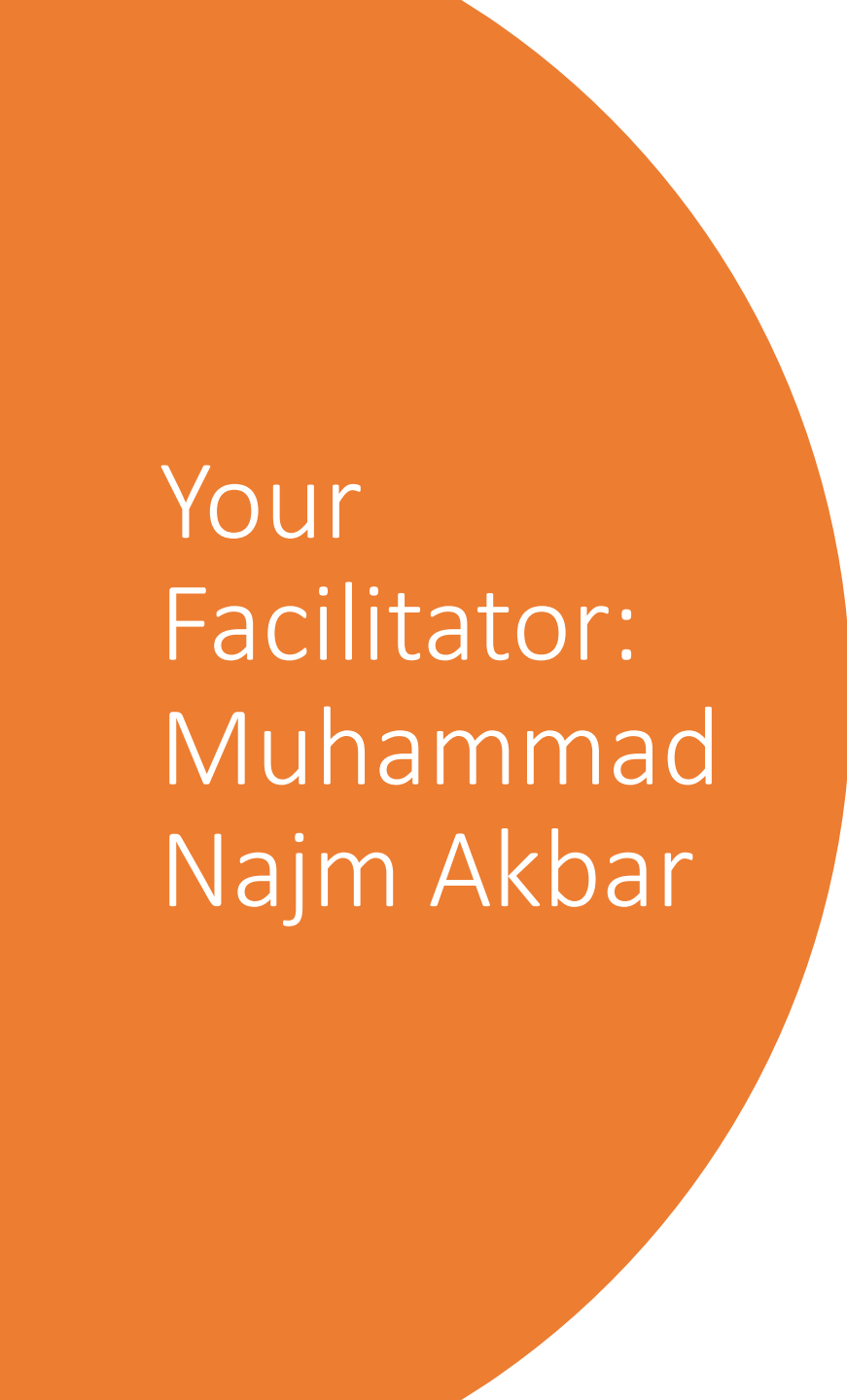




Industrial Revolution

Muhammad Najm Akbar

makbar@mpc.edu

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Your Facilitator: Muhammad Najm Akbar

- I have been teaching since 2005 but this is my third teaching assignment at MPC and in history.
- I have an MA in History from Fresno State, 2022, and two graduate degrees in International Relations from Tufts University, 1995 and 2011.

Pakistan is the country of my birth. I had my undergraduate level of education there until 1979 when I completed sixteen years of learning with a degree in English Literature.

I have lived and worked or studied in Massachusetts, New York, Virginia, and California.

History has been my passion since I began my education in the late 1960s and continues to be a lifelong pursuit.

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The Industrial Revolution

I want to begin with the story of two scholars and two books and connect them to what we are trying to understand today.

In the 18th century, there lived in England an ecclesiastic scholar. His name was Reverend Thomas Robert Malthus (1766-1834). Reverend Malthus had a deep interest in economics. He made a determined effort to understand the factors that influenced human happiness and progress. Looking at the economic conditions prevailing up to the end of the 18th century, until exactly 1798.

This is where I would like to introduce the second scholar and his book, A Farewell to Alms, A Brief Economic History of the World. A UC Davis historian Gregory Clark published it in 2007 and taught a course on the Industrial Revolution which is now available on [YouTube](#).

Malthusian Model

- Reverent Thomas Malthus [An Essay on the Principle of Population](#) (1798).

AN ESSAY ON



THE PRINCIPLE
OF POPULATION

THOMAS
MALTHUS

Clark's Research

- Gregory Clark defined the Malthusian thought as enunciating that before 1800 economic policy was turned on its head: vice was a virtue, and virtue a vice. What he meant was it before 1800, all those elements that characterize failed modern states, such as “war, violence, disorder, harvest failure, collapsed public infrastructures, bad sanitation- were the friends of mankind before 1800. They reduced population pressures and increased material living standards. In contrast, policies beloved of the World Bank and the United Nations today- peace, stability, order, public health, transfer to the poor- were the enemies of prosperity. They generated the population growth that impoverished societies, (Clark P5).
- Let us see why Clark reached that conclusion.

Malthusian Model

- In 1798 which means technically by the fourth decade of the period we broadly label as the Industrial Revolution; Malthus had no idea that he was living through a momentous period. He determined, taking a long view of the world economy, that the economy of humans in the years up to 1798 turned out to be just the natural economy of all animal species, with the same kind of factors determining the living conditions of animals and humans.
- The scholars later labeled that situation as the Malthusian Trap.

Malthusian Trap

- Reverend Malthus wrote his essay in search of “truth,” and for “the future improvement of society.” His understanding was that to attain that objective, the population must always be kept down to the level of the means of subsistence. He thought, “the biggest obstacle in the way to any very great improvement of society,” had to be removed to attain human welfare.
- In Chapter One, he admits that the 18th century, was “a period big with the most important changes.” These changes, he thought, could in some years be decisive for the future of mankind. His concern was “whether man shall henceforth start forwards with accelerated velocity towards illimitable, and hitherto unconceived improvement, or be condemned to a perpetual oscillation between happiness and misery from and after every effort remains still at an immeasurable distance from the wished-for all goal.”

Malthusian Trap

- Malthus postulated his realistic diagnosis of the absence of “perfectibility of society” and formed, in his words, “two postulata,”
 - “First, that food is necessary to the existence of man.
 - Second, that the passion between the sexes is necessary and will remain nearly in its present state.”
- These were, he argued, fixed laws of human nature and implied that “the power of population is indefinitely greater than the power in the earth to produce subsistence for man. A population, when unchecked, increases in a geometrical ratio. Subsistence increases in an arithmetical ratio.”

Malthusian Trap

Malthus believed that the effects of these two unequal powers, population, and production, must be kept equal which required a strong and constantly operating check on the population. He explains, “This natural inequality of the two powers of population and production in the earth, and that great law of our nature which must constantly keep their effects equal form the great difficulty that to me appears insurmountable in the way to the perfectibility of society.”

Malthus believed that the superior power of the population “cannot be checked without producing misery or vice, the ample portion of these two bitter ingredients in the cup of human life in the continuance of the physical causes that seemed to have produced them bear too convincing a testimony,” (Chapter 2).

What did the Industrial Revolution Achieve?

Clark argues that “the logic of the Malthusian model matches the empirical evidence for the pre-industrial world. While even long before the Industrial Revolution small elites had an opulent lifestyle, the average person in 1800 was no better off than his or her ancestors of the Paleolithic or Neolithic,” (P 5).

Clark postulated that the Industrial Revolution shattered the stasis of the preindustrial, Malthusian world. It produced for the first time “economic growth fueled by increasing production efficiency made possible by advances in knowledge.” The Industrial Revolution secured efficiency advances which translated into “the astonishing rise of income per person that we have seen since 1800,” (P 8). Essentially, England experienced accelerated growth of per capita output and labor productivity from 1763 to 1860.

How did the Industrial Revolution Happen?

- A Revolution means a sudden, radical, and complete change.
- Clark believes that the Industrial Revolution was not “a sudden fissure in economic life.” In his view, “the classic Industrial Revolution in England in 1760-1860 was a blip, an accident, superimposed on a longer-running upward sweep in the rate of knowledge accumulation that had its origins in the Middle Ages or even earlier,” (P. 10).
- He considers that an evolutionary account of gradual changes spread over the period between 1200 and 1860 in Europe, is a more plausible explanation, (P 10).
- The Industrial Revolution had as its components the Agricultural Revolution, Transport Revolution, and Technological Revolution.

What Does the Industrial Revolution Mean?

Patrick K. O' Brien in his article of 2010 published by MIT Press, titled Deconstructing the British Industrial Revolution as a Conjecture and Paradigm for Global Economic History distilled the following features of the First Industrial Revolution:

A range of innovations of world significance

The steam engines of Newcomen and Watt,

Henry Cort's path-breaking technique for puddling iron,

The weaving machines of Kay and Cartwright.

He categorized them as novel and indigenous to the British Isles.

However, a few others such as the invention of roller spinning, Wedgwood's "China," or the techniques used to manufacture, bleach, dye, and print cotton cloth, he discovered, was no longer acclaimed as peculiarly "English" (P. 15).

What Led to the Industrial Revolution?

Patrick O'Brien includes the following as the significant causes or origins of the First Industrial Revolution:

The kingdom's highly productive and responsive agriculture;

Its abundant and accessible supplies of minerals, particularly coal;

Foreign trade, sustained by massive and cost-effective state investment in naval power. He emphasizes, "It occurred largely because of the Island state's favorable national endowments and massive investments in naval power" and,

Technological discovery and innovation, (P 24). Textile, mining, and smelting sectors benefitted enormously.

Great Inventors

- The following is a timeline and list of important dates of the Industrial Revolution:
- 1712:
Thomas Newcomen invents the first productive steam engine.
- 1719:
John Lombe opens the first silk-throwing factory in Great Britain in Derby.
- 1733:
James Kay invents a simple weaving machine called the Flying Shuttle. **The textile industry thrives because of innovations like this and others that followed.**
- 1755:
Professor William Cullen designs a small refrigerator machine at the University of Glasgow.
- 1764:
James Hargreaves invents the Spinning Jenny, which allows workers to produce multiple spools of thread at the same time.
- 1769:
James Watt patents his revision of the steam engine, which features a separate condenser.

Great Inventors

- 1779:
Samuel Crompton invents the spinning mule, which combines spinning and weaving into one machine.
- 1785:
Edmund Cartwright invents the power loom, which replaces the flying shuttle.
Henry Cort invents iron refining techniques.
- 1787:
Beverly Cotton Manufactory, the first cotton mill in America, opens in Beverly Massachusetts and is powered by horses.
- 1790:
On December 20, 1790, Samuel Slater opens his first textile mill in Rhode Island, which is the first American factory to successfully produce cotton yarn using water-powered machines.
- 1793:
Eli Whitney, an American, invents the cotton gin which greatly increases the production of cotton.

Great Inventors

- 1801:
On December 24, 1801, Richard Trevithick test drives the world's first steam-powered locomotive, called the "Puffing Devil" or "Puffer" on the streets of Camborne, England.
- 1802:
An American farmer, Thomas Moore, invents the first wooden ice box.
On March 24, 1802, Richard Trevithick patents his steam-powered locomotive called the "Puffer Devil."

How Did the Innovations Have an Impact?

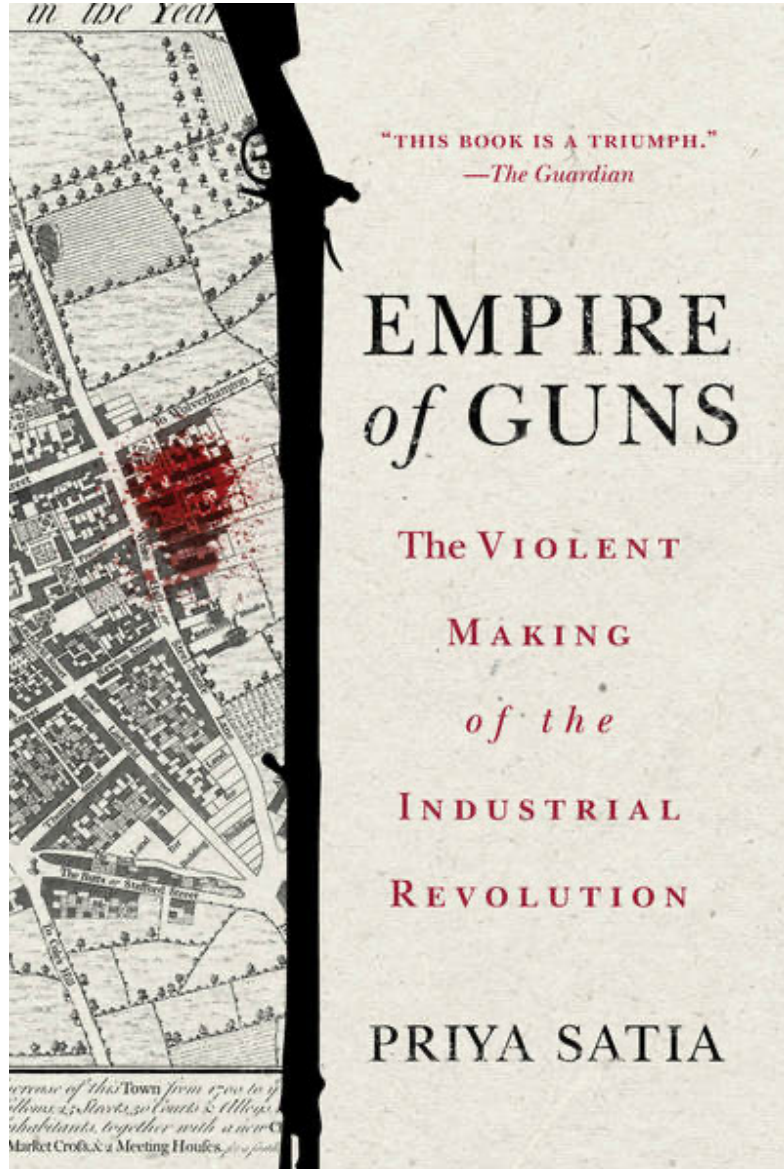
International trade, interlinked with the British Naval power, was a major contributor to the Industrial Revolution.

O'Brien points out that over the eighteenth century, the volume of goods sold overseas multiplied four times compared to a multiplier of over just two from 1500 to 1700.

Ratios of exports to gross national product increased from a little over 4 percent in the reign of Elizabeth (1558-1603), to 6 percent after the Restoration, beginning 1660, to 8 percent at the Glorious Revolution (1688), and reached 12 percent under George III (1760-1820).

At least half of the increase in industrial production during the long eighteenth century (1688 – 1815) was sold overseas.

Increasingly urban, British industrial labor provided manpower while facing challenging working and living conditions and yet held on to the prospects of a rising middle class and prosperous family structures.



How Did the Innovations Have an Impact?

- International trade, interlinked with the British Naval power, was a major contributor to the Industrial Revolution.
- A Stanford Professor of International History, Priya Satia, published [Empire of Guns: The Violent Making of the Industrial Revolution](#) in 2019, exploring the reasons and the scale that crucial inventions like the steam engine, puddling, iron smelting, and weaving had achieved.
- Stanford Press introduces her book as exploring, “the true root of economic and industrial expansion: the lucrative military contracting that enabled the country's near-constant state of war in the eighteenth century. Demand for the guns and other war materials that allowed British armies, navies, mercenaries, traders, settlers, and adventurers to conquer an immense share of the globe, in turn, drove the rise of innumerable associated industries, from metalworking to banking.”

How Did the Innovations Have an Impact?

- Contrary to the classical view, Satia believes that instead of steam engines assisting the war effort, “war had assisted the spread of steam engine. These inventions- steam engines, lathes, and the puddling process, facilitated the rise of large-scale industry. They were interdependent and mutually reinforcing, and the state stood at the center of the networks around them. Major turning points of the Industrial Revolution steam engine, puddling, and copper sheeting- were triggered by war and produced by networks of contractor-industrialists, (P 161).

War and the Industrial Revolution

Satia argued that war was foundational to modern industrial life. Britain, she pointed out, was involved in major military operations 87 of the years between 1688 and 1815, declaring war against foreign powers no fewer than eight times...”

Because the war was the norm in this period, “... and it shaped the economy....” the British state, being the single most important factor in the economy, the largest borrower and spender and employer played a crucial part in it. The state, she emphasizes, was a consuming entity, supporting private industry through bulk purchases at critical times. It cut a wide swath as a consumer, literally investing Britons in its war-making (P2).

In this environment, the arms maker morphed from a morally unremarkable participant in industrialization to a uniquely villainous merchant of death, (P3).

Military-Industrial Complex

The military-industry society, a collective of interdependent economic actors tied in varying ways to the state, in which there was no economic space not in some way connected to war, (P7).

The diverse gun makers needed the authorities to “ensure their interest in businesses bearing on supply and carriage-canal construction, banking, trade to Africa in the New World, and so on. Likewise, businessmen from those worlds became invested and involved in the gun trade,” (P 100).

The nation stood for the gun industry, and the gun industry stood for the nation. In the wars of the second half of the century, in fits and starts, the Ordnance Office shaped revolutionary change in an industry central to the making of the state, the nation, and the empire.” (P 101).

Military-Industrial Complex

The way gun makers operated was “a kind of virtual factory: a highly subdivided and efficient system of mass production, but too inclusive to house under a single roof. Well before the era of machine production, these factories together produced the standard British military arm in millions,” (P 100).

The government enabled this development of the scale of production throughout the three major wars Britain fought in the second half of the 18th century: the Seven Years’ War, the American War, and the French Revolutionary and Napoleonic Wars, (P.101).

Military-Industrial Complex

The British denied similar growth in their colonies if possibilities existed there. East India Company, for example, understood that arms manufacture was triggering revolutionary change at home, and refused to encourage the local industry which had been one of its suppliers, (P7).

“While military purchasing driven by Britain’s aggressive colonial expansion incited industrial revolution at home, British officials abroad intentionally stymied similar transformation in the colonies,” (P 176).

Military-Industrial Complex: the Ordnance Office

The Ordnance Office worked towards dramatically expanding the trade's productive capacity to secure the arms the Kingdom needed in its ever-larger conflicts and produce mass quantities, (P 102).

The dialogue between contractors and the state on prices and patterns improved the efficiency of mass production. Government offices led the way in many key innovations in key industries. Association with government contracts and innovations is a “common factor behind the pivotal organizational and technological breakthroughs of the time. War demand for mass quantities on standard patterns stimulated forms of production larger in scale, more complex, and more administratively demanding than those in civilian life. It posed organizational challenges that these industries would not otherwise have faced, fueling experimentation and change,” (P 180).

War Needs and the Industrial Revolution

During the Seven Years' War, Britain provisioned 96% of the combined army of British, Prussians, and other allied forces, numbering more than 100,000, plus 70,000 British sailors and soldiers at sea and in the Americas. No previous 18th-century army had exceeded 80,000, (P 108).

Stores were constantly being depleted because the post-seventeen-sixty-three peace was purely notional. The Seven Years' War flipped the British state into a condition of almost permanent warfare for half a century, (P 110).

War Needs and the Industrial Revolution

From 1688 to 1815, roughly 80% of public expenditure was for military purchasing. Arms and ammunition accounted for only four to 5% of that.

This means that whatever 18th-century industrial business you were in, you probably made something the government needed for war. We know the broad array of businesspeople with a stake in the gun trade, imagine a similarly wide net for each of these businesses with significant shares of military demand.

British military expenditures headed the European league tables on a per capita basis, and Britain was the site of the Industrial Revolution. These were not coincidental but deeply interconnected developments,” (P 167).

War Needs and the Industrial Revolution

O'Brien's research reinforces Satia's argument. He points out that by the close of the Seven Years' War, something like half of the nation's nonagricultural workforce depended directly or indirectly on markets overseas for its livelihood. As pôles de croissants, London, Bristol, Hull, Glasgow, Newcastle, Liverpool, and other maritime cities provided infrastructures, skilled workforces, and transportation and distribution networks to service internally as well as overseas trade. The country's geographically conditioned but sustained commitment to a naval strategy for the defense of the realm carried unintended but important consequences for the development of a leading maritime public-cum-private sector of the British economy over time (P 35).

War Needs and the Industrial Revolution

O'Brien also emphasizes that not long after the Hundred Years War (1337 – 1453), England's kings, aristocrats, and merchants began to conceive of naval power, funded and sustained by the state, as the first line of defense against external threats and as the force required to back conquest and commerce with continents outside Europe (P 36).

After the restoration of the monarchy and aristocracy in 1660, Britain's elite sustained the political consensus required to form a highly effective fiscal naval state.

War and the Industrial Revolution

Satia affirms that the government war demand built up the economic sectors that we know as “private” industry and finance.

Contracting was foundational to the first industrial economy. Government-induced investment was critical to the rapid application and development of ideas that had been the subject of experimental interest; it drove substantive progress in heavy metal industries, steam power, and textiles. British merchants and manufacturers’ ability to provide the ships, cannons, guns, food, transport, and finance that the state needed depended on the Industrial Revolution.

The Industrial Revolution was about reorganization and expansion of industry as much as it was about technological change, often driven by the state,” (P 176).

Conclusion

- The Industrial Revolution was a watershed moment in the British and World history.
- It enabled British industry to attain a worldwide reach because the British Naval power created demand and colonialism ensured supplies of raw materials and markets for manufactured goods including textiles and guns.
- Most significantly, it shattered the Malthusian Trap and enabled production and efficiencies to rise and translate into economic growth and income per capita.
- Industrial labor faced difficulties but also discovered upward paths for social mobility and better family life.