the century, in the 1860s-1870s, and in the decade before World War I.

But other government policies and attitudes clearly retarded the pace of technology transfer and industrial development. The Ottoman regime continued to impose and maintain tariff structures that were very unfavorable to industry, for example, retaining duties on the flow of goods within the empire until nearly the end of the century. While European pressure to maintain low import duties is an important explanatory factor, the answer lies partially in Ottoman attitudes that continued to regard duties primarily as revenue earners rather than development instruments. In its effort to encourage investors, the state regularly

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[9]Baranson (1969) and Ghatak (1981).
[10]Pollard (1981), 245.

granted monopoly rights to pioneering factory founders. While this may have helped the pioneers, it prevented the emergence of imitative followers.[11] Anxieties about air and water pollution accompanying factories played some role, resulting in official delays or outright denials of the needed construction permits. Official fears of groups of workers concentrated in factories certainly was a factor. During the reign of Abdül Hamid, and probably at other times, the government was very suspicious of the concentrated workforce that factories required and thus dragged its feet on industrial development. Such fears were reinforced by leading resident European merchants who seemed to fear a re-born Terror or perhaps another Paris Commune on Ottoman soil. Their hysteria during the strikes of 1908 vividly illustrates these attitudes towards Ottoman factory workers.[12] On the role of guilds in 19th century economic life, the state vacillated, variously supporting and condemning monopolies. The usefulness of guilds in domestic political life and considerations of equity continuously were being weighed against the desire for more efficient production.

Literacy

Literacy is often seen as the key to successful industrial development and, in this respect, the Ottomans appear in a surprisingly favorable light. As is well known, the development of a western-model Ottoman educational system had proceeded rather far. The number of students attending state-run secular secondary schools doubled between 1867 and 1895. At the latter date, there were at least 7,000 state schools at all levels, including nearly 4,000 upper level institutions. Altogether, some 1.5 million children of school age actually attended, about 20 percent of the total eligible.[13] Literacy historically is difficult to measure. One approximate measure is the enrollment rate in primary school per 10,000 children of school age. If we use this as a standard, selected Ottoman districts fare well in comparisons with a number of European countries. The proportion of Ottoman children in Istanbul primary schools was greater than the national averages in Spain, Italy and Russia. In seven Ottoman provinces representing

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[11]The Ottomans were hardly alone in making this error. Similarly, in Europe, the Duchy of Berg gave its pioneer cotton spinner a twelve year monopoly, thus preventing other mills from being established. Pollard (1981).

[12]Donald Quataert, *Social Disintegration and Popular Resistance in the Ottoman Empire, 1881-1908* (New York, 1983).

[13]Karpat (1985), 219 and Stanford J. Shaw and Ezel Kural Shaw, *History of the Ottoman Empire and Modern Turkey,* II (Cambridge, 1977), 112-113. My thanks to Joyce Matthews, History Department, SUNY Binghamton, for her work in comparing Ottoman and European education figures. Compare these statistics with, for example, national data in B.R. Mitchell, "Statistical Appendix," in Carlo M. Cipolla, ed., *The Emergence of Industrial Societies,* Part Two, 1976 ed. (New York, 1976), 801-802.

the Balkan, Arab and Anatolian regions— Aydın, Edirne, Bursa, Salonica, Aleppo, Erzurum and Ankara— the proportion of children in primary schools surpassed the Italian and Russian national averages. Thus, one could argue, Ottoman literacy rates in many areas had reached levels approximating those of nations whose industrial economies vastly exceeded, by many times, Ottoman manufacturing output.

Investment Capital

It is at this juncture that we begin to see the important, indeed the crucial, role played by capital availability. For a host of reasons, there was never sufficient free Ottoman capital for investment in industry, to the frustration of would-be entrepreneurs. In the 1840s, for example, several Ottoman Muslims sought to import steam engines and mechanized looms but had to appeal to the state for financing. Similarly, various guilds turned to the government for investment capital during the late 1860s, apparently unable to furnish it from their own resources. Entrepreneurs who had the capital, the Jews of Salonica for example, tended to spread their risks in a variety of manufacturing and mercantile enterprises, diluting the impact of their investments in industry. The presence of low import tariffs deterred many from investing in vulnerable manufacturing enterprises.

Ottoman industrial development and technology transfer thus depended heavily on foreign capital. For most of the 19th century, European capital, in stupefying quantities, went to other areas of Europe and to the white settler states elsewhere in the world. Many modern-day economists have argued that direct foreign investment is the key for technology transfer in manufacturing. It is noteworthy that foreign capital played a vital role in the industrial development of countries such as 19th century Russia and the United States. But it did not provide the catalyst for Ottoman industrialization. Direct foreign investment in the Ottoman Empire began in the 1870s and was of significance only after 1890. Significantly, hardly any of it went to the industrial sector: altogether, industrial enterprises absorbed only one percent of all foreign capital invested within the Ottoman frontiers. These foreign investors preferred to place their capital in enterprises and facilities that promoted the flow of goods between Europe and the Middle East, e.g., railroads and ports.[14] The structure of the international

[14] Also see Edward P. Hawthorne, *The Transfer of Technology* (Paris, 1972) and Sherman Gee, *Technology Transfer, Innovation and International Competitiveness* (New York, 1981).
Was the foreign ownership of firms using advanced technology, for example, the railroad companies, a factor that delayed technology transfer in the Ottoman Empire? This has been challenged in the

economy did not have a place for the Ottoman empire as a major industrial power, or for Mohammed Ali Pasha's Egypt but it did for America and Russia and, a century later, for Korea and Singapore. The function of banks in the Ottoman Empire thus was different than in Great Britain, France or the United States. Ottoman banks were not intended to be sources of industrial capital.[15]

It was not a matter of catching up, but rather of the Ottoman public and private sectors grasping opportunities provided by the international economy and working within the context provided by that economy, the Ottoman system and the interaction between the two. We have to look at the spaces in which Ottoman manufacturing potential could function with some freedom, the areas in which entrepreneurship, capital, labor and opportunity could mesh. In the Ottoman case, supplying government needs offered an opportunity for the big factory sector during the early part of the century. In small-scale manufacturing, British yarn gave the opportunity to release the Ottoman labor engaged in hand spinning for weaving and other activities. Later in the century, conditions inside Europe increased labor costs there to the point that Ottoman competition in some basic industries, such as mechanized yarn spinning, became possible. Ottoman labor thus became more competitive and a wider range of privately-owned factories emerged to supply domestic needs. In small scale production, too, cheap Ottoman labor was the foundation for competitive production aimed a local markets. And also, niches emerged where this labor exported selected products to international markets, notably carpets and labor-intensive lace and embroidered products.

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recent literature and there are growing doubts about the ability of imported technology to accelerate growth. Real concerns have developed among economists about direct foreign investment that brings in a package of capital, management and production technology. Economists are still uncertain about the relationship between growth and technical progress.

[15]Pollard (1981), 209.

II

THE TRANSFER OF LOW-LEVEL TECHNOLOGY TO THE OTTOMAN EMPIRE

When referring to technology transfer and manufacturing, we usually think of the machines and equipment located in big factories. These high-technology items have a natural appeal and glamour, at least to the economic historian, for they are the grand instruments of production. As we will see, such machinery was employed in a Middle Eastern location to make products such as cotton yarn or cloth, silk thread or flour. But technology transfer in manufacturing involves other, less immediately visible items as well, ones that do not come so quickly or readily to mind. The focus in this section will not be on the steam engine nor on the factory, but on the humbler products of European origin that Ottoman manufacturers adopted in their competitive struggle for survival. These humble goods themselves sometimes were products of highly-sophisticated and extremely-expensive technologies. But they were very inexpensive to purchase, labor saving, and played a key role in the evolution and continuation of Ottoman manufacturing during the 19th century. We will begin by examining Ottoman adoption and use of European-made yarn and of synthetic dyes. Both became integral components in the survival strategies of Ottoman manufacturers and entrepreneurs. The last is the sewing machine, also the product of high technology but itself a simple instrument of production. By studying Ottoman use of Western yarns, dyes and of the sewing machines, we obtain another vantage point for understanding Ottoman manufacturing and its transformation in the 19th century.

Yarn

Most scholars have understood the flow of imported manufactures into the Middle East as a measure of Ottoman industrial decline. In their view, one can gauge the internal manufacturing collapse by counting the imports; the rising tide of imported yarn and cloth registers the loss of jobs in Ottoman spinning

and weaving. The reasoning behind this view, however, is fundamentally flawed: it ignores the possibility that former spinners and weavers found other occupations in manufacturing, the service sector or agriculture. It discounts, in advance, the possibility that some of the new occupations were more productive than the former tasks.[1]

It is more accurate to say that while imports of yarn and cloth destroyed existing industries they also created important new ones and transformed yet others. For example, yarn imports obliterated the once-prosperous putting-out system centered in Kayseri and extending into west and west-central Anatolia. The massive influx of British yarn imports began in the 1790s, was interrupted by the Napoleonic wars, and then rose very dramatically in the 1830s. During that decade, Kayseri merchants were very much on the defensive. But, they still managed to supply raw cotton from Adana to spinners in north Anatolian towns such as Zile, Merzifon and Vezir Köprü as well as Bor in the southeast. The merchants then had these town workers weave cloth for local use or for export to the Crimea. Or, they sold the yarn to large manufacturing centers such as Bursa. By the 1860s, however, the Kayseri putting-out empire had collapsed under the pressure of continuously-declining prices for British goods.[2]

But it is a mistake to assume that such a collapse signalled the end of Anatolian textile manufacturing. Rather, it meant only the end of this one particular manufacturing network. Simultaneous with the fall of Kayseri merchants' empire, we see the rise of a brand-new manufacturing activity in the town of Arapkir, not far from Malatya. There, new weaving enterprises emerged in the 1820s and 1830s and flourished until World War I. This new industry was based entirely on the import of British yarn. By 1836, there were 1,000 new looms in the town, using about 210,000 lbs. of British yarn to weave a coarse cloth that was cheaper, more durable and more color fast than that made in Britain. As the British consul noted:

> The quantity is not important but the fact of so many looms being employed is remarkable as the manufacture has sprung up within about six years, previous to which the looms were few and the yarn was the produce of the country.[3]

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[1] For a mathematical approach to this view, see Şevket Pamuk, *The Ottoman Empire and European capitalism, 1820-1913* (Cambridge, 1987), 108-129.

[2] For example, Great Britain (hereafter GB), Foreign Office (hereafter FO) 195/253, 1844.

[3] GB FO 78/289, 8 November 1836.

At this time, the weaving industry at Arapkir engaged 4,800 Muslim and 1,200 Armenian households and reportedly was in a thriving condition. In the 1860s, a new dyehouse was built in the town, an indication of continuing prosperity. Annual cloth production was rising sharply in the 1880s, to some 120,000 pieces, and the industry was still "thriving". By the early 20th century, the number of looms had increased, to 1,200. Prior to its adoption of British yarn in the 1820s and 1830s, Arapkir does not appear to have been a manufacturing center of any note. The town's rise to prominence seems important for a number of reasons. First, it shows that the import of British yarn did not necessarily cost Ottoman jobs. To the contrary, in this case it created and maintained jobs in 6,000 households. The development of this town also contradicts an assumption about the supposed connection between geography and the impact of imports. Distance from the coast was *not* crucial. Arapkir is further from the coast than the towns of Zile, Merzifon and Vezir Köprü but it adopted British yarn before the three other towns. The crucial variable here was not geography but the absence of an organized manufacturing activity that would impede the adoption of a new technology. Both the yarn spinners of the three towns and the Kayseri merchants involved stood to lose much if British yarn were imported. In Arapkir, such impediments to innovation did not exist. And so, the town rose to manufacturing prominence as the other three towns declined.[4] This is not a unique example. Residents in the town of Gürün in 1900 worked on some 3,500 looms, weaving cotton and wool cloth from British yarns. The Merzifon weaving industry, for example, and that of Amasya as well were restructured and re-emerged as important textile production centers. In the late 1870s, the two towns—whose industries had been written off three decades earlier by British consular observers—annually were importing some 5,000 bales of British yarn to supply local looms.[5] In 1900, some 1,500 looms in the west Anatolian town of Buldan wove cloth from imported British yarn. Quite close by, in the town of Kadıköy, virtually the entire population of 10,000 made British yarn into a strong cotton cloth sold everywhere in Anatolia.[6] Yarn imports to Harput rose sharply in the final decades of the century as the province

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[4]GB FO 78/289, Brant, 22 May 1836; Başbakanlık Arşivi (hereafter BBA) İradeler Meclis-i Valâ (hereafter İMV) 21959, 1279/1863; United States National Archives (hereafter USNA) Reel T 681, Jewett at Sivas, 1 March 1888.

[5]Ibid.; GB A+P 1908, 117; France, *Bulletin consulaire français. Recueil des rapports commerciaux adressés au Ministère des affaires étrangères par les agents diplomatiques et consulaires de France à l'étranger* (hereafter BCF) 1901, Reel 34 and 1911, Reel 40.

[6]Rudolf Fitzner, *Anatolien. Wirtschaftsgeographie* (Berlin, 1902). This is the source for GB, Naval Staff Intelligence Department, *A Handbook of Asia Minor*, July 1919. GB, Accounts and Papers (hereafter A+P) *1912-1913, Annual Series, Smyrna.* Also, Germany, Deutsches Reich. Handel und Industrie. *Berichte über Handel und Industrie* (hereafter Buhi) *1902, Smyrna.*

began large scale exports of striped cloth, some 120,000 pieces annually, to nearby provinces.[7] During the 1860s, nearly 4,000 looms in and around Diyarbakır wove cloth from British yarn and exported it elsewhere in the empire.[8]

The above examples demonstrate the positive impact of imported yarn on Ottoman manufacturing. But here, a cautionary note needs to be added: these stories should not lead us to conclude that the handspinning of cotton yarn merely vanished overnight, with the rise of British imports. In other words, the adoption of a new technology did not lead to the complete abandonment of the old technology. On the contrary, significant quantities of yarn continued to be spun by hand, in the home, down until the very end of the period. Even in the early 20th century, when the Ottomans were importing literally thousands of tons of yarn and cloth, traditions of home spinning remained in many areas. Much of it was subsistence spinning, by families too poor to buy the imported product; for example, Kurdish women around Diyarbakır during the 1850s or villagers near Sivas in the 1880s. At Harput. hand spinning actually had been bolstered in the late 19th century when more efficient cotton gins replaced the old hand gins. Villagers then hand carded the cotton and spun it on small wheels for home looms. These spinners used some 1.5 million pounds of cotton, 75% of the local cotton crop.[9] But there also was commercial handspinning, until astonishingly late dates. At the turn of the century, village spinners around Mosul annually provided urban weavers with over 1.5 million lbs. of cotton yarn. When times were tough, these weavers abandoned their purchases of the yarn, bought raw cotton, and spun it themselves. Similarly, women near Aintab annually spun an estimated 100 tons of yarn for sale to local weavers, using cotton imported from Adana, India and Europe. The prevalence of hand spinning in such quantities is a striking reminder that technology transfer was an uneven and very prolonged process.[10]

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[7]GB A+P AS Kharput for 1885, 11 September 1886; FO 195/1887, Kharput province for 1886. GB A+P AS 1889, Erzeroum for 1887-8 and AS 1891, Erzeroum 1889-1890 and various FO 1890-1911.

[8]GB FO 78/289, 8 November 1836; FO 195/799, July 1864.

[9]Buhi 20 August 1907, X, Heft 9; *La Revue commerciale du Levant, bulletin mensuel de la chambre de commerce francaise de Constantinople* (hereafter RCL) 31 Mai 1904, Lettre de Harpout.

[10]Sarah Shields, "An economic history of nineteenth century Mosul," Ph.D. dissertation, University of Chicago; Buhi 1907, Heft 9, 740.

Dyestuffs

The development of synthetic dyestuffs in Europe and their adoption in the Middle East had important consequences for Ottoman textile producers. Artificial dyes first were developed in Britain and then in Germany, the center of the industry during the later 19th century. The discovery of alizarin, that possessed thirty-six times the color strength of madder, the vegetable source of red dye, was published in 1852 and in 1869 was isolated in the anthrax.[11] Other synthetic dyes, that have the same molecular structure as the dyestuff occurring in nature, appeared later; artificial indigo, for example, came only in the early 20th century. By contrast, coal tar dyes, anilines that are not equivalents of the natural dyes but substitutes were developed in the 1850s.

While art connoisseurs bemoan the use of such synthetic and substitute dyes, their use had many advantages for the Ottoman economy. Adoption of artificial and substitute dyestuffs freed Ottoman manufacturers from a dependence on natural dyestuffs that had become increasingly troublesome. Booming European textile production during the late 18th and early 19th centuries created very strong demand for the necessary raw materials that sharply drove up the prices for natural dyestuffs. The example of the Islamic dyers guild (*Islam boyacı esnafı)* in a five year period during the 1830s illustrates the general problem of price inflation. This guild first obtained the right to raise its charges by 25 percent because of price increases for the starch and indigo used to color tenting cloth. A year later, the guild won another increase, of 20 percent. Four years later, the same guild obtained increases of 17 percent to dye one type of cloth and a 40 percent to dye another type. During the early 1840s, the demand pull of the European market was so powerful that some imported logwood dyestuffs had become altogether unobtainable inside Ottoman frontiers and the various guilds scrambled to obtain the limited supplies of other dyestuffs.

Such shortages certainly help explain the difficulties that Ottoman textile producers had in competing with European manufacturers. But they also point to the attraction that synthetic or substitute dyestuffs might hold for them. These dyes solved the problem of competing with European buyers of natural dyestuffs

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[11] These discoveries almost overnight destroyed the export business in the natural dyestuffs. Tuncer Baykara, "Kökboya," *Istanbul Üniversitesi Cografya enstitütüsü dergisi,* 8, 14, 1964, 221-226. Heinrich Stich, *Die weltwirtschaftliche Entwicklung der anatolischen Produktion seit Anfangs des 19. Jahrhunderts* (Kiel, 1929) 79 and compare with USNA T 238, reel 6, 26 September 1863. For an example from France see Laurence Wylie, *Village in the Vaucluse,* 2nd ed. (Cambridge, MA) 1964, 17-19.

since they were available in essentially unlimited quantities and were very inexpensive in price. Ottoman textile producers thus could adapt quickly to meet demand. Synthetic and substitute dyes had other advantages. They freed Middle East textile producers from the labor-intensive tasks of gathering and preparing natural dyestuffs, or paying others for the work, and liberated them from the vagaries of nature. Furthermore, the European dyestuffs were relatively simple to apply although carelessness and the inability to read the directions did lead to problems.

The availability of these new dyestuffs probably played a pivotal role in the extraordinary expansion of the carpetmaking industry.[12] Growth in this industry had been strong for decades and it exploded in the 1890s, mainly at the lower end of the price scale. Ottoman carpet production soared and the number of workers in the industry increased from c. 10,000 to 60,000. Carpet making is labor-intensive and the appeal of carpets for Europeans lay in their nature as hand-made objects in an age of standardized production. A vast consumer market emerged as technology freed the industry from the constraints imposed by relatively scarce labor. The production ceiling for carpets rose substantially with the adoption of mechanized wool spinning and the use of synthetic dyes. Hand spinners of wool could work in other parts of the carpet business, in some cases as knotters. Synthetic dyes liberated producers from potential shortages of natural dyes that might occur either because of labor unavailability or a simple lack of adequate supplies of the raw materials. These dyes also freed the industry from the scarcity of skilled workers who had learned the complex and difficult job of mixing natural dyes. The limited number of skilled dyers able to manipulate the natural materials seemed irrelevant in the presence of synthetics and substitutes that virtually anyone could use. Also, as demand and profits soared, the need to produce rugs faster became more urgent. Enterprising merchants escaped from the monopoly of their competitors' dyehouses. Thus, in one example, some İzmir merchants dyed the yarn themselves, using anilines or, in other cases, gave dyestuffs to peasants who mixed the colors at home. Synthetic dyes had yet another advantage for carpetmakers; they could provide the shades and nuances that were highly prized by European and American buyers but were unobtainable from nature. All these factors propelled a vast increase in the import of synthetic and substitute dyestuffs. Throughout the entire later 19th and early 20th centuries, however, the battle raged inconclusively between those promoting and opposing the use of the synthetics and anilines. The opponents

[12]For details and sources, see Donald Quataert, "Machine Breaking and the Changing Carpet Industry of Western Anatolia, 1860-1908," *Journal of Social History* (Spring 1986), 473-489.

claimed careless dyeing would turn away buyers and ruin the industry. In the end, the better quality synthetics tended to be used more in the established rugmaking centers while small producers preferred the aniline dyes, that were cheaper and easier to use. The least expensive rugs often were made solely from cheap aniline dyes while the better qualities used the synthetics, often in combination with natural dyestuffs. Thus, at the carpetmaking center of Uşak, for example, natural dyes remained common but the town annually imported some 50,000 kgs. of alizarin and anilines.[13]

The new dyes had a particular importance for the production of textiles besides carpets since, about the time of their discovery, the Ottoman changeover to imported yarn largely had been completed. Textile producers benefitted from European technology that provided them with steadily-cheaper basic materials—both yarns and dyes. The combination of undyed imported yarn with synthetic and substitute dyes allowed Ottoman cloth makers to reduce costs still further. Imported yarn that was dyed in Europe cost from one-third to one-fifth more than yarn that was imported in an undyed state. Local manufacturers could undercut foreign competition by dyeing the yarn locally with the synthetic dyes. The savings came in several ways. Use of the synthetic dyes avoided the duty on red yarn, importers paid only the lesser duty on the dyestuffs. Domestic and commercial cloth makers now could bypass professional dyehouses and save a great deal, with some risk to quality and fastness. Local dyeing of yarn transferred the labor input from Europe to the Middle East where it was less expensive and, relatively, became still cheaper as the century progressed. Hence, Ottoman textile makers could enhance their competitive position. The cloth they made was acknowledged as imperfect but it served the lower end of the market.[14]

The use of synthetic and substitute dyestuffs for yarn varied considerably, depending on the needs of the local manufacturer. In c. 1900, for example, the district (*sancak*) of Mardin imported 80,000 packets of unbleached yarn and only 5,000 packets of European-dyed red yarn. But at Maraş, by contrast, red yarn formed over 40 percent of all yarn imported and it was of the better qualities. Red yarn was imported for *peştimal* weaving at Trabzon because the color made there was too dark and local dyers could not provide the light colors then in fashion.

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[13]Ibid.; *Bursa sergisi*, Nr. 4, 10 Temmuz 1325, 44,45. K. von Scherzer, *Smyrna* (Wien, 1873), 171,172. Archives du Ministère des affaires étrangères, Archives du Quai d'Orsay. Correspondance commerciale (hereafter AE CC) Turquie, 56, report for 1895; Austria, Haus- Hof- und Staatsarchiv, Vienna, Auswartiges Amt (hereafter HStA,AA), Januar 1896. John Kimberly Mumford, *Oriental Rugs* (New York, 1900), 150-158.

[14]Buhi, 9, 20 August 1907; GB AS 3931 for 1906, 10; A+P 1908, 117, 7253, Erzeroom for 1907.

At İzmir, imports of dyed yarn dropped sharply with the opening of several factories for dyeing both cotton and wool yarns. By 1912, a British-owned dyehouse, that used German equipment and technicians, had driven imported dyed yarn off the market.[15]

In late 19th century Aintab, cloth makers competed fiercely with those at Aleppo and in their ultimately-successful struggles, the new yarn and dye technologies played a central role. During the 1880s, Aintab producers imported red yarn to build a textile industry at the expense of Aleppo red cloth makers. The Aleppo producers tried to win back their market by adopting aniline and alizarin, reducing their costs 10 percent as compared to red yarn imported from Germany and Switzerland. Trouble developed at Aleppo, however, because the travelling representative of the European dyemakers had not properly taught the use of the new dyes. At the turn of the century, Aintab manufacturers responded in turn by adopting paranitralin, a new dye medium cheaper than alizarin, and so won back their market.[16]

Sewing Machines

The Frenchman Barthélémie Thimonnier invented the first sewing machine in 1841, to mass produce uniforms for the French army. Unfortunately for M. Thimmonier, rioting tailors destroyed his machines. Five years later, the American Elias Howe made a number of improvements and by the 1860s, sewing machine sales in the United States reached over 100,000. The entry of sewing machines into the Ottoman empire has been difficult for me to trace. In commercial statistics, they usually are included under the general rubric of "machines", without further elaboration. They tend to be mentioned specifically only in passing. For example, a government shoe factory at Erzincan used sewing machines to produce 40,000 pairs of boots per month during the Russo-Turkish War of 1877-78.[17] But otherwise, we have no direct references before 1900, perhaps because there were very few in use until then. In 1904, however, *La Revue commerciale du Levant,* the bulletin of the French Chamber of Commerce of Istanbul, published a special issue on the sale and use of sewing machines in the Ottoman empire. As was the practice in these special reports,

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[15]GB A +P AS 1893-4, 97, 5581, 7 April 1893; A+P AS 1890-1911; *Halep Vilayeti Salnamesi 1317/1899*, 191,192; Charles Issawi, *The Fertile Crescent 1800-1914* (Oxford, 1988), 372,381. Buhi, III, Heft 10, 22 Januar 1902; Austria, Berichte der k. u. k. Österr.-Ung. Konsularämter über das Jahr (hereafter k und k) 1904, I, 1, Alep; k und k 1907, VIII, 1, Alep.

[16]See sources just cited in n. 15.

[17]Fred Burnaby, *On Horseback Through Asia Minor* (London, 1898), 202.

correspondents of the journal living in dozens of cities and towns sent in reports and so provide us with an unusually-detailed account.[18]

Ottoman use of sewing machines seems to have been quite limited until the very end of the 19th century. At that time, entry of the American firm, the Singer Sewing Machine Company, into the Ottoman market stimulated their vastly-expanded use. Previously, sales had been dominated by English, French and German manufacturers but their machines had been rather elaborate and comparatively expensive. For example, the Paris company "Cornély de Paris" produced a machine appropriate for embroidering the silk cloth of Bursa. These were quite expensive, costing well over 350 francs. But the Singer company introduced much cheaper machines of two different types. The first were pedal-driven machines that cost about 170 francs each, or half the price of the Paris-made machine. And the company produced a still-cheaper, hand-driven, machine that sold for 92-100 francs.

Offering a well-made and cheaper product, the Singer firm quickly captured the lion's share of the Ottoman market by utilizing two policies that already had brought it global success. Previously, European sewing machine makers had demanded full payment on delivery of their products. Thus, sales had been restricted primarily to Ottoman manufacturers, such as the shoemakers, whose full-time employ rationalized the expense and who could make the large, single payment required by the English, French and German manufacturers. The Singer company established a monthly payment system that immediately caught on with buyers. Cobblers and tailors in shops bought the pedal-driven machines while women at home bought the cheaper hand-driven machines. In most Ottoman provinces, over 80 percent of the purchases were on the installment plan. In addition, and again in contrast to its competitors, Singer founded depots in many locations to make repairs and provide spare parts. In 1900, for example, it established a central depot in the city of Harput with sub-agencies in the provinces of Diyarbakır, Mosul, Baghdad and Basra. During the first four years at Harput, sales averaged about 400 machines per year. At Bursa, where there were scarcely any c. 1875, sewing machines had become a necessity at the turn of the century, thanks to Singer's good showrooms, monthly payments, exchange policies and service. The company accounted for 75 percent of the 500 machines annually sold in that area. Near Konya, sales averaged 250 machines while at

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[18] *RCL* issue of Fevrier 1904 is the source for most of the following discussion. Also see *RCL*, Mars 1904.

İzmir some 16,000 were sold in just three years, between 1903 and 1905. In 1910, Sivas province contained some 2,000 machines.[19]

The Singer and other sewing machines clearly contributed to the revival of Ottoman manufacturing that took place after 1870 and that acquired real momentum near the turn of the century. The ready-made garment industry of Istanbul, for example, boomed during the early years of the 20th century. Thanks to very cheap labor, sales of locally-produced, ready-made clothing totalled perhaps 7 million francs, about twice the value of imported ready-made garments. Families working at home—husbands, wives, their children, and occasionally a hired outsider—used German and sometimes cheaper Austrian cloth. They sewed suits, overcoats and trousers and used sewing machines for all the tasks except putting on the buttons. The families then sold the final product, for a fixed price, to Austrian department stores in the city.[20] Sewing machines also played an important role in the revival of the Istanbul shoemaking industry. By the 1850s, this industry seemed moribund, bewildered by the fashion changes and European competition. But, during the second half of the century, Istanbul shoemaking revived. Small workshops that were scattered all over the capital employed 5-10 workers, both male and female. For each step—cutting, sewing, hole punching, heel and sole making, etc.—there was a particular worker employed at a certain piece-work rate. Using both hand labor and sewing machines, the workshops daily produced enough shoes to recapture virtually the entire domestic market and export shoes to Egypt as well.[21] In the new century, however, the industry continued to evolve and shoemakers began to abandon sewing machines in favor of specialized machinery.[22] Around Bursa, pedal-driven sewing machines accounted for three-quarters of total sales, certainly for commercial use in workshops. This proportion was far higher than in areas such as İzmit and Harput, where sales of the lighter hand-driven machines predominated. The availability of the sewing machine might be an important factor in the increasing production of Bursa silk textiles near the end of the century. At Aleppo, the adoption of some 1,500-2,000 German sewing machines reportedly played a decisive role in the late 19th century boom in the production

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[19]BCF 1906, 564, Brousse and 1907, 613, Smyrne for 1905. United States Consular Reports, Monthly Reports, E. Sussap, reel 40. In 1907, the empire imported 7.8 million piasters of sewing machines, each costing approximately 160 francs. Reinhard Junge, "Türkische Textilwaren," in *Balkan-Orient Sonderausgabe der Zeitschrift, Die Textile Woche,* 1916-1917, 441.

[20]RCL Février and Mars 1904.

[21]Buhi 1904, 306-308. Junge (1916-1917), 446, asserts that a shoemaking guild of Turks survived into the 20th century.

[22]G. Herlt, "Die Industrialisierung der Türkei," *Das Wirtschaftsleben der Türkei,* II (Berlin, 1918), 59.

of silk and half-silk textiles.[23] Overall, however, most sewing machines sold were of the cheaper, hand-driven variety, purchased by women who lived in poor quarters of towns and cities and in small villages. The women bought the machines on time and used them for wage work done in the home. Here we see the proliferation of home industry in very many areas of the Ottoman empire, facilitated by the transfer of a simple machine.

In these examples of the transfer of low-level technology, we have seen the rapid exchanges between the European and Ottoman economies. The yarn and dye technologies were quickly and quite widely adopted. They offered immediate savings to the Ottoman user, a rapid return on investment. Sewing machines were more of a problem because of their relative expense. In this case, it took a credit innovation from outside to solve capital-shortage difficulties. Once introduced, widespread adoption quickly followed.[24]

These low-level technology examples also point to the vitality of small-scale manufacturing, in small workshops and in homes. There was considerable innovation and adaptability here. It is clear that any history of Ottoman manufacturing during the 19th century must include this kind of industry. Although it sometimes seems invisible, it employed vast numbers of workers and thus was of real significance. Often, these women and men manufactured part of the time, blending this labor with household work or agricultural tasks. Therefore, these examples also show that we need to re-define our meaning of work and employment. And finally, the stories of low level technology transfer involved work that was poorly paid. Thus, they illustrate the global niche that the Ottoman empire was filling, the role it was playing in the international economy.

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[23] James Reilly, presentation to the 1988 meeting of the Middle East Studies Association.

[24] In agriculture, the story of the American McCormick reaper closely parallels that of the Singer machine. The reaper was inexpensive, easy to use, and the U.S. manufacturer provided numerous repair facilities in the Ottoman provinces. As a result, thousands were sold in the late 19th century.

III

TECHNOLOGY TRANSFER AND FACTORY ESTABLISHMENTS IN THE OTTOMAN EMPIRE

Introduction

In 1914, the Ottoman Empire clearly was not a great industrial power, in the usual sense of big, inanimately-powered factories. The level of Ottoman technological development in relatively large-scale manufacturing is hard to measure precisely, given the lack of comprehensive statistics. An official Ottoman survey of industry carried out in 1913 provides only a very crude approximation. The survey, the work of the Hungarian, Durant, with the assistance on an Ottoman official, Fuat Bey, had very many defects and is quite incomplete. It did not list factories in the Balkan provinces, then slipping from Ottoman control. This lacuna is important since the Salonica region and Macedonia in general contained the heaviest concentration of large-scale manufacturing in the late 19th century Ottoman empire. The survey also did not include the industrial zone of the Adana region, nor for that matter, any region besides Istanbul and western Anatolia. This incomplete survey of Ottoman industry counted some 374 mechanical engines of various sorts, mainly steam engines, that generated a grand total of some 21,000 horsepower. The factories, according to this count, employed 16,975 persons in 1913.[1] The enumerated cotton and wool yarn factories contained perhaps 112,000 spindles and employed some 5,500 persons.[2] Another count offers different figures. This report gathered

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[1]The Ottoman survey initially was published as Ticaret ve Sanayi Nezareti, *Sanayi İstatistiki 1329, 1331* (Istanbul, 1917/1333). For a contemporary European analysis of the survey see, Friedrich Hoffmann, "Die Industrie in der Turkei," *Weltwirtschaftliches Archiv*, Bd. 14, Januar 1909, Heft 1. A modern Turkish transliteration of the survey is A. Gündüz Ökçün, *Osmanli Sanayi : 1913, 1915 Yılları Sanayi İstatistiki* (Ankara, 1970). Also see Vedat Eldem, *Osmanlı Imparatorluğunun iktisadi şartları hakkında bir tetkik* (Istanbul, 1970); Zafer Toprak, "Osmanli Devleti ve Sanayilesme Sorunu," and "II. Meşrutiyet ve Osmanlı Sanayii", *Tanzimat'tan Cumhuriyete kadar Türkiye Ansiklopedisi*, 5(Istanbul, 1985), 1340-1344 and 1348-1359.

[2]Eldem (1970), 131-132, 139. In 1861, by comparison, the United Kingdom held 34 million spindles, France 6.8 million and Italy 0.45 million. Steam engines installed in 1861 generated 2,450 in Britain and 1,120 in France and 50 in Italy (in 000 HP). By 1914, Italy had 4.6 million spindles. Figures from Pollard (1981), 230-231.

statistics from the 1913 survey and other sources, such as data from chambers of commerce in several Ottoman cities. According to this estimate, c. 1914, some 35,000 persons worked in "large industrial establishments" in the entire empire.[3] This is about double the number counted in the official survey.

Neither set of statistics present Ottoman big factory manufacturing in a very favorable light when compared with that in other countries. In 1838, the United States contained 1,900 steam engines that generated 36,000 horsepower. Thus, nearly eighty years before the Ottoman enumeration, the United States contained steam engines generating 75 percent more horsepower. In 1841, Hungary contained only 11 steam engines while in 1863 steam power there generated 8,601 horsepower. But, by 1898, that country's steam engines possessed 262,000 horsepower in industry and 45,000 horsepower in mining.[4] This Hungarian example shows us that Hungarian technology transfer and industrialization surged during the 1860s-1870s, a period of the Ottoman state's substantial but unsuccessful 19th century-push for industrialization. In 1898, there were 1.2 million horsepower in Austrian industry (some fifty times that in the Ottoman Empire a decade later) and 3.9 million horsepower in German industry. In 1900, industry employed respectively 13, 23 and 37 percent of the active population in Hungary, Austria and Germany.[5] Bohemian mechanized cotton spinning mills and printing employed 140,000 workers in c. 1850, more than twenty times the mechanized yarn Ottoman workforce of 1913. Russian mechanized factories employed 565,000 persons in 1860; an average of 39 persons/establishment. Barcelona had 91 cotton mills in 1805 with 10,000 workers. The first Watt engine in Spain appeared in 1832, about the time of its Ottoman appearance. By 1861, 99 percent of the Spanish spindles were mechanized as were 45 percent of the looms. These figures dwarf Ottoman big factory levels and, it will be recalled, Spain ranked near the bottom of industrialized European states.[6]

Large-scale mechanized Ottoman factories originated in state efforts to transfer the new technology from Europe.[7] Overall, the central government accounted for most of the comparatively-big and mechanized factories built or attempted before 1840. With few exceptions, these were located in Istanbul and its surroundings, including İzmit and the shores of the Bosphorus and eastern Marmara Sea. After 1840, private entrepreneurs played an increasingly important role and were the dominant element in factory formation during the final half of

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[3]Eldem (1970), 286.

[4]Pollard (1981), 226-7.

[5]Pollard (1981), 227-228.

[6]Pollard (1981), 202-206.

[7]The mechanized silk factories are not included here, see Chapter IV.

the century. The number of privately-owned factories accelerated sharply beginning after 1880 when, according to one account, three quarters of all Ottoman factories were founded. Virtually all of these new plants were in private hands.[8]

State efforts began with Sultan Selim III who built or mechanized a number of factories, mostly to serve military purposes, between 1790 and c. 1804. A second wave of state factory founding occurred between 1826 and the 1830s, including a spinning mill at Eyüp and a tannery and bootworks at Beykoz.[9] The government established a mechanized fez factory in 1835, containing a fascinating blend of labor and technology. For the skilled workers to make the fezes, the factory contacted the beylerbey of Tunis, Husayn Pasha. But for the modern machinery, the state summoned equipment from England and Belgium.[10] Other innovations at this time included a wool spinning and weaving mill at İslimiye in the Balkans, erected in 1836 to weave military cloth. About this same time, the cannon and musket works at Tophane and Dolmabahçe were converted to steam.[11]

The Tersane shipyard on the north bank of the Golden Horn in the capital typifies the pattern of state-sponsored technology transfer of the time with its heavy reliance on foreign equipment and personnel. During the 1830s, English engines and engineers arrived to modernize the weapons manufacturing capability of this renowned arsenal. By the end of the decade, two successive English supervisors had given way to an American.[12] There were "an immense number of persons employed. Amongst the superintendents there are many nations, several English, Americans, French, &c."[13]

At this time, in another Istanbul-area factory, both Germans and French worked, making wool cloth for the army.[14] In these two examples, the machinery and technicians were quite mixed in their international origins, belying the British industrial supremacy of the time.

During the 1840s and 1850s, the state founded another cluster of factories in an industrial park located to the west of Istanbul. The complex included an iron and steel foundry. It also contained a boatyard that assembled at least one

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[8]See Edward C. Clark, "The Emergence of Textile Entrepreneurs in Turkey, 1804-1968," Ph.D. dissertation, Princeton University, 1969. Eldem (1970), 121.

[9]Clark (1974).

[10]BBA Hatt-i Hümayun (hereafter HH) 52737 C, 1252/1836-7.

[11]Clark (1974), 65-67 and Eldem (1970), 117-120.

[12]James E. Dekay, *Sketches of Turkey in 1831 and 1832,* (New York, 1833), 310-311; William Knight, *Oriental Outlines* (London, 1839) 184-187.

[13]Francis Hervé, *A Residence in Greece and Turkey,* II (London, 1837), 123.

[14]DeKay (1833), 124.

ship; but this was done with mainly imported parts. The Dadyan brothers, Bogos and Ohannnes, were in overall charge of these factories and others, including a mohair factory located in the İzmit area.[15] It seems that mainly British subjects were summoned to work. Among these was the Binns family, whose descendants were to play an important role in Anatolian economic life during the late 19th century.[16] At this time, the state also built or planned to build factories at Balıkesir and Baghdad, to serve military needs.[17]

Perhaps the most famous of the Dadyans' factory efforts was the complex at Hereke, that began to emerge in the mid 1840s. The factory there originally was intended to make cotton textiles and English machines and workers were imported for the purpose. But the projected mill then was abandoned. Ohannes Dadyan had bought a silk workshop in Vienna and brought it to Hereke, together with the former master of the factory, his family and his workforce. The cotton machinery therefore was dismantled and sent to a factory at Makriköy. Then, as new technologies in silk evolved at Lyons, Frenchmen were summoned to Hereke. In the late 1840s, the foreign workforce included Germans (probably the Viennese), some 15 of them women, 22 Italians and 10 Frenchmen. There reportedly were no Muslim workers at this time. Armenians monopolized the Ottoman workforce, actively excluding the Greeks. The carpet production for which the factory is so famous did not begin for decades, perhaps as late as 1895. In this case, the state summoned rug knotters from carpetmaking centers. The sources disagree, some say the first knotter came from Uşak, others argue for Gördes, Demirci and Kerman, in Iran. The 1,700 workers involved in this domestic transfer of technology were women, girls and men, exclusively Greek and Turkish Ottoman subjects. The Ottoman dyemaster, who had been German-trained, supervised the use of German dyes.[18]

The industrial development program of the 1860s-1870s has been brought to our attention by Osman Nuri Ergin, author of *Mecelle-i Umur-u Belediye*.[19] Among other goals, the official Industrial Reform Commission sought to mechanize several Istanbul manufacturing sectors, a project that hardly advanced beyond the planning stage. This commission seems to be the final example of a concerted state effort to direct the course of factory formation in the Ottoman empire. Thereafter, the state shifted its emphasis from building factories to

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[15]Clark (1974); Victor Binns, in a letter of 11 April 1990, states that the factory worked in mohair.

[16]From the diary of Ann Binns, extracts of which were generously provided to me courtesy of Victor Binns.

[17]Clark (1974).

[18]Clark (1969). Charles MacFarlane, *Turkey and Its Destiny* (London, 1850). May Beattie, "Hereke," *Hali*, vol. 4, no. 2, 1981, 128-134.

[19]See I (Istanbul, 1330), 748-765; Celal Ömer Sarç, "Tanzimat ve sanayiimiz," in *Tanzimat*, I (Istanbul, 1940), 423-440. The latter is translated in Issawi (1966), 48-59.

encouraging their establishment by entrepreneurs. Starting in the 1870s, the state passed a series of laws to stimulate factory-founding by the private sector. But new state factories continued to emerge throughout the period, for example, the 1891 opening of the Muslim Bosnian factory of Wultschtrinly, Jussuf and Company. A product of the efforts of an immigrant Bosnian and subsidies from the state, the factory was located at Karamürsel and made primarily military cloth. It possessed some 100 looms of the most modern type and employed 350-500 male workers, mainly Bosnians and Altanese.[20] There were other state factories as well. At Erzincan, for example, the military had founded a tweed fabric factory, that they expanded in 1902, producing only for the military.[21]

During the earlier 19th century, the workers in state factories were richly international in their origins while the equipment tended to be British, although not always. By the end of the century, the origins of the machinery reflected the global diffusion of technology from the British Isles. For example, the military cloth factory at the Fezhane contained English steam engines while the İzmit plant owned German ones as well, and used German dyestuffs (as did the Hereke factory).[22] Overall, German machinery became more important in the final decade before World War I. For example, the 500-600 male and female workers in the newly-founded Imperial Ottoman Cloth and Material Factory at Eyüp c. 1900 used mainly German machinery.[23] Ottoman patterns of technology purchase and labor recruitment generally tended to reflect the relative shifts in technological prowess among the European nations. France was easily the most important source of skilled labor for the Ottoman silk industry while Germans technicians became the preferred recruits in matters relating to chemistry, ranging from dyestuffs to smokeless powder. In shipbuilding, however, Britain remained the favored source for workers and machinery; the Şirketi Hayriye ferryboat is a good example.[24]

State factories encountered a wide variety of problems, some that reduced the flow of skills to Ottoman workers. Nearly every state factory enjoyed protected markets, producing for the military, civil servants and/or the palace. Some had a guaranteed and cheap source of workers as well. In the mid 1830s, the state regularly used orphans to manufacture yarn in its factories while, in the 1850s, it enlisted adults convicted of misdemeanors.[25] While privileged access to markets and workers certainly can be seen as advantageous, there were pitfalls.

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[20] k und k, 1903, Konstantinopel; k und k 1901, XIX, 1, Konstantinopel; Clark (1974), 102; Buhi, 1904, 298.

[21] BCF reel 35, no. 303, Erzeroom in 1902.

[22] k und k 1903, Konstantinopel, 13.

[23] k und k 1901, XIX, 1, Konstantinopel.

[24] See Chapter IV for silk; Buhi 1904, 327; *Sivas*, 23 cr 1320, 3.

[25] BBA I MV 13393, 1271/1855.

Since sales were guaranteed almost irrespective of price and quality, state factories had little incentive to improve efficiency in order to cut costs. Also, the use of foreign technicians posed difficulties in the context of Ottoman Muslim culture. Christian Europeans simply were not the most effective role models and were unpersuasive as opinion leaders, even in those instances where they knew the language. Their advice often was ignored. In many cases, the hired technicians believed their jobs was to run the equipment and not necessarily to teach new skills. The enormous wage differentials between foreign and Ottoman workers that were typical contributed to poor relations between the two groups. The Beykoz paper factory, for example, paid its Ottoman workers some 3-15 piasters/day c. 1900 but offered its English workers a daily wage of 64 piasters.[26] The organized labor groups, the guilds, recognized the threats posed by the factories and often interfered in their operations. The papermakers guild, for example, opposed formation of the İzmit paper factory until the government agreed to give them one-tenth of gross production in addition to the right to sell all of the factory's production.[27] Such factors, in sum, harmed the effectiveness of the state factories and diminished the diffusion of skills from foreign to Ottoman worker. At the Tophane and Tersane establishments, for example, the large numbers of foreigners did not diminish markedly over time and remained a significant presence throughout the period.[28] Another problem is very similar to that suffered by the state economic enterprises of the Turkish Republic. That is, bureaucrats were placed in charge of factories about whose operations they had no knowledge or interest.

> These very great men, of whom there is always one, and sometimes more, attached to every public establishment in Turkey, are a serious evil. Entirely unacquainted with the business of which they are appointed to preside, they do harm whenever they attempt to meddle....[29]

Efforts by private entrepreneurs to establish big mechanized factories date back to the first half of the 19th century, but most of these are poorly documented. A high-ranking officer at the Tophane arsenal had a part interest in the glass factory at İncirkoy and in the Büyükdere brick and tile works (both in the greater Istanbul area).[30] During the 1840s, two merchants, one of them from the privileged merchant group (*hayriye tüccarı*), attempted to import machinery for carpet making. Another private entrepreneur at this time announced plans to build an indigo factory at İznik in order to check rising imports of the dyestuff.

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[26]Buhi 1904, 277.

[27]After a decade, Bogos Dadyan broke this monopoly so that the factory could sell its output directly. But then he was ordered to reach a negotiated settlement. BBA I MV 12510, selh C 1270/1854.

[28]DeKay (1833), 120.

[29]DeKay (1833), 122-3.

[30]Clark (1969), 7-33; BBA I, MV 233, 24 Za 1256/1841.

During the early 1860s, another opened a mechanized shoe leather factory at Trabzon.[31] In 1873, one Sheikh İbrahim Edhem Effendi, from the Özbek tekke in Üsküdar (on the Asian side of Istanbul), built a steam engine of three horsepower, probably for use in its small workshop. He later was appointed, by the famous reformer Midhat Pasha, director of the Men's Industrial School in Istanbul (at Sultan Ahmet) and subsequently played an important role in the development of the Ottoman industrial schools.[32] During the mid 1870s, an Ottoman Armenian and the Frenchman M. Berlie together founded a steam-powered furniture factory at Beşiktaş (in Istanbul), employing some 350 workers.[33] A significant shift in the nature and pattern of Ottoman factory formation began to take place in the 1880s and acquired real force in the 1890s. First, the number of Ottoman factories increased quite substantially, at least tripling in two decades. Second, the major force in factory formation unquestionably became the private entrepreneur, both Ottoman and foreign. Ottoman subjects were the majority of factory founders but their investments totalled only about one ninth those of the foreigners.[34] And finally, Ottoman factories after 1880 geographically were far more dispersed. Before 1880, the vast majority of mechanized factories were located in Istanbul and in the silk districts of Bursa and Lebanon. Most new factories were founded elsewhere, as we shall see shortly, in locations as diverse as Salonica, Trabzon, Adana and Uşak. In most instances, the new factories produced foodstuffs or consumer goods for use in the immediate area, products that enjoyed "natural protection" from European competition. Some industrialists competed directly with Europe, notably in making cotton and wool yarn and later in cloth. Only a very few ventured into heavy industry, with its vast capital requirements and intimidating foreign competition. At İzmir, the largest iron works in the Ottoman world employed some 200 workers and contained just one forge.[35]

This new pattern was due to a convergence of a number of factors. European industrialization had generated surplus capital beyond its own requirements; some of these funds potentially now were available to expand the Ottoman manufacturing sector. Moreover, the more mature European industrial economies were shifting from the export of consumer goods to that of capital equipment and thus were aggressively seeking markets. This was a marked shift from the earlier 19th century when, for example, British legislation prohibited (albeit ineffectually) the export of industrial equipment. Also, given the sharp improvements in Ottoman literacy, the relatively-simple technology being

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[31]BBA Cevdet Maliye 1742, r 1261/1845; BBA Hüdavendigar eyaleti mesaili muhimme 2281 and 2282, 1262/1846; BBA I MV 8615, 16 r 1268/1852; BBA Cevdet İktisat 1520, r 1262/1846.

[32]Grace Martin Smith, "The Özbek Tekke of Istanbul," *Der Islam*, vol. 57, #1, 136.

[33]*Revue de Constantinople*, 5 Decembre 1875, 203.

[34]Eldem (1970), table following 121.

[35]Buhi Januar 1902, III, 9; GB A+P 1908, 116, 7252, Altintop at Smyrna.

imported was more assimilable than it had been a half century earlier. In addition, we need to point out that European wages had been rising since the early 19th century. This factor, combined with relatively-very low Ottoman wages and the availability of efficient simple machinery, such as that for cotton spinning, made it possible for Ottoman entrepreneurs to compete in certain sectors. And finally, government policy since the 1870s had reduced tariffs and lowered the price of locally-manufactured goods for Ottoman consumers.

The operation of Ottoman factories was governed by an 1865 law (earlier legislation, if any, is unknown at this time) that remained unchanged until at least 1904. This legislation divided steam-powered establishments into several categories, each with its own regulations. Generally, no factory could be located near government buildings nor could any private factory manufacture gunpowder. Factory owners paid the salaries of the required government inspectors and the state retained the right to audit and close any factory. An 1880 law that formed the Ministry of Public Works gave its minister the responsibility for overseeing factories. To establish a factory, investors made formal application to the Minister who forwarded the request to the Sultan. The application included information on the nature of the enterprise, the general area of its proposed location and the identity of the investors. The applicants typically requested certain privileges from the government. Prior to the 1870s, tax exemptions usually had been granted only upon specific request. Beginning in 1874, however, the state initiated a general policy of duty-free imports of machines and tools for factories using advanced technology. And, in 1876, it exempted the yarn produced in such factories from all internal and export duties.[36] In granting permission to found a factory, the state noted the duration of the concession, its tax exemptions, if any, and the identity of the concessionaires. After 1886, perhaps as a desperate act to attract investors, monopoly rights became common in the concession agreements. That is, the concessionaire received exclusive rights to manufacture a certain product in a given city, province or group of provinces. Many of the applicants were Ottoman officials, often in positions related to industry, who therefore would play a role in the life of the factory.[37] But in some cases, the official was acting only as an intermediary, using influence to gain the concession and for the service being included among the company's officers. In such cases, the concessionaires included both the Ottoman officials with the connections and the Europeans with the capital. Some officials were very high in rank. Perhaps the most notable example is the Head Chamberlain of the Ottoman court, Osman Pasha, who in the late 19th century was heavily involved in a variety of factory, port and public works concessions

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[36] *Düstur*, 1st tertip, 4, 427-8 and 6, 320-1 and 7, 402-405. Buhi 1904 analyzes and summaries the legislation.

[37] See, for example, *Düstur*, 1st tertip, 5, 467-72.

and in the Zonguldak coal mines as well.[38] Such important officials often obtained concessions detrimental to economic growth. In 1899 and 1901, two different high-ranking officials received twenty-five year monopolies to found sack and sailcloth factories in the provinces of Kastamonu and İzmir. In 1896, the wife of the former Grand Vizier Halil Rifaat Pasha received a concession to build and operate a wool spinning and weaving factory in Sivas. In addition to the import duty exemptions for the needed foreign machinery, that were common in such cases, she also obtained a 90 year monopoly, during which period no competing factory could be erected in the provinces of Ankara, Harput, Sivas, Erzurum and Diyarbakr. In effect, this concession and the sack and sailcloth concessions blocked the growth of entire manufacturing sectors.[39]

Other entrepreneurs besides Ottoman officials were active in the establishment of factories during the later 19th century. Many, probably most, Ottoman investors in manufactories were merchants, now investing their accumulated capital. During the mid 1880s, the Ottoman Jewish merchant Mişon Levi obtained rights to build glass factories in Istanbul and in Salonica. In 1889, the Yedikule cotton spinning mill emerged, thanks to the Eastfarre family, of English origins and resident in İzmir since the 18th century. This family also founded a wool mill in 1903 and a weaving factory in 1912.[40]

The equipment and workforce of the privately-operated factories displayed the same richly-diverse international origins as the factories founded by the state. The owner of the famed Pashabahce glass factory lived in Trieste and, according to one source, was the Jew Saul Modiano. The factory started with 100 skilled Styrian and Bohemian glassmakers, attracted by specially-built housing and the German school for their children, taught by a Catholic priest. In the early 20th century, the original workers still formed two-thirds of the employees but they had been joined by some 30 Hungarians, Germans, Italians, French and Greeks and by 400 Ottoman subjects as well. At that time, the factory had just finished installing very modern equipment, of unknown origins, to great effect.[41]

In the early 1890s, nearly three-quarters of the largest Istanbul flour mills were owned by Ottoman subjects. At that time, c. 1892, they invested considerable capital to modernize their mills with very advanced equipment, replacing millstones with rollers. Expecting new successes, they encountered unforeseen difficulties. The equipment in this case was too sophisticated for the low educational level of the workers and their supervisors. Also, the grain from

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[38] *Düstur*, 1st tertip, 6, 472-82.

[39] *Düstur*, 7, 626-7, and 643-5; BCF Reel 34, Nr. 149, Sivas for 1901.

[40] Clark (1969), 101-102.

[41] Clark (1969), 102; Buhi, 1904, 321; Avram Galante, *Histoire des Juifs de Turquie*, II (Istanbul, 1986), 73. These sources variously offer 1881, 1891 and 1899 as the beginning date of operations.

the Rumelian and Anatolian fields was too full of foreign matter that prevented the rollers from properly grinding the grain. To these new problems was added one familiar in late Ottoman labor history, the boatmen of Istanbul. These boatmen, organized into guilds, had seen their jobs threatened when the flour mills located directly on the shores of the Golden Horn, so that ships could directly offload their grain at the mill site. The boatmen refused to accept this innovation and forced the ships to anchor slightly offshore, so that the guild could transfer the grain to its own vessels for transport to the shore. This saved the guildsmen's jobs but much reduced the efficiency of the new mills.[42]

After Istanbul, Macedonia contained the next largest concentration of mechanized factories in the empire, thanks mainly to merchant capital investments during the late 19th century. Salonica and Monastir merchants founded a cloth factory at Salonica while a Salonica cloth merchant was a partner in a Niausta spinning mill. Grain merchants founded flour mills in Salonica, Monastir, Prischtina, Üsküp, Edirne and Dedeağaç. An iron merchant owned a new horseshoe factory at Üsküp while leather merchants owned leather factories in Salonica.[43]

In many areas of the European provinces such as Karaferia/Veroia, Niausta and Modena/Edessa, Greeks played the pivotal entrepreneurial role. For example, in 1913, they possessed two of the three wool weaving mills whose owners are known.[44] At Üsküp, however, Albanians owned almost all the larger factories. Ottoman and foreign Jewish entrepreneurs played the critical role in that remarkable burst of factory founding that occurred in Salonica during the early 1880s, at the time of railroad building. They founded nearly all these factories and characteristically employed French nationals both as directors of the operations and as workers. The distillery, for example, had a French director while its machinery and equipment were imported from France. In a single decade, these Ottoman and foreign Jews also founded six soap factories, one factory for tile and bricks, another for nails, another for cigarettes and thirteen additional establishments.[45] By the mid 1890s, local wool spinning factories consumed 80 percent of regional wool production. In cotton spinning, there were four steam-powered factories in the region, founded between the late 1870s and 1890. (At Edirne, the mills consumed 30 percent of local raw cotton production.) Two of the mills in Salonica were Jewish owned. Most of this equipment came from England and at least two of these factories were managed by Englishmen, who each received lodging plus 350 pounds sterling per year. In the early 20th

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[42]Buhi 1904, 310-311 and compare with other activities of the boatmen in Quataert (1983).

[43]Buhi, XIX, 6, 18 April 1913, for example, 406-416 and 444-445. Also see k und k and A+P reports from Salonica for 1893-1908.

[44]Ibid. 444-445. I assume these were Ottoman Greeks but this may be incorrect.

[45]Ibid; also BCF XIV, 1887, Salonique.

century, wool cloth factories at Salonica and Niausta relied on German and Austrian machinery.[46]

The Allatini family located in Salonica provided the most important group of entrepreneurs in European Turkey. Basing their fortunes as merchants specializing in agricultural exports, family members had established steam-powered flour mills back in the mid 1850s. Around 1880, they founded a steam-powered brick factory, then a brewery and finally cotton spinning mills. Perhaps because of its Italian origins, the Allatini family turned to Italy for the equipment to modernize the steam flour mill. The Allatini's allied with other important Jewish families in Salonica—the Fernandez, the Misrachi and later inter-married with the Torres family. These latter three families themselves established factories, often with Allatini support. For example, the Torres family was co-owner of a Salonica spinning mill.[47]

The big factories present around Adana, that pale in importance when compared to those in the European provinces of the empire, owed their origins to the fertile plain of the Çukurova. By 1914, there were four cotton spinning and weaving mills in the region, two at Adana and two at Tarsus. Together containing over 40,000 spindles, all of these mills had emerged after the 1880s. In common with late-19th century factory formation elsewhere in the empire, merchant capital played the key role. Greek subjects, the Tripani brothers, who also ran a brick plant at Mersin, and Cosma Simeonoğlu owned two of the mills. Mavromati, a rich merchant, owned the third while a Muslim from Egypt, Rasim Dokur, opened the last, in 1911. In addition to being steam-powered, the mills had much in common. In several cases, the entrepreneurs began in cotton ginning and used the accumulated capital to finance mechanized yarn spinning and still later, mechanized weaving. At least two of the spinning mills used British machinery but apparently no foreign workers. Labor, however, was scarce and so the owners summoned and housed Armenian workers from Hacin, Zeytun and Aintab.[48]

İzmir, in common with Salonica and unlike the Adana area, contained a sophisticated and broad-based factory network serving both local consumer needs and the export trade. Factories at this great Aegean port ranged from box making for figs to flour mills to textile weaving. Most factories were owned by the resident foreigners, who were about one-quarter of the total population of the city. The steam-powered flour mills were owned primarily by Greeks and dated

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[46]Ibid; also GB A+P 1893-94, 97, 5581, Salonica; Buhi XIX, 6, 18 April 1913, 440.

[47]Buhi 18 April 1913, XIX, 6, 451.

[48]*Adana Vilayet Salnamesi 1319/1903*, p. 189. Clark (1969), 98-99; GB A+P 1889-1913; RCL 31 Octobre 1910, 501-504.

back to 1845.[49] In the 20th century, up-to-date French and British milling equipment gave the industry "the most perfect system that can be got".[50] In some cases, the profits from flour milling were reinvested in manufacturing. In c. 1885, one İzmir family that already owned a flour mill imported machinery to spin wool yarn for carpets. Madame Abbott, a British subject, had opened a textile printing factory during the early 1860s but was forced to close it after local Armenian entrepreneurs complained to the state.[51] In the 1880s and again in the early 20th century, two Jewish entrepreneurs opened factories in the city relating to cigarette making.[52] The largest single Ottoman textile factory owed its birth in 1912 to the efforts of the English Eastfarre's (who earlier had founded the Yedikule plant) and the French Merblanche family, similarly resident at İzmir since the 18th century. As elsewhere, the origins of İzmir machinery were very mixed at the century's end. Near the turn of the century, several factories began spinning and dyeing wool yarn for the carpet industry: in one case, British capital purchased German machinery and employed German workers while an Ottoman-capitalized spinning mill used English equipment. Another British-funded company, making olive oil, used American equipment and the Bomonti brewery used German equipment. Germany provided two-thirds of all the electrical equipment installed after 1908, a role that reflects its general position in the transfer of technology at the end of the period.[53] So far, we have discussed the relatively-dense clusters of factories that existed in Istanbul, Ottoman Europe, İzmir and, to a much lesser extent, the Adana region. In addition, there were a few other mechanized factories scattered about in various locations. In the early 20th century, there were mechanized cotton spinning mills at Elazig, Gallipoli, Manisa (that was founded by a Muslim) and another at Trabzon, formed with British capital. Except for their location, we know scarcely anything about them.[54]

The burgeoning carpet industry of the later 19th century prompted a mini-boom in wool spinning mills. In c. 1900, a Bosnian notable opened a small wool spinning factory at Eskişehir, using Austrian machinery to re-work the remnants of carpet production and respin them.[55] An Englishman and several Bosnians owned another wool spinning mill at Bandirma. It was the largest in Anatolia and was built c. 1906. Other entrepreneurs taking advantage of the boom included the Griffith family and the Halilağazadeler of İzmir as well as the

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[49] k und k 1910, Smyrna; Clark (1969), 95-6.
[50] GB A+P 1906 AS 3931, 9.
[51] FO 195/687, 4/20/1861; Clark (1969), 95-6.
[52] Galante (1986), III, 343.
[53] GB AS 3931, 1906, 9; A+P 1908, 116, 7252; Buhi 1913, 24 September 1912, 18, Smryna; Clark (1969), 100-101.
[54] Clark (1969), 96; Luckerts(1906), n. p.
[55] k und k, XVIII, 1, 1902, Konstantinopel.

Çolakzadeler of Kula. Two wool spinning mills at Afyonkarahisar and İzmir (already noted) used Belgian machinery at the turn of the century. The American Blackler, president of the United States Chamber of Commerce for the Levant, opened a wool spinning plan at İzmir in 1911.[56] There were three mechanized wool spinning factories at Uşak, built in the decade spanning the turn of the century, to supply yarn to the carpet industry. All were built by different partnerships of Muslim carpet merchants-respectively led by the Tiritoğlu, the Yılanoğlu and the Başakoğlu families. While some praised the products of the new factories, others complained about the bruised yarn that the machines produced, yarn that reportedly also was greasy, causing severe difficulties in the subsequent dyeing stages.[57]

At Isparta, mechanized textile production efforts dating back to the 1870s offer a classic example of a failed initial effort to transfer technology. A local Ottoman official named Müftüzade İsmail set up several mechanized looms with the advice of M. Mille, a Frenchmen who was the Isparta tobacco monopoly director. A military officer in Antalya made the looms for Müftüzade İsmail who placed them in the Christian quarter of Isparta. The effort failed, however, because the entrepreneurs were unable to obtain enough of the regular, imported yarn that was required to feed the looms. To circumvent this problem, they attempted to import spinning machines from Europe. But this effort also failed because skilled workers able to tend and repair the machines were not available in the town.[58]

Conclusion

The concentration of factories in Istanbul hardly was coincidental. The capital's enormous population offered a rich labor pool and consumer market. This already-abundant labor source was supplemented by the Muslim refugees who passed through the city as well as by the migratory labor that routinely trekked to it for work. Salonica province, for its part, had the highest population densities in the empire. Both Istanbul and Salonica had well-developed sea and rail links to domestic and international markets. The small Adana cluster, for its part, owned much to excellent transport and to close linkages with the cotton production of the Çukorova plain. The labor shortage here was overcome. The port of Izmir had a far more abundant population and a relatively-dense network of rail lines feeding it. Foreigners, including long-time residents, and Ottoman minorities played important roles in providing the capital and the technical skills for all of the big factory clusters. Ottoman Muslims played key if less important

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[56]*Uşak il yıllığı 1967* (Istanbul, 1968), 173; Stich (1929), 112-113.

[57]B. Atalay, *Türk halıcılığı ve cihan halı tipleri panoraması* (n. d., c. 1952) 46-67 and *Bursa sergisi*, nr. 4, 10 Temmuz 1325 and nr. 6, 14 Agustos 1325.

[58]Böcüzade Süleyman Sami, *Isparta tarihi* (Istanbul, 1983), 243-4.

roles throughout the period, especially in the later years. Their role tended to be greater away from the big coastal cities. In some industries, such as the wool spinning connected with carpet making, Ottoman Muslims probably were the dominant element, if the Bosnians are counted among them. The case of the Bosnians in industry, as that of the Circassians in agriculture, shows some of the economic benefits that the Muslim refugees bestowed on the late Ottoman economy. And finally, the various examples have shown that no European country monopolized the supply of imported machinery and labor to the Ottoman economy. The equipment and the trained personnel flowed from all over Europe, and the United States. Thus, the multiple sources of technology indicate its 19th century diffusion from Great Britain. It also reflects the political position of the Ottoman Empire. The empire remained an independent state able to maneuver among the European rivalries and select to its own advantage.

IV

TECHNOLOGY TRANSFER IN THE SILK INDUSTRY OF THE OTTOMAN EMPIRE

Throughout its development in the long 19th century, 1750-1914, the Ottoman silk industry vividly demonstrated the intimate relationship between technological and market change.[1] In the course of the period, the industry had a history of dramatic transformation. It began the long century as a still important producer of silk cloth, although now mainly for domestic consumption rather than export, and, in some areas, as an increasingly-important exporter of raw silk. Silk cloth output fluctuated but, taking the long view, generally remained steady between c. 1750 and 1850. Raw silk production, however, increased sharply in many regions, including Bursa, Salonica and the Lebanon. The restructured industry with its export emphasis on raw silk underwent a severe, disease-induced crisis from the 1860s through the 1880s. This crisis, by reducing raw material supplies, also harmed cloth production. The industry then recovered and went on to surpass earlier output levels. During the final decades of the period, silk cloth production also increased impressively in many areas. Embedded in this story are five distinctive episodes of technology transfer, involving (1) silk cloth finishing, (2) so-called "short" reeling of raw silk, (3) the application of steam-power to the reeling process, (4) measures to overcome diseases afflicting the industry, and (5) mechanized cloth weaving.

The first episode involving technology transfer concerned the silk cloth industry at Bursa, that had remained more or less constant from the 1750s into the first decade of the 19th century. During the early decades of the 19th century, the silk weaving industry at Bursa enjoyed a period of unusually sharp growth as output boomed. The prosperity was based on a technological shift in the finishing of silk cloth. The new method involved using a process of polishing

[1] The focus in this chapter is on the silk industry of the Bursa area, but other regions are discussed as well.

the cloth with stone instead of the fire technique that previously had been employed. This fire method commonly had been used in the French textile industry through the 1760s but the origins of the stone method are unknown at this time. This new method produced a cloth that was twice as brilliant, smoother and cheaper. The technique first appeared at Istanbul c. 1815, where the artisans sought to keep it as their own monopoly. It was immediately taken up at Bursa, however, as well as at Damascus and Diyarbakır. As a result, the demand for Bursa cloth reportedly doubled and output rose to perhaps record heights. Silk cloth polishers in Istanbul sought to obtain government assistance but the state did not support their demands for a monopoly.[2]

Despite this important innovation and its successful adoption at Bursa, the subsequent decades were difficult ones for the silk cloth industry, in Bursa and elsewhere. Much of the industry's difficulties stemmed from two different factors that destroyed the growth momentum achieved with the new technology and undermined domestic demand. The abolition of the Janissaries and the sumptuary reforms of Mahmud II overnight eliminated a major market for the silk weaving industry, the dress of the Ottoman military and the civilian bureaucracy. At the same time, the post-Napoleonic inrush of British thread accelerated the ongoing replacement of silk with cotton cloth among many other Ottoman consumers. Given these two sets of circumstances, the level of annual Bursa silk cloth production during the 1840s, about 20,000 pieces, probably was below that of the 1810s but approximately the same as in the late 18th century.[3]

Some entrepreneurs struggled against this tide and tried to reorganize Ottoman silk weaving. In 1835, one İzzet Pasha in the district (*kaza*) of Bursa sought to reorganize workshops in order to make silk textiles like those in

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[2]BBA Cevdet İktisat 1642, 9 Ra 1231/Feb 1816. The fire method of finishing wool cloth is depicted in Denis Diderot's *L'Encyclopedie* where it is stated to be peculiar to the French textile industry. See, *A Diderot Pictorial Encyclopedia of Trades and Industry,* II, Charles C. Gillespie, ed. (New York, 1959), Plate 314. An examination of the complete encyclopedia does not show other examples of fire finishing nor any examples of stone finishing. Silk is presented in illustrations 2714-2871. See *Diderot Encyclopedia. The Complete Illustrations, 1762-1777,* 5 vols. reprint (New York, 1978). Joseph von Hammer, *Umblick auf einer Reise von Constantinopel nach Brussa und dem Olympos, und von da zuruck über Nicea und Nicomedien* (Pesth,1818), 69, states exports reached 100,000 pieces but is not more specific. Mehmet Genç, "Osmanlı maliyesinde malikane sistemi," in Ünal Nalbantoğlu and Osman Okyar, eds., *Türkiye iktisat tarihi semineri, metinler, tartışmalar* (Ankara, 1975), 273, shows that the *muaccele* for silk cloth production was steady between the 1740s, at 58,000 kuruş and 1808, when it was 60,000 kuruş. It then jumped to 76,000 during the period 1811 and 1833. Both statistical increases coincide perfectly with the technological shift.

[3]GB FO 195/113, Sandison at Bursa, 15 February 1840; compare with Genç and Hammer data presented in n. 2 above.

Europe. His plan included the explicit determination to do so without reliance on foreign technicians. He hired masters from the Bursa cloth industry to weave new patterns and contracted a 50-50 profit-sharing arrangement with them. As a part of the effort, he sought a state loan to buy looms and machinery in Europe. The central government gave him a seven year monopoly on the use of this technology in the Bursa area but declined the loan, for reasons that bear repeating here. The government council (the *Meclis-i Valâ*) observed that, in Europe, capitalists and industrialists were not aided by the state. Therefore, it argued, İzzet Pasha should not receive the requested loan but instead should borrow the money elsewhere.[4] During the next five years, the entrepreneur bought and set up some dozen looms on the Italian model to weave the desirable European-style silk cloth. At this time, he was employing one Italian weaver and so had broken with his vow to rely only on local workers. But the results still were unsatisfactory and the cloth did not resemble the European. He re-petitioned the council that again offered him a seven year monopoly on the use of imported looms and machinery and again refused to loan him money.[5]

This story has two unusual aspects. First, the effort involved an Ottoman Muslim and second, it focused on the improvement of silk cloth weaving. At this time, that is, during the 1830s and 1840s, the majority of entrepreneurs in the silk industry either were foreigners or Ottoman minorities. And, most entrepreneurs devoted their energies to changing the technology of raw silk but not silk cloth production.

Two distinct but related kinds of new technology entered the Ottoman empire during the decades of the 1830s-1840s. The first change concerned adoption of the so-called short reel as a replacement for the long reel then prevalent in the Ottoman empire. Several factors promoted use of the short reel. First, very few of the silk mills in England, then the major buyer of Bursa silk, were adapted for the long reels that required much more physical space than the short reels. Also, the short reel yielded a softer and more lustrous product. The machines were not expensive although they were more labor intensive:

> the method in no way differs from their own, save in additional care; the diameter of the wheel is smaller—the water is allowed to change itself

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[4]BBA Cevdet İktisat 424, 20 C 1251/Oct 1835.

[5]BBA I MV 99, 21 C 1256/August 1840; GB FO 195/113 Sandison at Bursa, 15 February 1840. The British source informs us that, by 1840, he had abandoned the 1835 effort to use only local labor and had imported an Italian weaver. It is possible he sought to import not only looms but also the short reel for spinning.

> more freely and therefore requires more fuel; but less heat is lost—temperature requires more attention, so that the resinous matter may be softened, but not that the silk become brittle; the threads have to be twisted round and round each other in passing out of the caldron, so that the fibers, before the resinous matter cools, may receive a rounded and compact form, and there is more refuse.[6]

For those willing to make the change and perform the small amount of additional labor needed, the rewards were considerable. To encourage the shift, silk buyers offered as much as 110 piasters for the short-reeled silk vs 60 piasters/*oke* for the other method. On the average, short-reeled silk in 1840 enjoyed a 25 percent price premium.[7] The second innovation involved abandoning manual reeling in favor of steam-powered reeling, a technique that perhaps did not greatly increase productivity. But machine spinning did yield the regular uniform product needed by the automated looms of Europe.

These two sets of innovations—the short reel and steam-powered reeling—were attempted nearly simultaneously at diverse silk-raising locations such as Bursa, Salonica, İzmir, and Amasya as well as in the Lebanon. The two innovations sometimes were introduced together but, in some areas, one would appear without the other. And in some locations, the old and the new technologies coexisted for long periods of time. At İzmir, a M. Mathon from the Ardèche region of France founded the first steam-powered mill while the British consul J. A. Werry established the second at Buca, four miles outside the city. Both mills already were in operation in 1845. At Amasya, the Freiburg firm of Matz Brothers sent an agent, in c. 1845, to give advances to cocoon raisers. The agent, whom the Ottomans called the Frenchman Grok, lived there for at least five years. He likely was a member of one of the five to six families that settled in the area and founded a water-powered silk reeling mill as well as some flour mills. This spinning mill, in common with many others in the empire, closed down when disease struck the industry during the 1860s.[8]

The Salonica silk industry seems to have been the first to adopt the new reels, beginning in 1829. In just four years, Italians established several hundred Piedmontese reeling machines at Salonica and instructed some 1,000 local reelers

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[6]David Urquhart, *Turkey and Its Resources* (London,1833), 180-181.

[7]GB FO 195/113, Sandison, 15 February 1840.

[8]GB A+P 1871, *Condition of the Industrial Classes in Foreign Countries,* 733; Buhi 1904, 312; United States Monthly Consular and Trade Reports, December 1908, Amasya; BBA Cevdet Hariciye r 1265/1849. Charles Issawi, *The Fertile Crescent 1800-1914* (Oxford, 1988), 378.

in their use.[9] The director of the Royal Silk Factory at Catania, for example, played an important role in this transformation. In 1838, piedmont-style silk accounted for one-third of all raw silk produced in the region (27,500 lbs vs 55,000 lbs of ordinary silk).[10] The introduction of this new technology caused now-familiar environmental problems. In 1842, for example, the central government received a complaint about the new mills in Salonica, built by foreign merchants to process the silk that they were buying in the surrounding districts (*kazas*). These factories, the plaintiff stated, produced a putrid smell and should be removed. In judging the course of action to follow, the council noted that these merchants had imported reels producing a smooth and regular silk. This was very profitable and, thus the council ruled, it was best not to interfere, adding that any additional factories should be constructed outside the walls.[11] At Salonica, Italians continued to play a leading role in technology transfer throughout the century. Only a minor portion of the raw silk reeled in these mills, however, was marketed in Milan or Trieste. Lyons was the major buyer during the 1830s-1840s and at the end of the century as well.[12]

The shift in technology seems to have brought some change in who controlled the industry at Salonica. The reeling mills at Salonica "were formerly entirely in the hands of the Jews."[13] At this time, the innovators, the Italians presumably, assumed ownership of at least some of the new establishments. In the 1860s, the city of Salonica held 19 filatures with 791 reels while nearby villages contained another 15 filatures. "The larger number of these factories are owned or rented by foreigners."[14]

At Bursa, the story of rapid technological change begins in 1834, when the Glaizal family—father, mother and four children—moved there and established a silk spinning mill, probably the first by the French in the city. But

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[9]This Piedmont system already was in wide use at the time Diderot prepared his Encyclopedia. See vol. II, Plates 316-317 of the Gillespie edition and illustrations 2714-2715 and 2724-2729 of the 1978 reprint cited in n. 2 above.

[10]Urquhart (1833), 180-181; GB FO 195/100, 31 December 1838, Blunt at Salonica and FO 195/176, 2 February 1843, Blunt at Salonica.

[11]BBA I, MV 733, 24r 1258/June 1842; also see discussion of a cloth/*biçki* factory to be built on property of a defunct steam flour mill in the Balat area of Istanbul and local concern about air pollution. It was stated that the factory would not scatter smoke about. See BBA I MV 16445, 14 Za 1273/1856.

[12]Urquhart (1833), 180-181; GB FO 195/176, Blunt at Salonica, 2 February 1843; A&P 1893-1894, 97, 5581, Blunt, 30 September 1893.

[13]GB FO 195/176 Blunt at Salonica, 21 January 1841.

[14]GB FO 195/649, Salonica, 12 June 1860.

the effort failed and the family (except for one son who died of typhoid in 1843), left in 1838 for Tiflis, where the father died of cholera. M. Falkeisen, a Swiss from Basle, took over the Glaizals' business and spinning mill, and succeeded where they had failed. In the year of the Glaizals' departure, the first short reels came to Bursa, on the insistence of London merchants. By 1840, short-reels were commonplace and in this successful transfer, M. Falkeisen surely played a role. He represented the Zurich firm of H. D. de Muralt, signed a contract with a firm from Lyons, and opened what most historians consider the first steam-powered silk reeling mill in Bursa. This occurred either in late 1844 or early 1845.[15] The factory, founded with the help of Tascyan Effendi, an interpreter at the British consulate, had a French director, M. Goular. Falkeisen hired a French forewoman, Marie Blache, to instruct the local women. Marie Blache had arrived in Bursa at the age of 32, a widow with a child, from Loriol/Drome, near Étoile.[16]

Falkeisen and Marie Blache were part of a small wave of French immigration to Bursa that played the critical role in the transformation of the silk industry. Many of these immigrants remained active in Bursa silk production and generally played an important role in the economic life of the city for the rest of the period. One important result of their activity was to reorient the raw silk export industry away from London, that had been a major market early in the 19th century. By the 1860s, Lyons and France generally dominated the Bursa market and continued to do so until World War I. The mechanisms of the French migration to Bursa are not known. We do not know how they were recruited or happened to arrive in the city but their movement coincides with that of foreigners to other Ottoman silk centers. Clearly, merchant houses seeking to stimulate Ottoman silk production were involved but we have no details. Most migrants arrived between 1845 and 1848; this is before the major eruption of the silkworm disease, pebrine, in France during the 1850s. (But it is possible that the home districts of these immigrants already was being affected by disease.) Antoine Goudard came from the Vaucluse in 1845 and took over the spinning mill of Paul Paulaki. Louis Brotte, from near Valence, came in 1846. His future wife arrived in 1853, a silk spinner working for M. B. Dufour who built a silkworm nursery and experimental farm for the highly-prized Macenas silkworm. Madame Brotte later ran a silk factory in partnership with her

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[15]Régis Delbeuf, *Une excursion à Brousse et à Nicée* (Constantinople, 1906). Vital Cuinet, *La Turquie d'Asie*, IV (Paris, 1894), 57-8 and USNA Film T19, r. 2, 1 October 1847, Schwaabe; GB FO 195/205, Sandison at Bursa, 25 June 1845.

[16]Most of the details of the French at Bursa are in Delbeuf (1906). Also see Alexander Treshorn von Warsberg, *Ein Sommer in Orient* (Wien, 1869), 148-149.

husband. Three different families of Gamet came in 1847-1848, from Privas (Ardèche). Eleven other families came during these two years, from areas such as Bouches du Rhone, Isère, Ardèche, Basses Pyrennées, Vaucluse, Ain and Lyons. All of them had been involved in the French silk industry, working as mechanics, spinners, dyers or weavers of silk cloth. Altogether, the French colony c. 1850 consisted of 67 members, including proteges such as the Keuleyans who founded a spinning mill in 1847, four or five other Armenian and Jewish families, and M. Falkeisen.[17] Here, then, is the technology transfer, carried in the persons of these skilled workers moving from France to the Ottoman empire.[18]

Other foreigners besides the French were involved in this vital initial transfer of technology and in their activities we can see the French-Italian-British struggle to direct the export trade in Bursa raw silk. M. Gasaiili, an Italian of unknown origins, had gained the post of collector of customs revenues and silk duties at Bursa. In 1846, as Falkeisen was expanding his mill, Gasaiili cooperated with other Italians, whose origins also are unknown, to build and operate the steam-powered mill in the city. The governor of Bursa, Mustafa Nuri, may have played a role in this endeavor since we know that he attempted to found a silk mill in 1847. In addition, these Italians set up several small-scale model spinning mills in each of the market towns of the Bursa silk region. These mills, founded to offer instruction in the new technology to the local residents, probably contained only the short reels and were not steam powered. By 1852, Gasaiili was operating three spinning mills and was building a fourth. But then, he lost his official position and his properties were confiscated. The British consul at Bursa, Mr. Sandison, also was quite active and he has left us with reports revealing some intimate details of the technology transfer process in the Bursa industry. During long his tenure in the city, Sandison concentrated considerable energy on spreading the new techniques. In 1843, for example, he persuaded the British consular agent at Mihalliç to employ the short reel and take advantage of the better prices. Greek villagers on the coast, he noted approvingly, already had done so. After the consular agent adopted the short reel, his example was followed by the agent's fellow townsmen and by nearby peasants as well. And, Sandison wrote to his superiors, the agent was planning to introduce the

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[17]Delbeuf (1906).

[18]Edmond Dutemple, *En Turquie d'Asie* (Paris, 1883), 192, asserts that 10-15 percent of the silk reelers in the town of Bursa were French. Given the small number of French in the town, this figure is impossibly high.

short reel at the important silk town of Geyve during the coming year.[19] There were other "opinion leaders". In 1852, one Hoca Agob wrote a manual in Armenian, quickly translated into Ottoman Turkish, offering instructions so that locally-reeled silk could be used by the mechanized weaving industry in Europe.[20] Also, in 1854, the Istanbul government approved a request from some silk merchants and funded the travel of an apprentice (from Migirdic) to Paris to learn about spinning reels (*ipek mancinik*).[21]

These efforts to make Bursa silk reeling more compatible with European manufacturing, initially prompted by rising demand for silk, were given particular urgency with the outbreak of silkworm disease in France during the middle 1850s. French cocoon production collapsed, dropping by two-thirds in just three years. The Ottoman silk industry prospered accordingly as cocoon and raw silk production boomed to supply French weaving factories. In numerous locations in the Anatolian and Balkan areas, new mills were established. At Edirne, for example, two filatures were established in 1864 and 1865, respectively by Neroay Papo and the Azaria brothers.[22] In 1851, the Bursa area had held some eleven new-style spinning mills, accounting for only about 10 percent of all silk exported.[23] Many were steam-powered but some of the short reels were manually operated. By the early 1860s, driven by events in France, the Bursa mills now numbered 90, including a large imperial mill, collectively containing some 4,300 reels. In the Lebanon, by comparison, there were 67 spinning mills in 1867, 10 of them French owned. By the end of the century, one count enumerated 131 silk reeling mills in the general region of Bursa. French factory owners at Bursa as well as in the Lebanon gave way to Ottoman subjects as the century progressed. In 1913, the French-owned only c. 6 percent of the productive capacity of the Lebanese mills.[24] Three-quarters of these 131 mills of the Bursa region were owned by Ottoman Armenians and Greeks and most of their factories were located in the smaller towns and villages. The descendants of the French immigrants owned eleven of these mills and ten of the eleven were located in the city of Bursa. French-owned mills accounted for 8

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[19]GB FO 195/208, 28 February 1844; Fahri Dalsar, *Bursa'da İpekçilik* (Istanbul, 1960); Clark (1979), 7; Donald Quataert, "The Silk Industry of Bursa, 1880-1914," in *Collection Turcica III. Contribution à l'histoire économique et sociale de l'Empire ottoman* (Louvain, 1984), 481-503.

[20]Halil İnalcik, "Harir," *Encyclopedia of Islam,* 2nd ed., III (Leiden, 1971), 218; also sources in Quataert (1984), n. 1.

[21]BBA I,MV 12045, 15 Ca 1270/March 1854.

[22]BCF 1910, Adrianople for 1909, 8-9.

[23]USNA T194, r. 3, 31 December 1850.

[24]Issawi (1988), 378.

percent of all filatures in the Bursa region. During the 1870s, by contrast, the French had owned a full one-quarter of all filatures in the province (French-owned mills then totalled twelve; the total number of mills had decreased since the 1860s when silkworm disease had reached the Ottoman empire). French control of the Bursa factories had fallen as the industry expanded throughout the region. Foreign entrepreneurs had concentrated in the largest urban centers of the region and from there had spread the new technologies. In rural areas closer to the sources of the cocoons, local entrepreneurs owned the factories.[25]

To disseminate the new technologies and obtain the needed workers, entrepreneurs employed a mix of strategies. At first, both the Italians and the French imported directors from their homelands to run the mills. And, as we already have seen, they employed French women spinners to instruct local girls and women in the tasks. Having arranged for the transfer of skills, the managers found themselves confronted by labor shortages. At the beginning, entrepreneurs in the town of Bursa itself recruited only from among Ottoman Greeks and paid wages that were considered "remarkably high". To increase the labor supply and thus find cheaper labor, factory managers built dormitories next to the factories and recruited "very young" girls from rural districts. These girls stayed in the dormitories through the spinning season and then returned home. To overcome the concerns of the girls and their families, both the ulema and the pope were brought in to help with recruitment. Announcements and proclamations intoned that work in silk factories was not immoral but proper and acceptable behavior and therefore was permissible in the eyes of the religious authorities and presumably, therefore, in God's. By the mid or late 1850s, Turkish and Armenian girls, as well as a few Jews, joined the Greeks and regularly worked in the mills. Real wages plummeted, falling a full 50 percent from their peak of c. 10 piasters per day in the mid 1850s. Thereafter, until World War I, spinners usually received a daily wage of 5-7 piasters.

A minor episode of attempted technology transfer, assisted by the government, occurred in the 1860s. A high-ranking government council (*Meclis-Valâ*) examined the decline in the weaving of silk cloth (*çatma yastık*) that covered furniture and pillows. Two Ottoman Muslim merchants (one of them a privileged *hayriye tüccari*), were seeking to revive this weaving at Üsküdar and Bilecik through a variety of means, including machinery import and the use of special cheap dyes. The state exempted silk textiles made in these two locations from customs and stamp (*damga*) taxes for ten years. It permitted the duty-free

[25] AE CC, Brousse 1853-1901.

import of European weaving machines, at least some of which were Jacquard looms. And, the council offered four-five month loans to those wanting to buy the machines, as well as five year tax exemptions on the textiles produced on the new equipment. This effort underscores the radical shift in government policies since 1835-1840, when it coolly rejected İzzet Pasha's plea for financial assistance on the grounds that such aid was not offered to entrepreneurs in Europe. *Laissez faire*-ism of the 1840s had yielded to activism.[26]

The next major episode of technology transfer in the Bursa industry was prompted by efforts to rescue it from the disaster brought by disease. In 1857, as the Bursa industry was completing its transition to short reels and steam factories, and as production of cocoons and raw silk increased by leaps and bounds, it too was struck by the silkworm disease that had ravaged France. Raw silk production fell terribly as counter-measures seemed without effect. Efforts to introduce Japanese silkworms, that were immune from the disease, failed. To make matters still worse, the newly-opened Suez Canal brought a flood of East Asian silk products onto European markets and drove down prices. Raw silk production at Bursa continued to slide during the 1870s and 1880s.

A remedy for controlling the disease had appeared in 1865, thanks to the work of Louis Pasteur. He discovered that with the use of microscope, the silkworm eggs and moths could be examined to develop a disease-free breeding stock. Both France and Italy adopted the new technique and began rebuilding cocoon production. At Bursa, there were repeated and extensive efforts to import these eggs during the 1860s and 1870s. Some Bursa merchants and silkraisers travelled to France and returned to implement the Pasteur techniques that they had acquired. But the efforts failed. That is, even with direct access to the source of the innovation and in the presence of a permanent French colony at Bursa, the technology transfer was unsuccessful.

A solution began to appear when the German vice-consul at Bursa, Scholer, contacted the Ottoman Public Debt Administration, that recently had been formed and given control of the silk tithe. Concerned to increase its revenues by developing silk production, the Debt Administration became a leader of technology transfer in the industry. To implement the transfer, the Debt Administration utilized Ottoman Armenians and a foreigner who in turn introduced the new technology mainly to the Ottoman Christian community.

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[26]BBA I MV 20290, 20 R 1278/October 1861; These arguments were repeated in 1870, and the exemptions renewed; BBA I, Şura-yi Devlet 836, 25 Recep 1287/October 1870.

The Debt Administration wrote directly to Pasteur who referred to M. Maillot, the director of the Montpelier Agricultural School. Maillot examined his files and recommended a former graduate, the Ottoman Armenian Kevork Torkomyan. Torkomyan Effendi negotiated with the Debt Administration and they finally agreed, in 1887, on a means to eliminate the disease and restore the industry. Torkomyan established a Silkraising Institute to raise disease-free silkworm eggs and train silkworm raisers in the Pasteur techniques. The Institute offered full and part-time education in Pasteur silkraising techniques and only those with Institute certificates legally could engage in the business of silkraising. Instructors, that is, the transmitters of these new techniques, included Torkomyan Effendi as well as Vice-Consul Scholer. In addition, a second Ottoman Armenian graduate of a French agricultural school, Yervant Beyazian, also taught at the Institute. These three instructors granted certificates to over 2,000 graduates of the program. As I have shown elsewhere, over 80 percent of them were from the Ottoman minority populations: Armenians formed about one-half and Greeks another one-third of all graduates. Thanks to these and other measures, the Ottoman silk industry was able to take advantage of booming world demand for raw silk. Raw silk production at Bursa more than tripled between the late 1880s and World War I; similarly impressive increases occurred in silkworm egg and cocoon output.[27]

These favorable conditions prompted some other technological improvements in the industry late in the period. For example, many of the Anatolian mills seem to have been modernized and enlarged and a number of new mills were founded. We have very little information on the subject, despite the comparatively-abundant literature. At Edirne and Souffli, five new filatures were established between 1903 and 1909, adding to the three already present in the former city. In Edirne, four of the mills were clustered in the area near the train station.[28] At Amasya, silkreeling had revived in the late 1880s due the activities of a Swiss firm under German protection. The company installed a device that killed the worms with steam and hot air, called the Dorr process, that replaced the oven method. Since this oven technique hurt the quality of the cocoons, the small cocoon raisers sold their output to the Dorr establishment. The Dorr system also had been installed in at least one mill in the Salonica area, leased by the Boutet brothers.[29] Other establishments of this type probably were built at

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[27]The above is taken from Quataert (1984) and Dalsar (1960).

[28]*Edirne Vilayet Salnamesi 1309*/1891-2, 181-2. k und k 1902, XVIII, 4; BCF 1910, Adrianople for 1909, 8-9.

[29]Buhi 18 April 1913, XIX, 6. Silk reeling, however, was undermined by the higher wages paid by a tobacco factory in Gevgeli, that employed 600 persons.

Bursa. Also, the French vice-consul Lacomme established a French egg raising company in the city of Bursa at the end of the century. Called "La Société Francaise pour l'exploitation de vers à soie de Brousse", the firm had 30 microscopes and 200 female workers.[30] Besides the addition of this new technology, the size of spinning mills certainly expanded. The average Bursa-area mill held 39 basins in the 1870s; by the end of the century, the average number nearly had doubled, to c. 70. (In the Lebanon, the average factory held 50 basins in the 1860s and 59 in 1913[31]). In these larger mills, the equipment spun from two to six, usually four, threads per reel. This represented an increase in the number of threads per reel, a practice patterned after the example of the French and Italians who avidly had adopted the technique in Europe. By contrast, this more productive method was not adopted in the Lebanon, where the equipment remained essentially unchanged after its original adoption.[32]

At Bursa, after these late-19th century innovations, there seems to have been little change in the spinning equipment of the factories.[33] At the end of the period, local machine manufacturers were producing most of the implements—the basins, reels and wheels—needed by silk reelers. Some equipment, however, such as the oscillation machine, continued to come from France.[34]

The Debt Administration had played an important role in the late 19th century diffusion of the new technology and in the creation of many of the new factories. Its model silkworm nursery at Bursa used equipment that was imitated both locally and at other Ottoman silkraising centers; this nursery, for example, certainly was the source of Dorr-model equipment employed at Amasya.[35] Near the end of the century, the organization also established a model filature at Salonica with the goal of encouraging local capital to enter the industry.[36]

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[30]*RCL* 30 Septembre 1900, 412.

[31]Buhi 1904, 281-2. Issawi (1988), 378. Ottoman subject Papas Istepan veled Migirdiç requested a concession for a 3 hp steam silk factory in Karinlin village of Akhisar *nahiye* of Geyve *kaza*. See BBA I Ticaret ve Nafia, rl #3, 27 rl 1316/July 1898.

[32]Junge (1916) and Roger Owen, "The Silk-Reeling Industry of Mount Lebanon, 1840-1914: A Study of the Possibilities and Limitations of Factory Production in the Periphery," in Huri İslamoğlu-İnan, ed., *The Ottoman Empire and the World Economy* (Cambridge, 1987), 171-183.

[33]The December 1911, *Levant Trade Review* states that the Bursa mills "equipment is about the same as is found in older spinneries of the nineties in France and Italy". 284.

[34]BCF 1905, #468, Brousse province.

[35]Buhi 1904; Stich (1929), 99-100.

[36]*RCL* 30 Septembre 1900, 407.

The final set of technological changes affecting the silk industry centered on the weaving of silk cloth. For the better part of the century, European attitudes towards the transfer of silk weaving technology were in marked contrast to those towards silk reeling, which they actively promoted to better supply weavers back home. Efforts to mechanize generally had been seen as inappropriate, that is, as threats to European producers.[37] This attitude changed only later in the century, as European industry increasingly emphasized the production of capital equipment and textile production outside Europe and the United States was allowed to mount.

In the Bursa region, silk cloth production staged an important and until now unnoticed comeback in the later 19th century. Annual cloth production apparently totalled 20,000 pieces, manufactured on some 200 looms, in the 1850s. By the mid 1890s, cloth output had mounted sharply. The number of looms working now numbered some 500 and they used 13,000 kgs of raw silk to weave 40,000 pieces of cloth. The buyers were Ottoman subjects while the technology was that employed 50 years before.[38] By 1908, there were 700-800 hand looms operating, consuming a record 37,000 kgs. of raw silk. Thus, the quantity of silk cloth woven on hand looms at Bursa doubled between the 1850s and 1890s and then tripled again during the next two decades. In 1910, new weaving technology arrived in the form of six motor-driven looms, installed by an Ottoman textile stock company. This single factory alone consumed about 10,000 kgs. of silk but the cloth was of poor quality.[39]

The rapid increase in silk cloth production at Bursa joined a larger trend as aggregate Ottoman silk cloth production mounted sharply towards the end of the 19th century. In common with the Bursa experience, this general growth only partly was due to the transfer of mechanical loom technology; other factors included the greater use of synthetic dyes and of machine-made yarn mixed with the silk to produce attractive, "silky" and cheaper textiles. A very modest growth in the number of mechanized weaving factories did occur, largely between 1908 and 1913, when five of the six mechanized Ottoman silk cloth factories were founded. Five were located in Bursa and one at the imperial factory complex in Hereke. Three of these were owned by Armenians, one by a Muslim, one was a corporation, and the last belonged to the imperial family (*hazine-i hassa*).[40]

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[37] For example, Warsberg (1869), 149-150.
[38] *RCL* 31 Octobre 1899, 935.
[39] k und k 1912, Brussa.
[40] Ökçün (1970), 161-162.

Mechanized looms took hold in other important silk cloth production centers at similarly late dates. Throughout the 19th century, Aleppo weavers had continued to supply important quantities of pure and mixed silk cloths to Ottoman and Egyptian buyers. At the turn of the new century, entrepreneurs in that city at first failed in their plans to adopt the Jacquard. At the time, abandonment of the experiment was blamed on the expense of the loom, some 20 Ottoman liras, and the total absence of trained repair personnel. A decade later, however, the city contained some 50 Jacquard looms and these, reportedly, had been locally-manufactured.[41] Nearly simultaneously, entrepreneurs in the nearby city of Diyarbakır enjoyed great success in adopting and using the Jacquard loom that they obtained from abroad. In approximately 1903, they imported some 120 of these looms to weave various styles of silk cloth. Diyarbakır producers used them effectively to compete with European manufacturers, a goal they shared with the Aleppo entrepreneurs, and Jacquard looms played a central role in the dramatic expansion of Diyarbakr cloth making in the early 20th century. Jacquard looms, 50 of them, also were introduced into the Iraqi provinces in c. 1903, forming one-sixth of the 300 looms weaving silk stuffs.[42]

Attempts to mechanize silk weaving in the Harput region successfully occurred at a much earlier date than at Bursa, Diyarbakır, Aleppo and the Iraqi provinces. Harput had a long tradition of sending Armenians to other parts of the Empire and to the United States for work and European contemporaries were fond of crediting these workers for the sophisticated local atmosphere. At Harput, the transfer of industrial technology owed much to emigré remittances and migratory labor returning home with new skills and capital. Mechanical silk weaving there dated back to the 1860s, when Harput was described as "the only town in the interior that has European machinery making silk tissues, cotton thread, plain and dyed cloths on the native pattern." [43]

At the turn of the century, the factory was using some modern English machinery, as well as a steam engine. Around 1900, an Armenian established a second, unusual, cloth factory at the nearby town of Mezre. In this case, the owner was assisted by his son, who had served apprenticeships in silk reeling factories in the United States and in Manchester. He replaced most of the metal

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[41]Buhi III, Heft 10, 22 Januar 1902, 417; compare with GB A+P, 1911, 87, as reproduced in Issawi (1966), 282.

[42]University Publications of America, *British Documents on Foreign Affairs: Reports and Papers from the Foreign Office Confidential Print. Series B. The Near and Middle East, 1856-1914*, Vol 16, British Trade in Mesopotamia, G. Lloyd, 1908, 104. Buhi 9, 20 August 1907, 712.

[43]GB FO 195/889, Taylor 18 April 1867.

machinery pieces with wood and substituted human power for steam.[44] The owner then approached the United States consul who placed a notice in his report that subsequently was published and distributed throughout the United States. These reports, like their British, French, German and Italian counterparts, were purchased and read by merchants and manufacturers looking for foreign markets. The American consul announced that the Mezre silk factory owner wanted to purchase American equipment that was easy to repair; interested persons, he said, should contact him at Harput. A half decade later, the Mezre factory contained a 40 ps petroleum engine, 24 silk reels, twelve silk looms, 300 silk spindles and 600 cotton yarn spindles.[45]

Conclusion

It is clear that the international market played the critical role in shaping the Ottoman silk industry as it developed at Bursa, Salonica and the Lebanon. Silk reeling in these locations became mechanized, with varying levels of technological sophistication, and acquired greater importance than previously in the local silk industry. In such areas, the industry as a whole, including the production of silkworm eggs and cocoons, became very focused on the European market. Other traditionally important silk production centers, however, were affected quite differently. At Diyarbakır and Aleppo, silk cloth production remained the predominant activity, supplied largely by nearby reelers using older technologies. Diyarbakır received the imported reeling techniques in the late 19th century, when the Debt Administration introduced it. But it apparently never was adopted at Aleppo, that remained the greatest of all Ottoman silk cloth producers. In the growing success of silk cloth makers, new machinery played a certain role in some areas, notably, perhaps, the Jacquard looms of Diyarbakır. But hand looms generally remained important until the end of the Empire and the expansion of the industry with this simple equipment is due to many factors. Here, in addition to the ability of local weavers to meet local taste demands and keep prices down, we also should mention the growing disparity between Ottoman and European wages that made the Middle East producer more competitive.

Ottoman non-Muslims and the foreigners played critical roles in introducing and disseminating the new technologies. Muslim efforts were not so successful. During the reeling phase, their entry certainly was blocked or

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[44]*RCL* 31 Mai 1904, Lettre de Harpout; AE CC Turquie, 13, Sivas, 1 Décembre 1900.
[45]United States Consular Reports, LXVI, 249, June 1901; Buhi 1907, 9, 20 August 1907.

discouraged by the well-established networks of the non-Muslims and Europeans in the silk trade. In the loom phase, the preponderance of non-Muslims and foreigners in reeling also proved to be a powerful disincentive to Muslim entrepreneurship. The Debt Administration reinforced such patterns through its own heavy dependence on foreigners and minorities as its key agents. Overall, the consular representatives of the foreign powers played a role in silk technology transfer that cannot be overestimated. They were involved in every phase of the transfer process, in every time period, and regardless of nationality.

French technology and French citizen/subjects dominated the transfer process and drove competitors from the field in most regions. They were the key agents at Bursa and the Lebanon and were important almost everywhere else. At the imperial silk works at Hereke, for example, there were both French directors and French workers present.[46] But at several Balkan locations such as Salonica, Edirne and their environs, Italians were important not only during the first transfers concerning the short reels but late in the period as well. During the late 19th century, Italians owned, directed or founded a number of silk mills. In part, this seems due to the Italian origins and mercantile networks of some Salonica Jewish entrepreneurs, such as the Allatini family. And finally, as the century progressed, European ownership of the reeling mills gave way to that by Ottoman subjects, mainly non-Muslims.

[46]AE CC Turquie 107, Gazay, 3 Mars 1884; AE CC, Istanbul, 116, Constans, 8 Avril 1901.

V

CONCLUDING REMARKS

Some Concluding Remarks

In trying to understand the Ottoman experience with technology transfer in manufacturing, it seems useful to begin by returning to the case of Japan. In the 1880s and 1890s, Japanese industrialization exploded with the foundation of hundreds of new factories, financed through local capital sources. In the first decade of the next century, the military forces of this rapidly-industrializing nation defeated those of Czarist Russia. The two events together heralded the emergence of a major new industrial and political force. Thus, Japan succeeded where the Ottoman empire failed. Analysts have scoured Japanese history for the reasons and have compiled formidable lists. And yet, even when all the specifics are added up, have we actually arrived at an explanation? Probably not, anymore than we understand why the industrial revolution occurred first in England. Take, for example, the notion that the isolation of Japan and its character as an island provided the context for the development of very strong group identity as well as protection from outside intruders. The usefulness of this notion seems questionable since, after, New Zealand also was a remote island with natural resources that did not follow the Japanese pattern. On the other hand, geography at some level helped the Japanese just as the Ottoman proximity to Europe played a role in shaping its own technology transfer process.

The pursuit of Japan as a model, in any event, seems inappropriate since among non-European states of the 19th century, Japan was the anomaly and the Ottoman empire was the norm. In an analysis of Japanese success and Ottoman failure, explanations should be sought in the particular mix of both global and local factors. This determined the nature, pace and extent of technology transfer and of big-factory mechanization. The world economy provided constraints and opportunities and determined the general framework and shape of the transfer process. The international division of labor prevailing at the time that the Ottoman and Japanese systems became part of the world economy precluded a place for a big-factory Ottoman empire but allowed one for Japan. In this

apparent tautology, the explanation needs to bend back on the host of unique factors that were present in each of the two cases.

Leaving Japan for the Japanese historian, let us try to look at some of the specifics of the Ottoman experience that might help us understand its encounter with technology transfer in manufacturing. Did the character of the Ottoman empire as the centuries-old mortal enemy of many European states retard the transfer of technology that might help revive its political and military strength? This seems unlikely, given the flow of 19th century-military technology into the empire. Further, the example of Mohammed Ali Pasha in Egypt shows that Middle East governments could use intra-European rivalries to obtain the desired manufacturing technology. So, geo-politics was a two-edged sword, allowing the Ottoman empire to exploit rivalries at the same time that its proximity made it an early target for European manufacturers. In balance, the Ottoman geo-political and historical relationship with Europe probably worked against the flow of technology transfer.

The Ottoman state remained uncertain about its commitment to protective tariffs and their absence hurt local industries. This policy ambiguity had several origins, one being the past economic practices of Ottoman officialdom. But there was another source: Britain. The British empire was the greatest power of the age and surely, contemporaries wondered, some of its success lay in its free trade policies. Never mind how inappropriate the model seems from our perspective, many Ottoman statesmen held such policies to be a desirable model. In any event, official and unabashed enthusiasm for protective tariffs would have foundered upon the rocks of European insistence on free access to the Ottoman consumer. Here, demands of the global economy seem most important.

During the 19th century, the Ottoman state apparatus grew relatively stronger as the Ottoman empire became progressively weaker and this consideration seems relevant here. Confronted with the problem of "how can this state be saved," the elites focused very little on the economy (unlike in Japan) and more upon the replication of themselves, that is, the expansion of the civil and military elites (according to a new model). The major net result of their famed policies of westernization and centralization was the vastly-expanded bureaucratic and military officer classes remarked on earlier. Whether the decision was conscious—a choice to ignore industrial development in favor of the English free trade model that cast the Ottomans in the role of raw materials supplier—or the natural result of the prevailing intellectual atmosphere (per Gramsci) remains

uncertain and needs to be explored. But the price paid is known, going down the path of Ottoman economic growth as opposed to development.

The state factories do not appear to have been intended as instruments of economic development but rather as mere suppliers of governmental needs. The other big factories established with private funds fall into two groups, those supplying the needs of the port cities and the Istanbul capital and those serving the export market (wool and silk spinning and tobacco processing). Ottoman subjects became increasingly active in founding and running these big factories, including those in silk spinning, and we have seen merchant capital as the source of most industrial investment later in the period. But the transfer of technology to big factories, both locally- and foreign-owned, paled in importance before the diffusion of the simpler technologies such as machine-made yarn and synthetic dyes. The spread of these technologies owed much to two factors. First, they were inexpensive and required little capital, an advantage in an capital-scarce economy. Second, their spread occurred with the blessings of the European powers. Afterall, their manufactures were being bought by foreign consumers, whose purchases generated the capital surpluses that helped fuel subsequent European industrial expansion.

And finally, examination of technology transfer allows us entree into the story of Ottoman manufacturing in general. Through the examples offered here—of big factories, of the silk industry and of the simple technologies—we begin to appreciate the wonderful complexity of that story. Within the environment furnished by global and local forces, Ottoman manufacturers fought to retain markets and make new ones. In some locations they failed. The Ankara mohair cloth industry vanished, and so did the textile empire of the Kayseri merchants. But elsewhere, and often, they succeeded. The vibrancy of the cloth makers at Aleppo, Diyarbakır, Arapkir and Buldan point to dynamism in the industrial sector, a result of Ottoman producers aiming at domestic markets. At Bursa, the silk industry continuously evolved not only to meet foreign demand but also to clothe Ottoman consumers. Other export examples could be enumerated to include the carpet makers or the embroiderers of Istanbul and north Syria, but the point seems clear enough. Ottoman manufacturers were adaptive, creative and innovative.

Études Turques - USHS
n°2

Donald QUATAERT

UFACTURING

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