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0521843138 - Guns for the Sultan: Military Power and the Weapons Industry in the Ottoman Empire

Gabor Agoston

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CHAPTER 1

Introduction: firearms and armaments industries

The “discovery” of gunpowder, the appearance of firearms, and especially their mass employment in warfare was one of the most significant developments of the late Middle Ages. Gunpowder – a mixture of saltpeter, sulfur and charcoal – was first made in China in the seventh or eighth century AD and the first proper firearms were manufactured there from the 1280s onward. The first firearm “had three basic features: its barrel was of metal; the gunpowder used in it was rather high in nitrate; and the projectile totally occluded the muzzle so that the powder charge could exert its full propellant effect.”¹ Within decades, gunpowder weapons had reached both Islamdom and Christian Europe, and by the first decades of the fourteenth century firearms were being used in European battlefields and sieges. By mid-century, firearms had reached Hungary and the Balkans, and by the 1380s the Ottomans were also acquainted with the new weapon. The Ottoman conquest of Constantinople was but one dramatic illustration of how, by the 1450s, cannons had become a decisive weapon in siege warfare. In the early fifteenth century, cannons were frequently being used aboard European ships and towards the end of that century shipboard artillery had already proved its value on the Mediterranean war galleys.²

The appearance of firearms and their mass employment in battles, sieges and by navies significantly changed the way states and empires waged wars. In order to remain militarily competitive in the gunpowder age, states needed cannons, cannon-proof fortifications, a sizable infantry armed with handguns, as well as navies with shipboard artillery. Organized violence between states and empires,

¹ Joseph Needham, *Gunpowder as the Fourth Power: East and West* (Hong Kong, 1985), pp. 14–15. Thanks to the monumental work of Joseph Needham and his colleagues, there appears to be a scholarly consensus regarding the place of origin and the direction of the transfer of knowledge of gunpowder from east to west. See Joseph Needham, Ho Ping-Yü, Lu Gwei-Djen and Wang Ling, *Science and Civilization in China, vol. V: Chemistry and Chemical Technology, pt. 7, Military Technology: The Gunpowder Epic* (Cambridge, 1986). From the latest literature see Alfred W. Crosby, *Throwing Fire: Projectile Technology through History* (Cambridge, 2002) and Kenneth Chase, *Firearms: A Global History to 1700* (Cambridge, 2003).

² Bert S. Hall, *Weapons and Warfare in Renaissance Europe: Gunpowder, Technology, and Tactics* (Baltimore, 1997); Carlo M. Cipolla, *Guns, Sails, and Empires: Technological Innovation and the Early Phases of European Expansion 1400–1700* (New York, 1965; reprint New York, 1996).

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geographical exploration and overseas expansion led to an unprecedented arms race. In order to participate effectively in the attendant inter-state rivalry, monarchs had to create their indigenous weapons industries or supply the necessary weaponry and ammunition otherwise.³ In the long run, the adequate and steady supply of weaponry and military hardware proved to be more important than (usually temporary) technological or tactical advantages. To be sure, superiority in weapons technology and tactics could occasionally have determined the outcome of individual battles or sieges, although weaponry in itself was hardly sufficient to win the day.⁴ However, states and empires that wanted to achieve long-standing military prominence and maintain military pressure for decades had to possess weaponry and military hardware in substantial quantities and of acceptable quality.⁵

Arms and ammunition production required investment in capital, manpower, organizational skills and so forth. Apart from paying and feeding the troops, arms production and shipbuilding constituted the most burdensome challenge for early modern states, for “gunpowder weapons and their services may have added a third to the costs of a campaign.”⁶ Thus, the examination of the supply of weapons can significantly enhance our understanding regarding the military capabilities of states and empires. Comparative data and analyses concerning the supply of weaponry and ammunition of competing empires in the gunpowder age might illuminate issues pertaining to larger questions, such as the shifts in the balance of power.

The aim of this book is to understand the Ottoman weapons industry, the systems and methods by which the Sultans procured their armaments. The bulk of the content examines the Ottoman armaments industry in the sixteenth and seventeenth centuries. It was not only a crucial period of Ottoman conquests and of subsequent setback, but also an age which – at least in the major European theaters of war where the Empire was drawn into conflict – was characterized by siege warfare rather than by pitched battles. In these sieges the supply of artillery and gunpowder

³ Geoffrey Parker, *The Military Revolution: Military Innovation and the Rise of the West, 1500–1800* (Cambridge, 1988; rev. 3rd edition, 1999); William H. McNeill, *The Pursuit of Power: Technology, Armed Force, and Society since AD 1000* (Chicago, 1982).

⁴ Cipolla, *Guns, Sails, and Empires*, p. 28; McNeill, *The Pursuit of Power*, pp. 12–20, 36–40; Parker, *The Military Revolution*, p. 43; Jeremy Black, *A Military Revolution? Military Change and European Society, 1550–1800* (London, 1991), pp. 12–13; George Raudzens, “War-Winning Weapons: The Measurement of Technological Determinism in Military History,” *Journal of Military History* 54 (1990), 403–33.

⁵ The history of military conflicts provides many examples which show how the lack of adequate weaponry and ammunition might force policy-makers to compromise or delay military operations. The most recent example would be the case of the 1,000-pound “bunker-buster” bombs used against Taliban targets in Afghanistan in 2001 and 2002. In February 2002, Pentagon planners reminded politicians and the public that, despite the rhetoric of President Bush, it was unlikely that a war against Iraq would be started soon, because army and navy inventories “ran dangerously low.” They suggested that it would take at least six months to replenish the stockpiles. See Walter Pincus and Karen DeYoung, “Anti-Iraq Rhetoric Outpaces Reality,” *Washington Post* February 24, 2002, A1.

⁶ J. R. Hale, *War and Society in Renaissance Europe 1450–1620* (London, 1985), p. 47.

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was a crucial element of success, as was the defense of the Ottoman frontiers against the Sultans' Hungarian, Habsburg, Venetian and Safavid adversaries.⁷

Gunpowder technology, the Military Revolution thesis and the Ottomans

As can be seen from the two quotations that open this book, contemporary politicians, Europeans and Ottomans alike, were well aware of the significance of firearms. The spread of gunpowder weapons stirred passionate debate among intellectuals of the Renaissance.⁸ Although no comparable debate in the contemporaneous Ottoman literature is detectable, it is noteworthy that the seventeenth-century Ottoman historian İbrahim Peçevi included a small section about the manufacturing of black powder in his chronicle. Writing around 1640, Peçevi repeated the well-known European myth about Berthold Schwarz, perhaps following one of his Hungarian sources. What is more interesting, though, is the fact that Peçevi discussed the invention of “black powder” together with that of printing.⁹

Many European historians have considered the “discovery” of gunpowder and that of printing as the two most significant inventions of the late Middle Ages. Indeed, historians, especially in Europe, have long been fascinated with the “gunpowder epic.” Many of them argued that “gunpowder blasted the feudal strongholds and the ideas of their owners,” a notion that was shared by such authorities as David Hume (1711–76) and Adam Smith (1723–90). Johan Huizinga went even further when he wrote that “the rebirth of the human spirit dates from the discovery of firearms.”¹⁰ According to one of the most influential historical theses of the late twentieth century – Geoffrey Parker’s Military Revolution theory – gunpowder weapons had far-reaching consequences regarding state formation and the power balance between states and civilizations. Parker substantially modified Michael Roberts’s original conception of the Military Revolution. In Parker’s version of the thesis, gunpowder weaponry and military technology occupy center stage. Since only monarchs possessed the necessary financial and organizational means to invest in cannon-proof fortresses (*trace italienne*) and to establish and maintain artillery corps of sufficient size to besiege these fortifications successfully,

⁷ Until the 1680s, there were only three major field battles (in 1526, 1596 and 1664) that took place between the Ottomans and their Hungarian and Habsburg opponents in Hungary, the most important theater of Ottoman–European land confrontations during the sixteenth and seventeenth centuries. In that same period of time, the Hungarian frontier saw dozens of sieges, heroic defenses as well as considerable efforts of fortress building and modernization, especially on the Habsburg side.

⁸ J. R. Hale, “Gunpowder and the Renaissance: An Essay in the History of Ideas,” in J. R. Hale, *Renaissance War Studies* (London, 1983), pp. 389–420.

⁹ İbrahim Peçevi (Peçuyly), *Tarih-i Peçevi* (2 vols., Istanbul, 1283/1866–67), vol. I, p. 83. It is known that Peçevi, who was born in Pécs, Hungary and spent most of his life on that frontier, used Hungarian sources while writing his own history of the Ottomans. From the latest literature see Pál Fodor, “Egy pécsi származású oszmán történetíró: İbrahim Peçevi,” in Ferenc Szakály ed., *Pécs a török korban* (Pécs, 1999), pp. 107–31.

¹⁰ For these statements see Hale, “Gunpowder and the Renaissance.”

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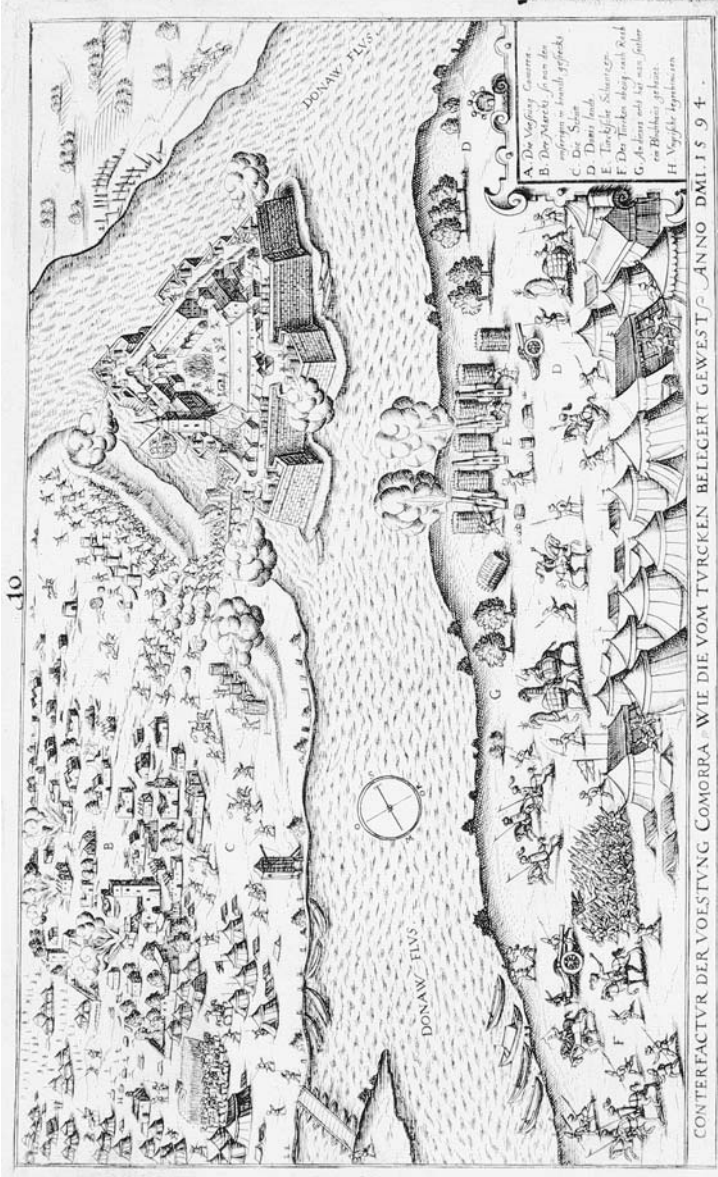
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Figure 1 Planned and built by the Italian master-builder Pietro Ferabosco between 1552 and 1555, Komárom was the only major fortress built or modernized according to the *trace italienne* that the Ottomans could not conquer in Hungary. However, the reasons for Ottoman failure are manifold: besides the fortress's architecture, the width of the Danube that rendered Ottoman cannons on the far side of the river ineffective, steadfast defense, cold weather and the outbreak of typhus that killed some eight thousand besiegers all mentioned by contemporaneous sources. Engraving by Johann Sibmacher (1594).

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Parker argues, cannons and the *trace italienne* eventually led to the strengthening of state power vis-à-vis the feudal lords and facilitated the emergence of centralized states. Similarly, superior firepower and ocean-going naval technology conclusively shifted the military balance towards Europe, and were responsible for establishing Europe's eventual hegemony over non-European civilizations, a process that many historians proudly label the "rise of the West."¹¹

The nature and the impact of the Military or Gunpowder Revolution are disputable and have been hotly debated for decades.¹² While some historians rejected Parker's ideas, accusing him of technological determinism,¹³ others incorporated them into their sweeping treatments of war and society. Students of warfare and military technology continue to examine the development of gunpowder and its role in the history of military conflicts and that of humankind. Military and economic historians have tried to determine the significance of European arms and ammunition production as well as the role of arms transfer and technological diffusion in the rise and fall of states, empires and civilizations.¹⁴ Others are more cautious regarding the historical significance of military technology. In his recent works, Jeremy Black questioned the importance of military technology as a determining factor in the "fate of the continents" and offered important qualifications regarding Europe's global expansion, emphasizing the relationship and interactions between European technology, economy and state formation.¹⁵ Despite criticisms of it, the Military Revolution thesis continues to exert considerable impact far beyond the works of historians and figures prominently in the appealing surveys on state formation and geopolitics.¹⁶ In this generalist literature, Europe's "aggregate firepower"

¹¹ Parker, *The Military Revolution*; cf. also Cipolla, *Guns, Sails, and Empires*. See also my "Disjointed Historiography and Islamic Military Technology: The European Military Revolution Debate and the Ottomans," forthcoming in the *Ekmeleddin Işhsanoğlu Festschrift*.

¹² Several of the important studies are readily available in Clifford J. Rogers ed., *The Military Revolution Debate: Readings on the Military Transformation of Early Modern Europe* (Boulder, CO, 1995). See also Black, *A Military Revolution?*

¹³ See, for instance, Bert S. Hall and Kelly DeVries, "The Military Revolution Revisited," *Technology and Culture* 31 (1990), 500–07.

¹⁴ Cipolla, *Guns, Sails, and Empires*; David Ayalon, *Gunpowder and Firearms in the Mamluk Kingdom: A Challenge to a Mediaeval Society* (London, 1956; 2nd edition, London, 1978); John Francis Guilmartin, Jr., *Gunpowder and Galleys: Changing Technology and Mediterranean Warfare at Sea in the Sixteenth Century* (Cambridge, 1974; rev. edition Annapolis, MD, 2003; all references are to the 1974 edition); Volker Schmidtchen, *Bombarden, Befestigungen, Büchsenmeister. Von den ersten Mauerbrechern des Spätmittelalters zur Belagerungsartillerie der Renaissance. Eine Studie zur Entwicklung der Militärtechnik* (Düsseldorf, 1977); Andrew C. Hess, *The Forgotten Frontier: A History of the Sixteenth-Century Ibero-African Frontier* (Chicago, 1978); McNeill, *The Pursuit of Power*; Trevor N. Dupuy, *The Evolution of Weapons and Warfare* (New York, 1985); Kelly DeVries, *Medieval Military Technology* (Peterborough, Ontario, 1992); Hall, *Weapons and Warfare*; Crosby, *Throwing Fire*; Chase, *Firearms*.

¹⁵ Jeremy Black, *War and the World: Military Power and the Fate of the Continents, 1450–2000* (New Haven and London, 1998); Jeremy Black, *European Warfare, 1494–1660* (London, 2002).

¹⁶ See, e.g., Paul Kennedy, *The Rise and Fall of the Great Powers: Economic Change and Military Conflict from 1500 to 2000* (New York, 1989); Charles Tilly, *Coercion, Capital, and European States, AD 990–1990* (Oxford, 1990); Brian M. Downing, *The Military Revolution and Political Change: Origins of Democracy and Autocracy in Early Modern Europe* (Princeton, NJ, 1992); Keith Krause, *Arms and the State: Patterns of Military Production and Trade* (Cambridge, 1992). Even

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and naval capability figure prominently and the far-reaching consequences that the proliferation of firearms brought about are usually accepted.¹⁷

While an increasing number of works present a more balanced and multi-causal, evolutionary (rather than revolutionary) explanation of European military changes, students of non-European history are lagging behind their Europeanist colleagues. The historiography of the Ottoman Empire, militarily the most sophisticated non-European adversary of early modern Europe, is a case in point. Given the significance of warfare in the history of the Ottoman Empire and that of the whole region once ruled by the Sultans, it is hard to understand that the Ottomans have until recently been sidelined by the flourishing literature of the New Military History.¹⁸

The Turkish archives are rich in material regarding Ottoman gun casting, saltpeter and gunpowder manufacturing, as well as shipbuilding, to name but the most important sectors of early modern war industry. Despite this, the history of Ottoman military technology and armaments industry is still *terra incognita* for students of European and Ottoman history.¹⁹ This is difficult to understand given the Ottomans' military endurance against their European and Middle Eastern adversaries. As a result of the lack of relevant studies on Ottoman military technology and arms production, it is hardly surprising that sweeping (and often misleading) statements with regard to Ottoman (and Islamic) military technology and military capabilities are often repeated in the generalist literature. Of these, the notion of "Islamic conservatism," the ideas regarding the Ottomans' supposed technological inferiority, as well as the Empire's alleged insufficient production capacity and its putative dependence on imported European weapons and ammunition have proved to be the most persistent.

those authors who disagree with the thesis feel it necessary to reflect on it. See, for instance, Hendrik Spruyt, *The Sovereign State and its Competitors: An Analysis of Systems Change* (Princeton, NJ, 1994).

¹⁷ I borrowed the term "aggregate firepower" from Jeremy Black.

¹⁸ It was not until 1999 that the first general text on Ottoman warfare appeared. See Rhoads Murphey, *Ottoman Warfare, 1500–1700* (New Brunswick, 1999).

¹⁹ The most recent handbook on Ottoman economic history (the first and only such undertaking published in English) hardly mentions the armaments industry. See Halil İnalçık and Donald Quataert eds., *An Economic and Social History of the Ottoman Empire, 1300–1914* (Cambridge, 1994), p. 465. Although some pioneering studies have been available for several decades, and in recent years there is a visible interest in the subject in Turkey, no monographic study of Ottoman weapons technology and war industries exists in any language. For the relevant studies by İsmail Hakkı Uzunçarşılı, Halil İnalçık, Djurdjica Petrović, Colin Heywood, Rhoads Murphey and Mücteba İlgürel see the bibliography. Although Birol Çetin's and Salim Aydüz's Ph.D. dissertations (on the eighteenth- and nineteenth-century gunpowder works, and on the sixteenth-century Istanbul cannon foundry, respectively) were not available to me during the writing of this book, an attempt has been made to include some of their findings during the final revision of this manuscript. Both are traditional institutional histories with valuable information. However, they lack the comparative approach, hardly use the relevant literature in foreign languages, and could have been more thoroughly researched, particularly Çetin's. Birol Çetin, *Osmanlı İmparatorluğu'nda Barut Sanayi, 1700–1900* (Ankara, 2001); Salim Aydüz, "Osmanlı Devleti'nde Tophane-i Amire ve Top Döküm Teknolojisi (XV–XVI. Yüzyıllar)," unpublished Ph.D. dissertation, University of Istanbul, 1998.

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Although the present book tackles many of the above questions, its aim is not to present a simple counter-thesis to previous views, but rather to broaden the scope of our examination by a thorough assessment of Ottoman arms and ammunition production. Based on extensive research in the Turkish archives, this book offers new insights regarding the early success of an Islamic empire against its European adversaries and its subsequent military failure.

Apart from the military aspects, it is hoped that the book will enhance our understanding of the Ottoman economy in general. The weapons and ammunition industries along with the construction of vessels were the only major branches of the early modern Ottoman industry that were managed, controlled and financed by the state. While arms and ammunition production meant challenge and burden for the Ottoman state, war-related industries also could provide important stimuli for the general economy, and could play a significant role in improving existing technologies or acquiring new ones.

From a theoretical and methodological point of view, I follow the emerging literature of the New Military History, which is no longer confined to the narrow study of campaigns and sieges; rather, it examines organized violence as a major challenge to early modern states, their societies and economies. My research also owes much to the pioneering studies of Carlo Maria Cipolla, John Francis Guilmartin, Jr., Bert Hall, William H. McNeill, Geoffrey Parker, and Keith Krause, all of whom have examined the diffusion of gunpowder technology, European arms production and the arms trade. While these works proved to be valuable guides during my research, when it came to the Ottomans, they raised more questions than provided answers. Although my research eventually led me either to disprove or to qualify some of the theses put forward by my scholarly predecessors, they inspired me throughout the process of writing this book, for which I am indebted to all of them.

Challenging Eurocentric and Orientalist views

Following superficially understood Islamic doctrines, authors such as Kenneth M. Setton, Eric L. Jones and Paul Kennedy fault the “extreme conservatism of Islam,”²⁰ the “military despotism,” which “militated against the borrowing of western techniques and against native inventiveness,”²¹ or the “cultural and technological conservatism,” for the failure of Islamic civilizations to keep pace with western

²⁰ Kenneth Meyer Setton, *Venice, Austria, and the Turks in the Seventeenth Century* (Philadelphia, PA, 1991), pp. 6, 100, 450. For its critique see Rhoads Murphey’s review in *ArchOtt* 13 (1993–94), 371–83. Setton places too much emphasis on the impact of religion. He argues that “the Spanish were caught in an era of religious bigotry, the Turks in a renewal of Islamic fanaticism, and neither people could keep abreast of the technological innovations which had been altering European society from at least the mid-sixteenth century” (*ibid.*, p. 6).

²¹ E. L. Jones, *The European Miracle: Environments, Economies, and Geopolitics in the History of Europe and Asia* (Cambridge and New York, 1987), p. 181. (The book’s third edition was published in 2003 showing that his Eurocentric views are still very much in demand.)

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military technology.²² Others advocate an East–West technological divergence and western technological superiority from the mid-fifteenth or late sixteenth century onward.²³ Along the lines of the traditional view of “Ottoman decline,” some students of Middle Eastern history claim that “the Ottomans lagged behind the West in weaponry and fighting techniques” as early as the end of the sixteenth century.²⁴ In several of his works, Bernard Lewis repeats his notions concerning the Muslims’ (chronologically unspecified) ignorance, their technological inferiority vis-à-vis the (unqualified) “West,” as well as their continued reliance on “foreign” technology and know-how. The chronology and reasons for the failure of the “Islamic world” to keep up with the “West” are seldom presented and the successes of “Islamic war departments” are mentioned only cursorily, as if they were mere exceptions to the dominant picture of continuous decline, inferiority and setbacks.²⁵

Examining the spread of firearms technology in Euro-Asia in chapter 2 shows that the adoption or rejection of firearms technology by Islamic societies had very little to do with Islam. Rather, it was a decision of the political and military elites of the respective societies, and was influenced by the social fabrics, economic capabilities, geopolitical realities and constraints, as well as by military and political objectives. The Ottomans were far from being prisoners of the “extreme conservatism of Islam” as suggested by the representatives of the traditional Eurocentric school. Chapter 2 provides ample cases regarding the continued Ottoman receptivity to new ideas and western military technology well into the seventeenth century. It also shows that the pragmatism of the fourteenth- and fifteenth-century Ottoman rulers made it relatively easy to adopt firearms technology and to come up with the organizational frameworks necessary to integrate and operate these weapons. Continuous military conflict with European armies equipped with firearms, as well as the existence of strong fortresses in the Byzantine Empire, in the Mediterranean and in Hungary, forced the Ottomans to adjust their weapons technology and tactics to these challenges. Military encounters with European troops and navies, as

²² Kennedy, *Great Powers*, p. 12.

²³ Cipolla, *Guns, Sails, and Empires*, p. 98. Cf. Victor Davis Hanson, *Carnage and Culture: Landmark Battles in the Rise of Western Power* (New York, 2001), pp. 254–55, where he claims that “the Ottomans increasingly looked westward, not merely for additional slaves and plunder but also for European weaponry and manufactured goods.”

²⁴ Arthur Goldschmidt, *A Concise History of the Middle East* (Boulder, CO, 2002), p. 140. Although the notion of “Ottoman decline” resurfaces from time to time in the generalist literature, very few students of the Empire would adhere to the traditional notion of decline nowadays. See Douglas A. Howard, “Ottoman Historiography and the Literature of ‘Decline’ of the Sixteenth and Seventeenth Centuries,” *Journal of Asian History* 22, 1 (1988), 52–77; Douglas A. Howard, “With Gibbon in the Garden: Decline, Death and The Sick Man of Europe,” *Fides et Historia* 26, 1 (1994), 22–34; Linda Darling, *Revenue-Raising and Legitimacy: Tax Collection and Finance Administration in the Ottoman Empire, 1560–1660* (Leiden, 1996), pp. 1–21; Cemal Kafadar, “The Question of Ottoman Decline,” *Harvard Middle Eastern and Islamic Review* 4, 1–2 (1997–98), 30–75.

²⁵ Bernard Lewis, *Muslim Discovery of Europe* (London, 1982; reprint 1994), p. 223; Bernard Lewis, *What Went Wrong? The Clash between Islam and Modernity in the Middle East* (New York, 2002), p. 13.

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well as contraband trade in weaponry, fostered the diffusion of military technology and know-how. When Ottoman technological receptivity was coupled with mass-production capabilities and superior Ottoman logistics, the Sultans' armies gained clear firepower superiority over their immediate European opponents by the mid-fifteenth century. Comparative data presented in the following chapters suggest that the Ottomans were able to maintain their firepower and logistical superiority against the Austrian Habsburgs and Venetians until the very end of the seventeenth century.

Chapter 2 also demonstrates that European–Ottoman military acculturation did not end in the sixteenth century. When at the end of the century Ottoman leaders realized that the Europeans outperformed the Sultan's soldiers in the use of hand-held firearms on the Hungarian front, the Grand Vizier and a clear-sighted observer both advocated the more massive use of firearms and encouraged the introduction of adequate countermeasures in tactics, along with suggestions for restructuring the army. The employment of European military experts (captives, renegades and adventurers) by the Ottomans continued into the eighteenth century. Since there were no revolutionary innovations in European firearms technology until the very end of the eighteenth century, the continuous (if somewhat delayed) transfer of European technology and know-how, and, more importantly, the Ottomans' logistical strength, were sufficient for keeping pace with Europe until the end of the seventeenth century.

Chapter 3 examines the weapons the Ottomans manufactured and used. The main objective of this chapter is to understand the bewildering terminology of Ottoman weapons and to offer a classification of Ottoman cannons that provides a basis for a comparative analysis of Ottoman and European cannons. Comparing Ottoman and European artillery pieces, the chapter challenges the notion that early modern Ottoman artillery was dominated by giant cannons, and shows that from the sixteenth through the eighteenth centuries the Ottomans used a large variety of cannons – from the smallest pieces that fired projectiles of 30–500 g to the largest *balyemez* and *şayka* guns of the cannon class firing shots of 31–74 kg in weight. In the fifteenth and early sixteenth centuries, while a number of exceptionally large bombards (hurling cut stones of more than 100 kg) were made and deployed in some of the Empire's key forts, medium- and small-caliber pieces were mostly predominant in fortresses. Among the smallest pieces *şakalozes*, the Ottoman variant of the Hungarian *szakállas* and of the German *Hackenbüchse*, were the most popular weapons – as were the *szakállas* in the Hungarian, Croatian and Austrian forts – and were the most practical and effective anti-personnel weapons deployed on both sides of the military border. Archival evidence demonstrates that the majority of Ottoman cannons designated as siege or battering guns (literarily “castle-smasher” or *kale-kob*) were also considerably smaller pieces than is assumed in the generalist literature. Such guns fired projectiles of 15–20 kg in weight, and they are not only comparable to the European guns of the culverin/*Karthaun* class, but also were often smaller in caliber than some of the Spanish and Austrian siege cannons.

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The most commonly used Ottoman “battering guns” (*darbzen*) fired shots of only 0.15–2.5 kg in weight. While the Ottomans – similarly to other Mediterranean nations – reserved some of their large stone-throwing pieces as center-line bow guns on their flagships, the majority of guns deployed aboard their galleons were small-caliber bronze pieces whose projectiles weighed between 3.7 and 8.6 kg. Most of the guns aboard the boats of the Ottoman river flotillas consisted of even smaller cast-iron guns that weighed only 20–40 kg and fired projectiles of usually less than 500 g.

In short, comparisons of Ottoman and Habsburg mortars as well as of Ottoman, Spanish and Venetian siege cannons and shipboard artillery suggest that Ottoman and European weapons were more similar than had been assumed. Since in the sixteenth and seventeenth centuries the Ottomans had continued to cast their large- and medium-caliber pieces of bronze – mainly because the Empire possessed abundant copper ore deposits – their guns were not only lighter than the cast-iron Austrian, Spanish or English pieces of similar caliber, but also safer. A comparative study of Ottoman hand firearms used by the Janissaries, that is, the Sultans’ elite infantry troops, shows that they were similar to the muskets the Ottomans’ Spanish and Venetian opponents used. For instance, the Ottomans adopted the Spanish *miquelet* lock. Despite these similarities, however, the chapter also reveals important differences, and argues that one field where the Ottomans lagged behind their European opponents was the lack of standardization. While standardization was hardly accomplished by the Europeans in general, the Austrians, and especially later the Russians, had considerably fewer caliber types within a certain class than the Ottomans did. This certainly made supply of ammunition a more difficult task in the Empire, and also hindered tactical reforms.

Chapters 4, 5 and 6 are devoted to the study of the Ottoman weapons industry: saltpeter and gunpowder manufacturing, and cannon casting. These chapters question the “dependency theory,” which claims that the Ottomans failed to establish an indigenous arms industry capable of meeting the needs of the Sultan’s army. According to Keith Krause the Ottomans were “third-tier producers” and “relied heavily on imported weapons and technologies.”²⁶ Others have suggested that after the battle of Lepanto (1571), which saw the (almost total) destruction of the Ottoman navy and shipboard artillery, the Ottomans became more and more dependent on foreign, especially English and Dutch, imports of weaponry and gunpowder. When the channels of this arms trade clogged up in the 1660s, the Ottoman troops and navies experienced difficulties in their supply. This in turn led

²⁶ Krause, *Arms and the State*, pp. 48–52. These views are repeated by Jonathan Grant who claims that the Ottomans remained a “third-tier producer” country through the eighteenth century and possessed capabilities only comparable to their similarly “third-tier producer” immediate rivals (Hungary, Poland, and the medieval Balkan states). See his “Rethinking the Ottoman ‘Decline’: Military Technology Diffusion in the Ottoman Empire, Fifteenth to Eighteenth Centuries,” *Journal of World History* 10, 1 (1999), 179–201. Geoffrey Parker in his earlier works also suggested that the Ottomans “experienced difficulty in mass-producing.” However, in light of new research he modified his views and this statement was removed in the 1999 edition of his book. See Parker, *The Military Revolution*, p. 126 (in both editions).