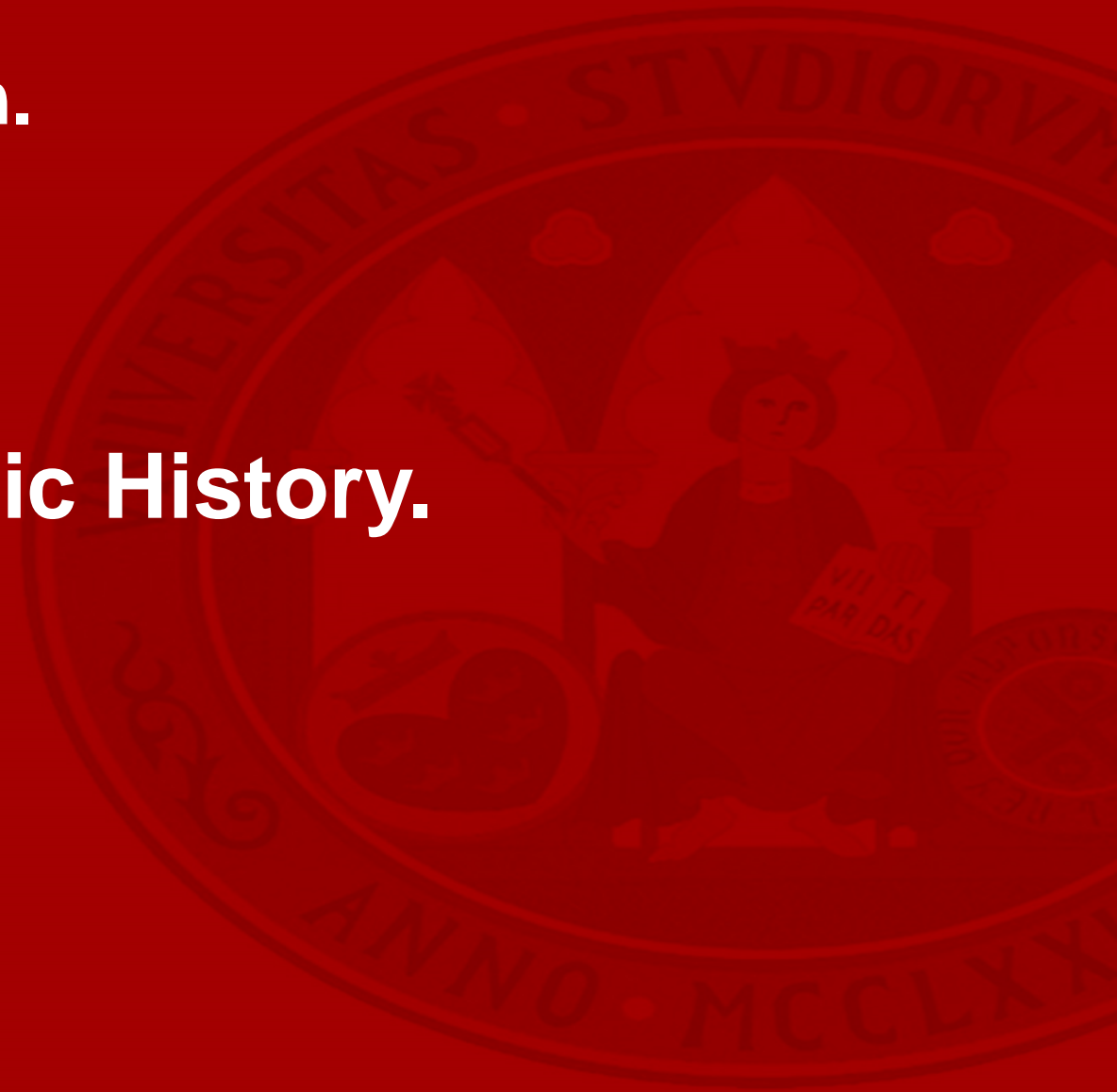


UNIT 2. The Industrial Revolution.

(2478) Economic History.



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- **2. The Industrial Revolution.**
- **2.1. Introduction.**
- **2.2. Basic Determinants of the Industrial Revolution.**
- **2.3. The Industrial Revolution and its Patterns of Development.**
- **2.4. Industrialization in Spain.**
- **2. 5. Conclusions.**



Textbook:

- ALLEN, Robert. 2011. Global Economic History: A Very Short Introduction (Very Short Introductions), Oxford University Press, 27-30.

Other References:

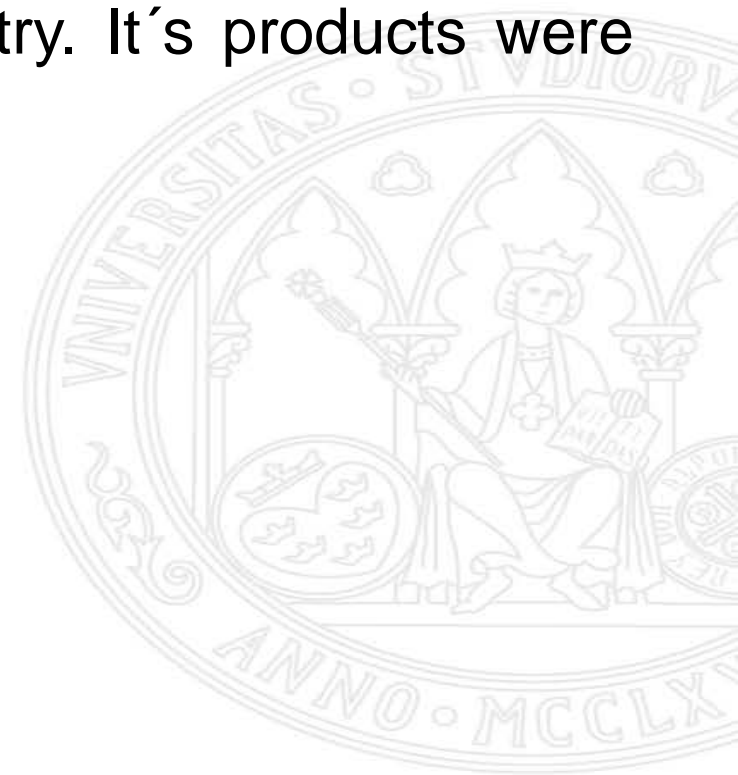
- ALLEN, Robert. 2009. Why was the Industrial Revolution British? [http://www.voxeu.org/article/why-was-industrial-revolution-british].
- GRIGG, David. 1992. The Transformation of Agriculture in the West, Blackwell Publishers, p. 6 [Table 1.1].
- PINKER, Steven. 2011. “A History of Violence. Edge Master Class” Edge.org [https://www.edge.org/conversation/steven_pinker-a-history-of-violence-edge-master-class-2011] .

- **1.1 Introduction:**
- To introduce UNIT 2, please watch the following video in which R. Allen discusses why Britain became industrialized while other countries did not [<https://www.youtube.com/watch?v=-vyNOWxp4rt4>].
- This clip is part of The CORE project. CORE is an open-access, interactive ebook-based course for anyone interested in learning about the economy and economics [<http://www.core-econ.org/>].

- **2.2. Basic Determinants of the Industrial Revolution.**
- The Industrial Revolution (IR) was the result of the transformation of the early modern economy.
 - England: high wages and salaries, low energy prices.
- (Allen, 2009). Britain's creative response to the challenges and opportunities created by the global economy that emerged after 1500.
 - 1st step: Britain took a commanding position in the extensive market that emerged.
 - 16th – 17th C.: The British wool textile industry competed with the established producers in Italy and the Low Countries.

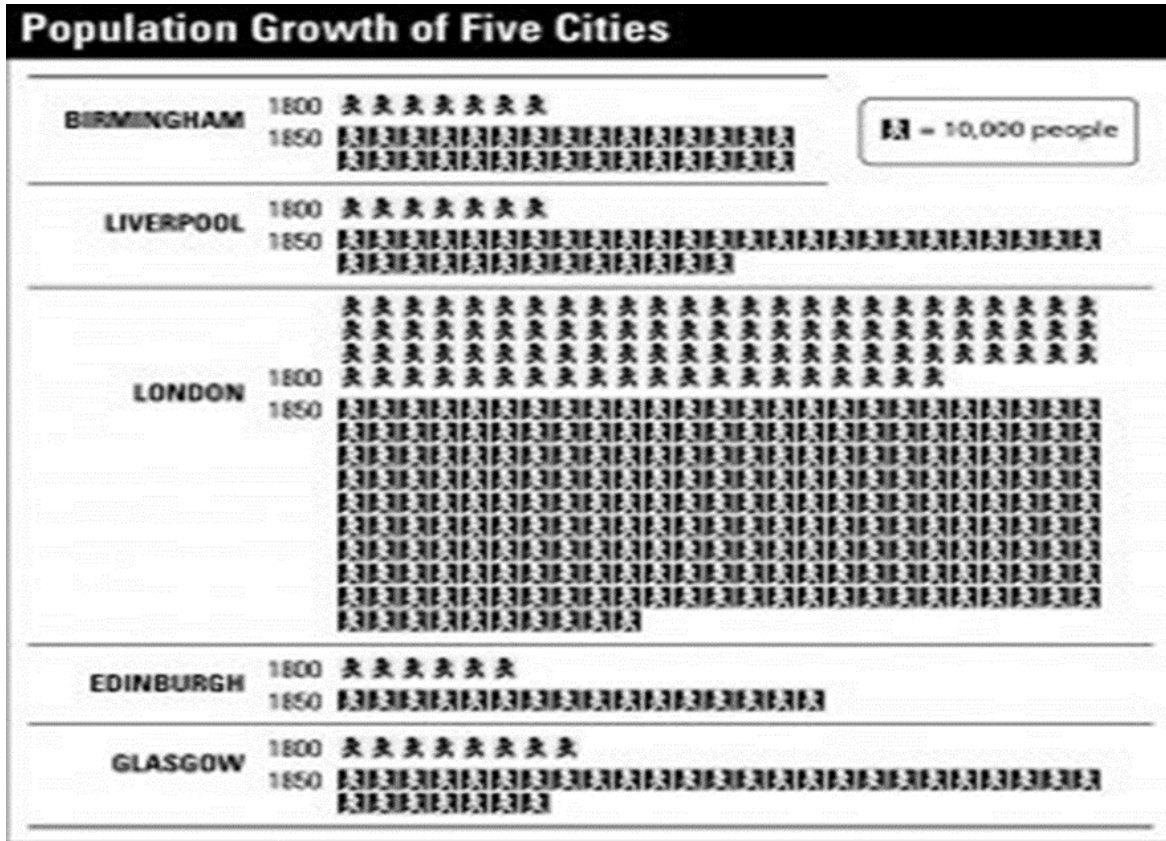
- **2.2. Basic Determinants of the Industrial Revolution.**
- 1st step: Britain took a commanding position in the extensive market that emerged.
 - 17th -18th C.: Britain extended her lead by expanding intercontinental trade:
 - Acquisition of colonies.
 - Mercantilism.
 - Trade promotion.
 - Naval power.
- 2nd step: Britain's success in the expansion of rural manufacturing industries and rapid urbanization.
 - The transformation of agriculture (see Table 1.1. Grigg, 1992).

- **2.2.1. Cultural and Political context.**
- East Anglia was the centre of the woollen cloth industry. It's products were exported to London.



UNIT 2.2. Basic Determinants of the Industrial Revolution.

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2.2.1. Cultural and Political context.

London's Population:

1500: 50,000

1600: 200,000

1700: 500,000

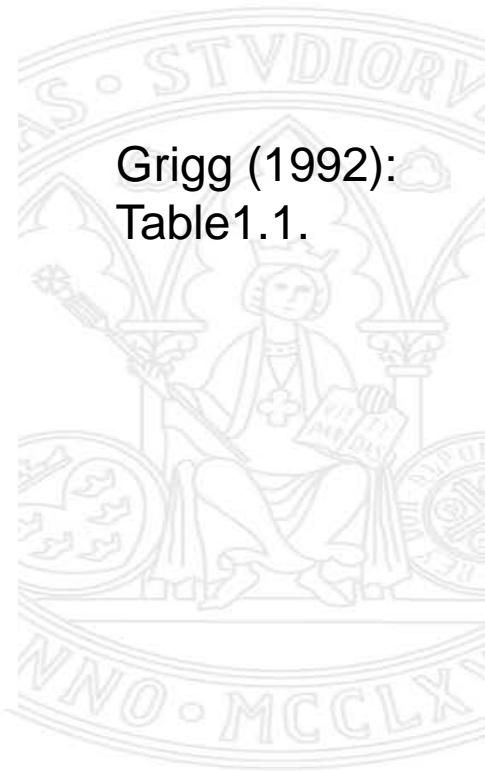
1800: + 1,000,000

<https://studentmadehistory.wordpress.com/2015/05/20/what-impacts-did-the-industrial-revolution-have-on-population-and-urbanization-by-abdullahi-mohammed-jesus-alvares-and-fluffy-hernandez/>

UNIT 2.2. Basic Determinants of the Industrial Revolution.

<u>Characteristics of Traditional and Modern Agriculture</u>		
	Traditional	Modern
Percentage of produce sold off farm	less than 50%	More than 50%
Percentage of inputs purchased	less than 10%	More than 30%
Percentage of workforce in agriculture	More than 70%	Less than 10%
Crop yields	1000 – 2000 kg per hectare	4000 kg and over per hectare
Source of fertilisers	animal. residues, Waste, legumes, Bones, etc	Chemical fertilisers
Weed and pest control	Rotations, inter-cropping, fallowing, biological control	Herbicides and pesticides
Labour input per		

Grigg (1992):
Table 1.1.



UNIT 2.2. Basic Determinants of the Industrial Revolution.

Weed and pest control	Rotations, inter-cropping, fallowing, biological control	Herbicides and pesticides
Labour input per Hectare	High	Low
Land per capita of Workforce	Low	High
Source of power	Human and Animal muscle	Tractors and electricity
Degree of Specialization	Low	High
Leading inputs	Land and Labour	Capital

Grigg (1992):
Table 1.1.

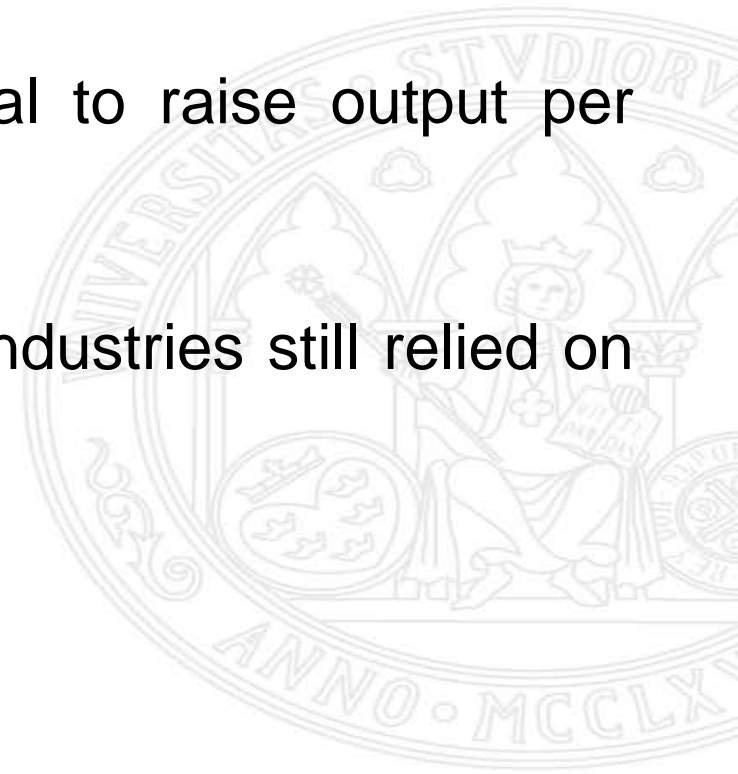


- **2.2.1 Cultural and Political Context.**

- The growth of British commerce had three important consequences (R. Allen, 2009):
 - 1. The growth of London created a shortage of firewood that was only relieved by the use of coal.
 - 2. The growth of cities and manufacturing increased the demand of labor
 - British wages and living standards were the highest in the world.
 - Beer, bread and beef.
 - 3. The growth of cities and wages stimulated agriculture.

- **2.2.1 Cultural and Political Context.**
- The IR was a turning point in world history.
 - A new era of sustained economic growth (1760-1850).
- The IR was the result of the transformation of the early modern economy.
 - 1.5% growth per year (1760 [1776]).
 - It was not the abrupt discontinuity that its name suggests.
- Technological change was the driving force behind the IR.
 - Inventions, innovations, new products:
 - were responses to the high wages and cheap energy of the British economy.
 - meant labor was replaced with capital and energy.

- **2.2.1 Cultural and Political Context.**
- Examples:
- **Steam engines** increased the use of capital and coal to raise output per worker.
 - Even with the invention of the steam engine, most industries still relied on wind and water power, horsepower and manpower.
- The steam engine was applied to transportation:
 - Railway.
 - Steamship.



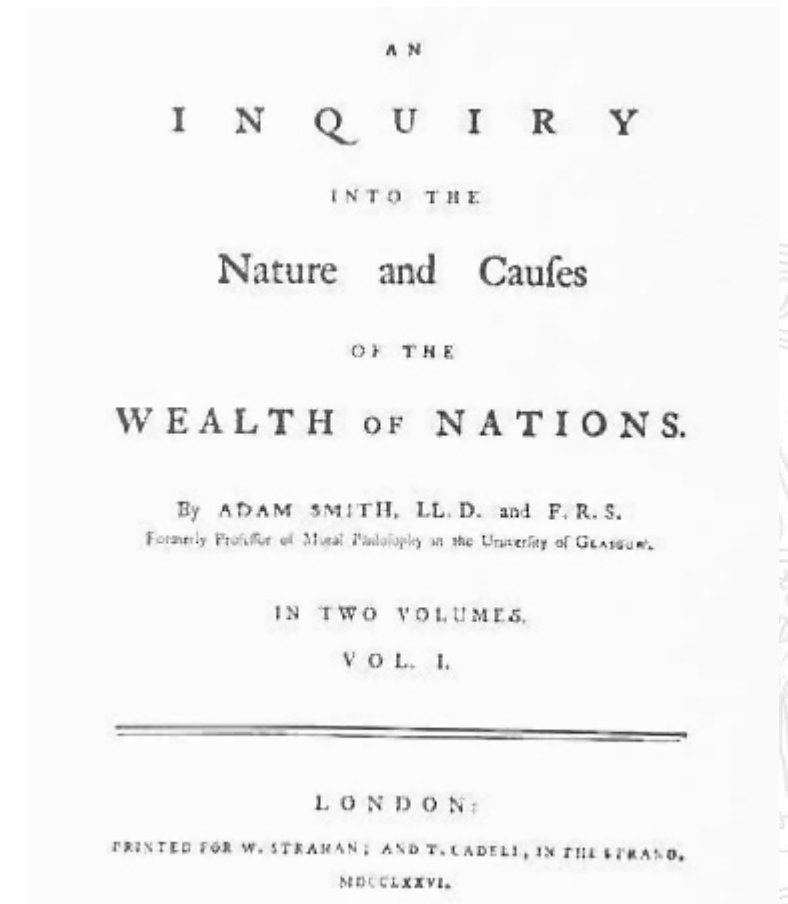
- **2.2.1 Cultural and Political Context.**
- Examples:
- **Cotton mills** used machines to raise labor productivity in spinning and weaving.
- New iron-industry technologies replaced expensive charcoal with cheap coal and mechanized production to increase output per worker.
- There were a host of simpler machines [[* division of labor *]] that raised labor productivity in less glamorous industries.

- **2.2.1 Cultural and Political Context.**
- Examples:
- Simple machines [**division of labor**] raised labor productivity in less glamorous industries.
 - Hats.
 - Pins.
 - Nails.



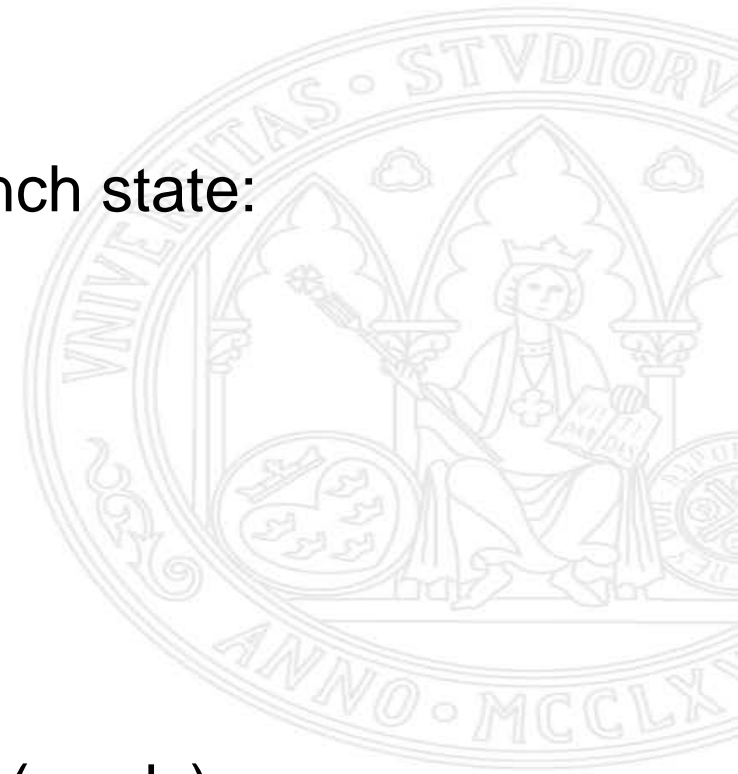
Source: Women working in the wiring hall of a hat factory, New York City, 1863. (Photo by Three Lions/Hulton Archive/Getty Images) [<http://www.gettyimages.es/detail/fotograf%C3%ADa-de-noticias/women-working-in-the-wiring-hall-of-a-hat-fotograf%C3%ADa-de-noticias/102171477#women-working-in-the-wiring-hall-of-a-hat-factory-new-york-city-1863-picture-id102171477>]

- **What was the division of labor?.**
- According Adam Smith (1776), the main cause of prosperity was increasing the division of labor.
- Smith asserted that ten workers could produce **48,000 pins per day** if each of eighteen specialized tasks was assigned to a particular worker. Average productivity: 4,800 pins per worker per day. But without the division of labor, a worker would be lucky to produce even **one pin per day**.

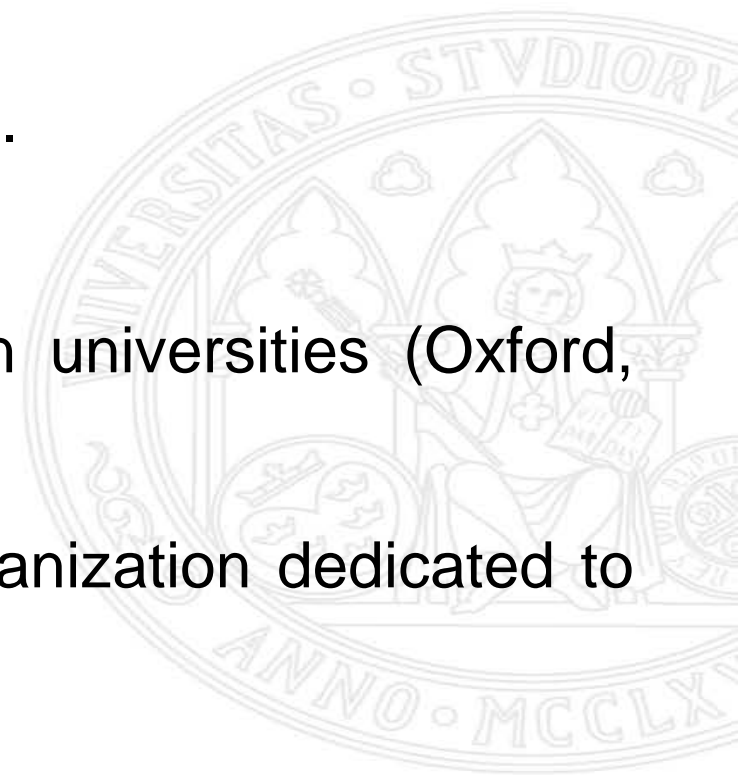


Source: Public Domain,
<https://commons.wikimedia.org/w/index.php?curid=1388734>

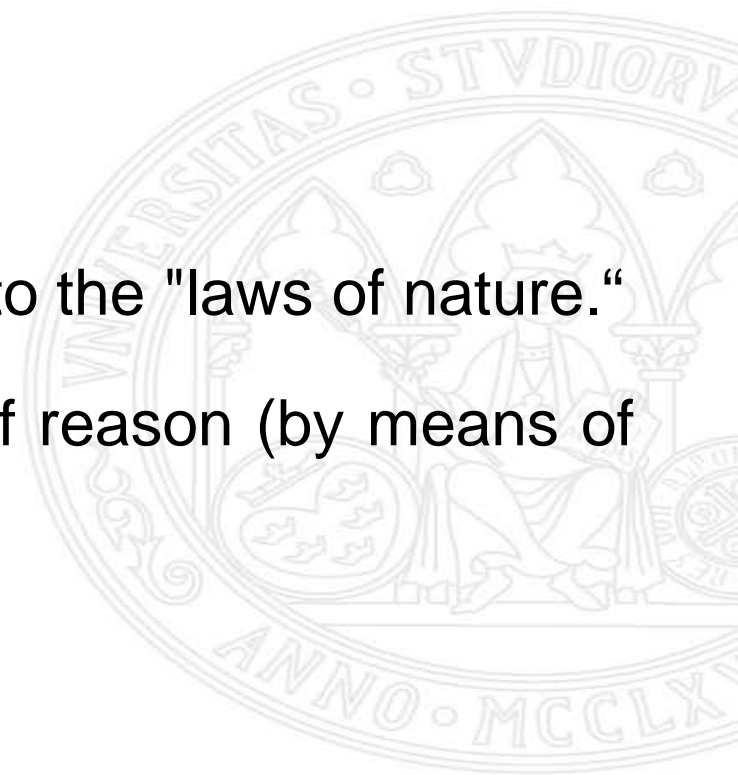
- **2.2.1 Cultural and Political Context. England:**
 - A. Scientific Revolution (1600).
 - B. English Constitution and Parliament.
 - C. England collected twice as much per capita as the French state:
 - Army: to keep domestic order.
 - Navy: to promote commerce (the Navy Act).
 - D. Power to take people's property:
 - Private Act.
 - Enclosure Act.
 - E. Public Utilities: infrastructure such as canals, turnpikes (roads).



- **2.2.1 Cultural and Political Context. England.**
- **A. Scientific Revolution 17th C.**
- New vision of the world: methodological and mechanical.
- Mathematicians, astronomers, and philosophers.
- The new science spread rapidly through education in universities (Oxford, Cambridge), academies and scientific societies.
- The Royal Society of England: the first permanent organization dedicated to scientific activity.



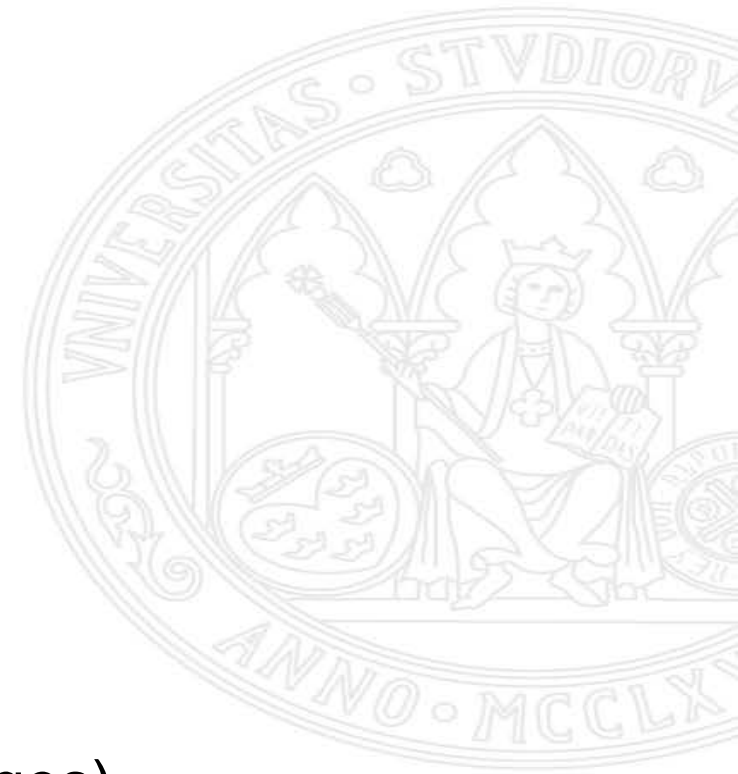
- **2.2.1 Cultural and Political Context. England.**
- **A. Scientific Revolution 17th C.**
- Two fundamental ideas in the Scientific Revolution:
 - 1. the universe and everything in it works according to the "laws of nature."
 - 2. the laws of nature can be discovered by means of reason (by means of observation and reasoning).



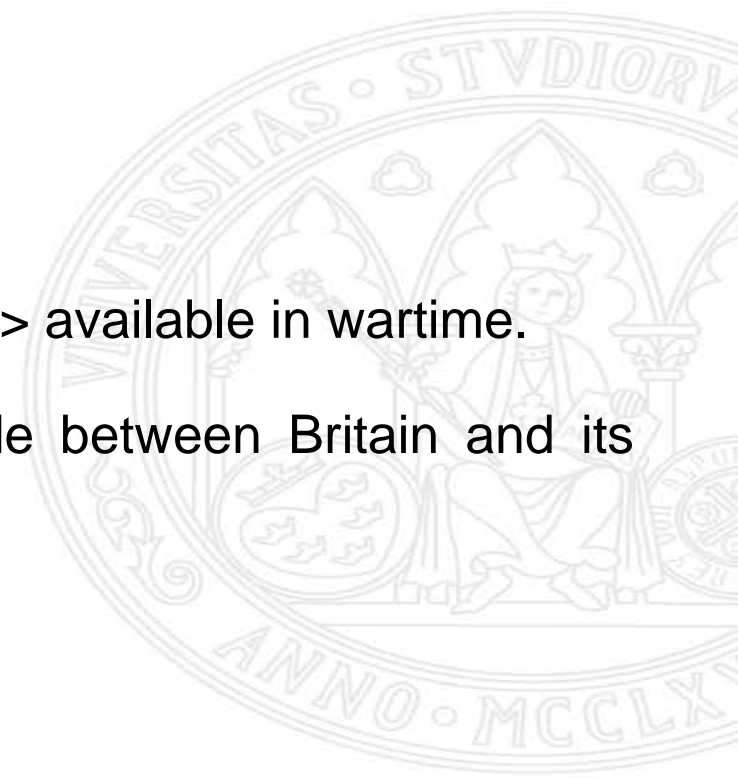
- **2.2.1 Cultural and Political Context. England.**
- **B. English Constitution and Parliament.**
 - The Revolution of 1688.
 - When James II was overthrown, modern English parliamentary democracy began.
 - Bill of Rights of 1689: the monarch held absolute power.
 - Changes following the Glorious Revolution:
 - The king was no longer above the law.
 - The Crown could not call or disband parliament.
 - Parliament gained a direct role in financial matters.



- **2.2.1 Cultural and Political Context. England.**
- **B. English Constitution and Parliament.**
 - Parliament introduced a land tax in 1693.
 - The French nobility was exempt from taxation.
 - But: most revenue was raised from consumer goods.
 - Beer.
 - Tobacco (colonies).
 - Sugar (colonies).
 - (NOTE: Wages higher than bare-bones subsistence wages).

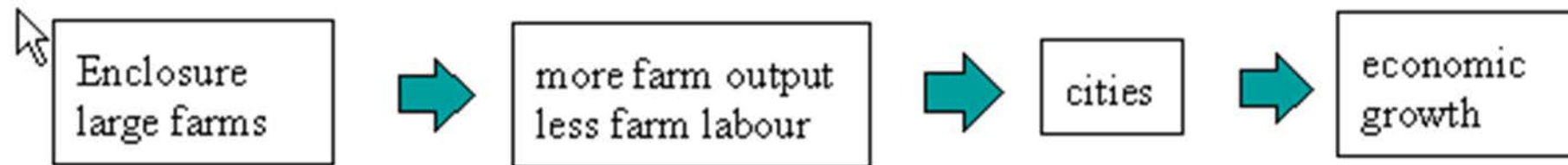


- **2.2.1 Cultural and Political Context. England.**
- **C. English collected twice as much per capita as the French state.**
 - Army: to keep domestic order.
 - Navy: to promote commerce (Navy Act).
 - [1381] laws to encourage the development of English shipping => available in wartime.
 - 17th C.--Laws that restricted the use of foreign ships for trade between Britain and its colonies (Unit 1).
 - Monopoly with the colonies.
 - To promote trade & economic growth.

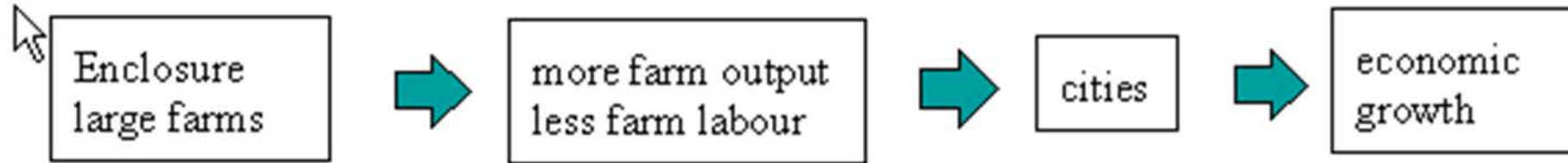


- **2.2.1 Cultural and Political Context. England.**
- **D. Power to take people's property in the name of the Parliament.**
- **Private Act:** applies to a particular individual or group of individuals, or a corporate entity.
 - Private acts can provide exemption from another law, or ensure someone is not held legally liable for an allegedly wrongful act.
 - Example: A Private Act overrode property owners opposed to the construction of public infrastructures.
 - **Enclosure Act:** laws that enclosed open fields and common land in the country.
 - Created property rights for land that was previously considered common.

- **Enclosure Act:**
- The standard explanation emphasizes enclosures and capitalist farming.



- Initiatives to enclose came from:
 - Landowners hoping to maximize rent from their estates.
 - Tenant farmers hoping to improve their farms.
- Parliament supported enclosure: bills.



- **2.2.1 Cultural and Political Context. England.**
- **E. Public Utilities: infrastructure such as canals, turnpikes.**
- Industrial Revolution created huge amounts of heavy produce which had to be moved.
 - Roads could not handle such weights and the vehicles needed to move this produce did not exist.
 - Canals were the answer to moving heavy objects large distances.

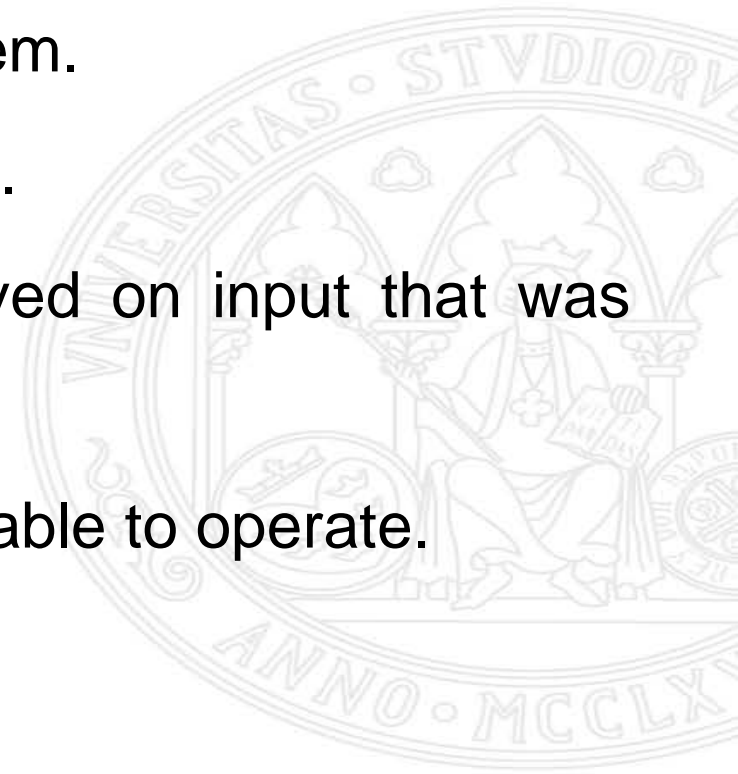
- **2.2.1 Cultural and Political Context. England.**
- **E. Public Utilities: infrastructure such as canals, turnpikes.**
- “Although the turnpike trusts became outmoded in the Victorian era, it must not be forgotten that this most ubiquitous institution, an important feature of the landscape for over 150 years, had been one of the central pillars on which the industrial revolution was based.”

Transport in the Industrial Revolution, D. H. Aldcroft (1983).

- **2.2.1 Cultural and Political Context. England.**
- The IR was sustained by the emerging scientific culture.
 - Inheritance from the Scientific Revolution of 17th C.
 - Scientific method.
 - Anthropocentrism.
- Popular culture.
- Shared the enthusiasm for inventions.
 - Innovations.
 - The most powerful changes were urbanization and the growth of commerce
 - higher literacy and numeracy (About the British level of formal instruction: N. Craft).



- **2.2.1 Cultural and Political Context. England.**
- The macro-inventions were made in 18th century Britain because that was the first time and place where people were paid to invent them.
 - The macro-inventions were biased technical changes.
 - They used input that was cheap in Britain and saved on input that was expensive.
 - Even under British conditions, they were barely profitable to operate.
 - They were not profitable to use elsewhere.



- **2.2.1 Cultural and Political Context. England.**
- Popular cultural.
 - At a certain point it was questionable:
 - Anthropocentrism.
 - Rationality.
 - “She’s a witch” Monty Python and the Holy Grial
[https://www.youtube.com/watch?v=zrzMhU_4m-g]



UNIT 2.2. Basic Determinants of the Industrial Revolution.

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- Did you know that ... the past was more violent than today ?
- Steven Pinker (Harvard University) argues that we are living in the most peaceful time in our species' existence.
- In the *Edge Master Class 2011: The Science of Master Class* (September 27) he presented six major historical declines of violence. One of them matches with a process that historians call the “Humanitarian Revolution”. (Momentum: 18th C).



Tribunal de la Inquisición, Francisco de Goya
(1812-1819).
Oil Painting, 73x46 cm.

- **Did you know...?**
- Facts:
 1. (Progressive) Abolition of judicial torture, hunts, religious persecution, dueling, blood sports, debtors prisons, slavery.
 2. Increase of literacy: Knowledge replaced superstition and ignorance; literacy gave rise to cosmopolitism (newspaper, reading history....).
- Source: PINKER, Steven. 2011. "A History of Violence. Edge Master Class"
Edge.org [https://www.edge.org/conversation/steven_pinker-a-history-of-violence-edge-master-class-2011].

Task 1.

- Please, read the text linked below, then answer the following questions.

ALLEN, Robert. 2009. Why was the Industrial Revolution English?.

[<http://www.voxeu.org/article/why-was-industrial-revolution-british>]

- 1. Comment on the following expression.



"The Industrial Revolution was Britain's creative response to the challenges and opportunities created by the global economy that emerged after 1500."

- 2. What were the three main consequences of the growth of British commerce?

Task 1.

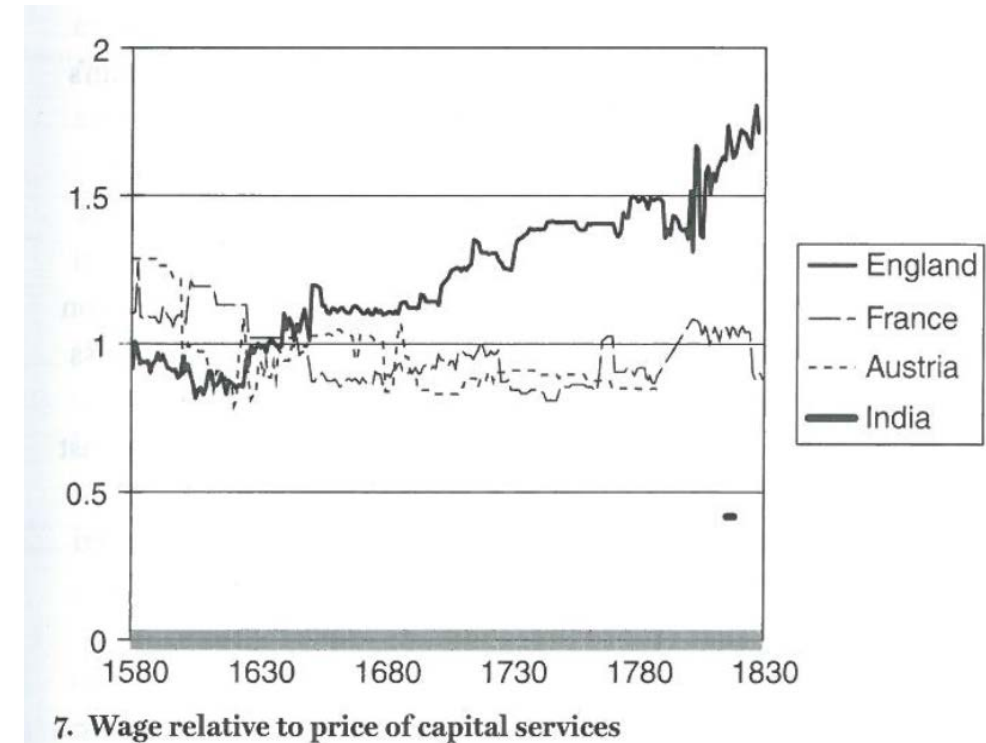
- 3. R. Allen (2009) emphasizes that changes in diet are relevant to higher wages. Can you explain why?.
- 4. Why does R. Allen say that the growth of cities stimulated agriculture?.
- 5. Regarding technological innovation, please explain why Chinese kilns were technologically more efficient than British ones.



- **2.3.1. Explaining the Industrial Revolution.**
- The explanation of why the IR was British is based on:
 - The British structure of wages and prices.
 - The relative importance to Cultural Developments and Scientific discoveries.
 - Cultural development and Scientific discoveries were known across Europe.
- The economy of high wages & cheap energy made it profitable for British firms:
 - To invent.
 - To use the breakthrough technologies of the IR.

UNIT 2.3. The Industrial Revolution and its Patterns of Development.

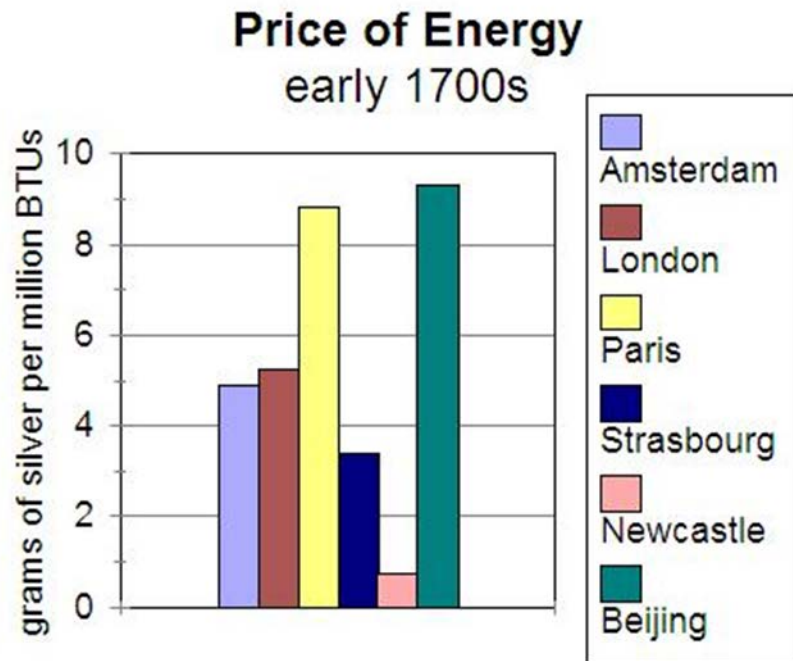
- **2.3.1. Explaining the Industrial Revolution.**
- The wages in Britain were high enough to enable most people to vary their diet:
 - 3 B (beer, bread and beef) vs. bare bones subsistence wages (diet based on grain).
- In the late 1500s English wages were similar to those in France and Austria.
- Mid XVIII- XIX: labor related to capital was at least 60% more expensive in England than on the continent.



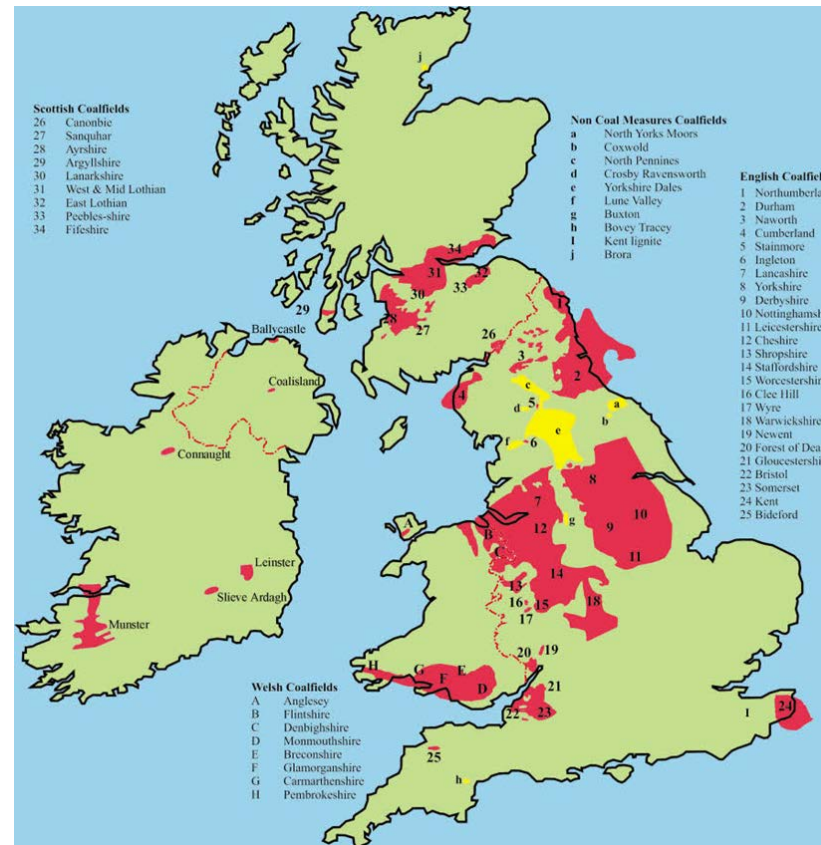
Allen (2011, 31): Figure 7

UNIT 2.3. The Industrial Revolution and its Patterns of Development.

- **2.3.1. Explaining the Industrial Revolution.**
- Energy: thanks to the coal fields in the North and the Midlands, Britain had the cheapest energy in the world.



Allen (2009)



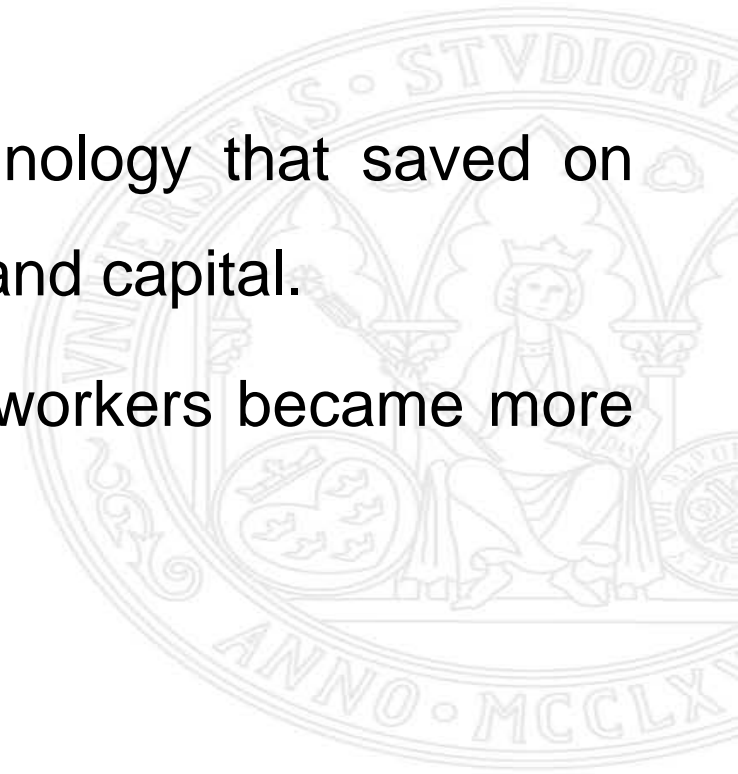
Coal Mining in the
British Isles
Source.

<http://nmrs.org.uk/mines/coal/index.html>

- **2.3.1. Explaining the Industrial Revolution.**

Corollary:

- Businesses in England found it profitable to use technology that saved on expensive labor by increasing the use of cheap energy and capital.
- With more capital and energy at their disposal, British workers became more productive.



- **2.3.1. Explaining the Industrial Revolution.**
- **A. The Cotton Industry.**
- Cotton was the first industry to be transformed by factory production.
 - Mid 18th CI: 8% GDP & 16% manufacturing jobs.
 - The cotton industry led the explosive growth of the Manchester area.
 - Britain's expansion came at the expense of India, China and Middle East.
 - China and India had the world's largest cotton industries.(Unit 1).

- **2.3.1. Explaining the Industrial Revolution.**
- **A. The Cotton Industry.**
- England could only compete if machines were invented to reduce labor.
- There were numerous attempts to mechanize production.
 - Years of experiments: innovation.
 - None involved great conceptual leaps.
- Workers benefited from continuous growth, but were liable to be laid off when there was a drop in demand or supply, like when the American Civil War cut the supply of cotton from the American Southern States.

- **2.3.1. Explaining the Industrial Revolution.**
- **A. The Cotton Industry.**
- Why did British inventors spend so much time and money on R&D?.
 - The machines that were invented increased the use of capital to save on labor.
 - Labor was expensive and capital was cheap.
- Cotton machines:
 - Reduced the hours of labor needed to produce one pound of yarn.
 - At the same time they increased the capital required per pound.
 - The savings made with mechanical spinning were greater where labor was more expensive.

- **2.3.1. Explaining the Industrial Revolution.**
- **A. The Cotton Industry.**
- The machines were not profitable anywhere else.
 - 1820s: cotton machinery proved profitable to install on the continent.
 - 1850s: cotton machinery proved profitable to install in low-wage economies such Mexico and India.
 - 1870s: factory cotton production began to shift into the Third World.

Task 2.

- Search the web for examples of technological innovations associated with the Industrial Revolution, particularly in the textile industry.
- **Example:**

In 1733, John Kay invented the 'Flying Shuttle'. This invention allowed wider cloth to be woven at a faster speed than before. Kay used his knowledge as a weaver to develop this machine.



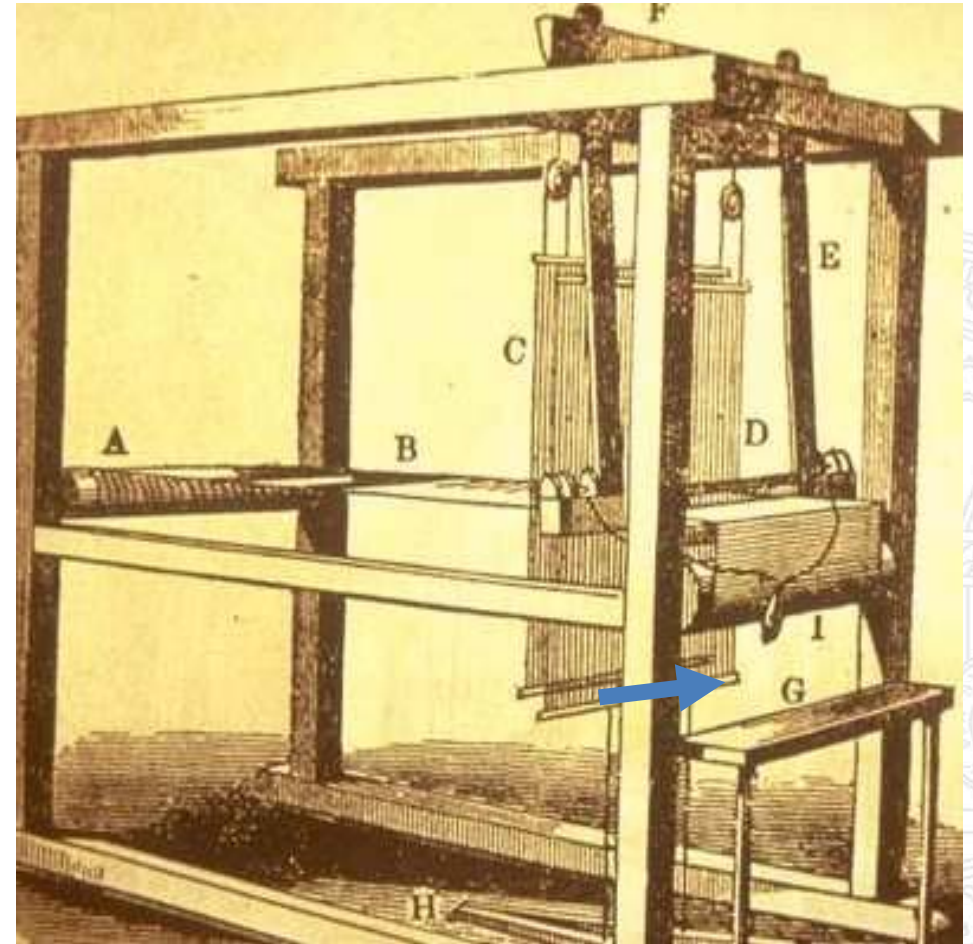
Source: Flying shuttle-
Greater Manchester
Museum Group
[http://www.gmmg.org.uk/
our-connected-
history/item/flying-
shuttle/](http://www.gmmg.org.uk/our-connected-history/item/flying-shuttle/)

Task 2.

- The flying shuttle represented an important step towards automatic weaving.
- With the flying shuttle, one weaver could weave fabric of any width more quickly than two could before.

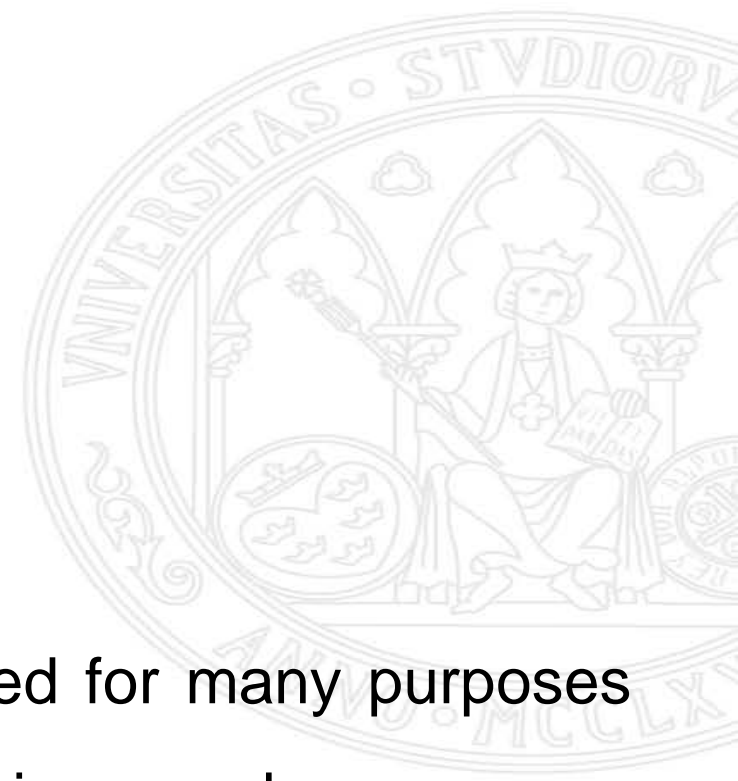
Source: Industrial Revolution. Pictures from the Industrial Revolution

http://f.tqn.com/y/inventors/1/S/d/T/flyingshuttle_big.jpg



- **2.3.1. Explaining the Industrial Revolution.**
- **B. The Steam Engine.**
- The steam engine was the most transformative technology of the IR:
 - Steam engine allowed mechanical power to be used in a wide range of industries.
 - Railways.
 - Ocean-going ships.
- Steam power was a spin-off of the Scientific Revolution 1600 => atmospheric pressure (Newcomen, 1712).

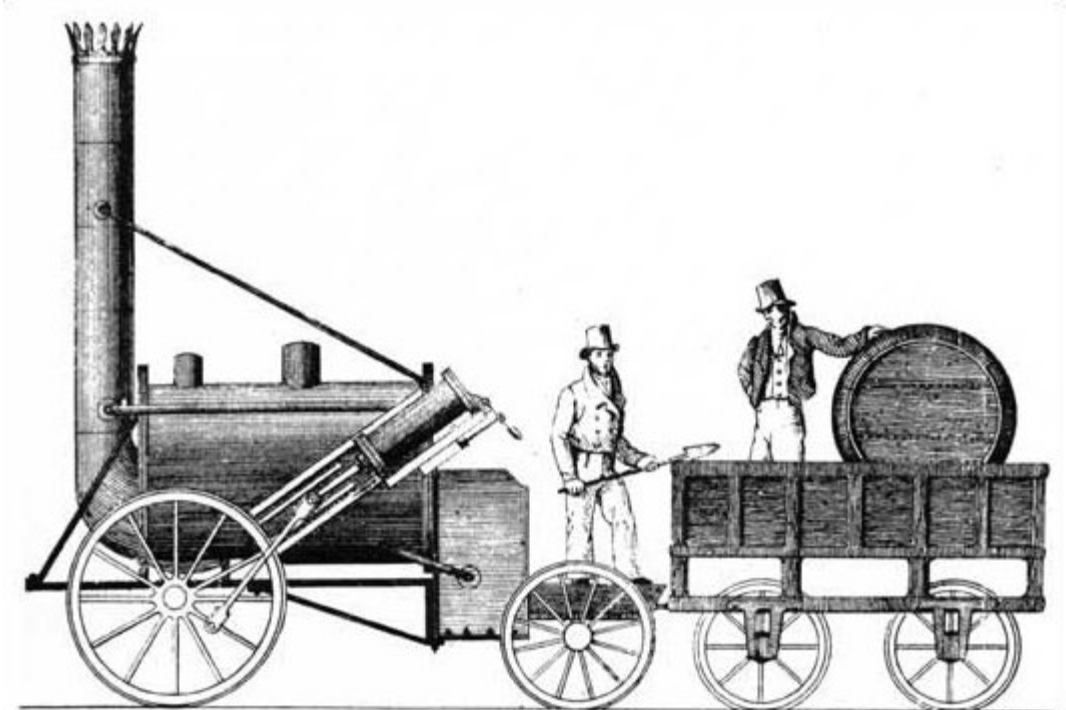
- **2.3.1. Explaining the Industrial Revolution.**
- **B. The Steam Engine.**
- R&D on the steam engine was conducted in England.
- Coal fields meant it paid to use the steam engine:
 - Original goal: to drain mines.
 - Early machines required vast quantities of coal.
- Steam power became a technology that could be applied for many purposes and used around the world, but only after the engine was improved.



- **2.3.1. Explaining the Industrial Revolution.**
- **B. The Steam Engine.**
- Most factories were powered by water until the 1840s.
- 1850s: the fuel consumption of steam engines had dropped enough to make them a cheaper source of power.
- Steam power revolutionized transportation.
 - Land vehicle: iron rails replaced wooden ones.
 - The lines were extended.

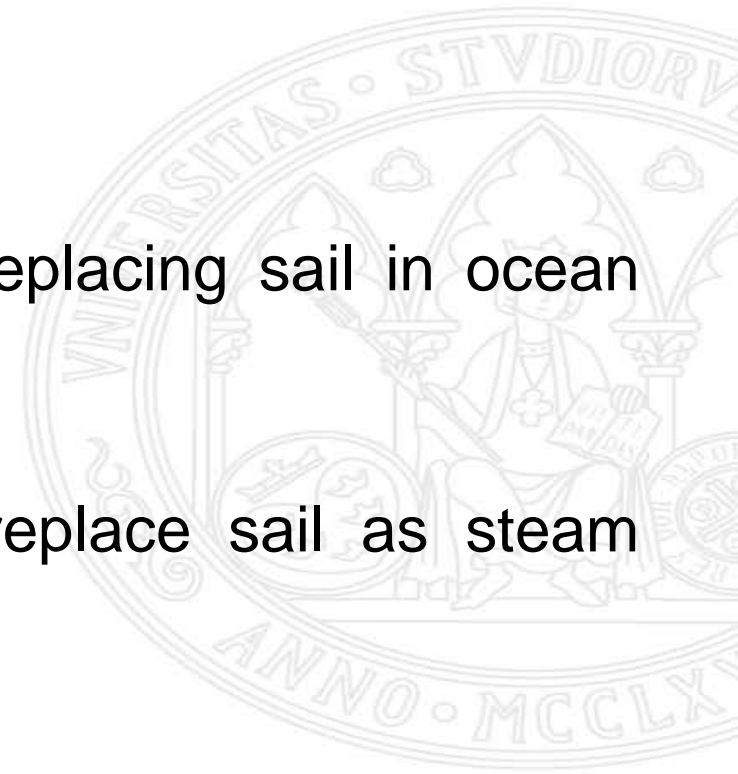


- **2.3.1. Explaining the Industrial Revolution.**
- **B. The Steam Engine.**
- Robert Stephenson designed the Rocket in 1829.
 - The Rocket was not the first steam locomotive.



Source: Public Domain,
<https://commons.wikimedia.org/w/index.php?curid=216014>

- **2.3.1. Explaining the Industrial Revolution.**
- **B. The Steam Engine.**
- Steam power revolutionized transportation.
 - Water locomotion: By the mid-19th C, steam was replacing sail in ocean transportation.
 - It took another half century for steam to fully replace sail as steam engines reduced coal requirements.



UNIT 2.4. Industrialization in Spain.

- **2.4. Industrialization in Spain.**
- The Spanish economy experienced a period of the relative stagnation during the second half of the 19th C., especially during the Restoration of the Bourbon monarchy.
 - After a promising early start: Catalonia exception.
- By 1910, Spain's level of industrialization was among the lowest in Europe.
 - Prados (1988, 169): Table 4.10

UNIT 2.4. Industrialization in Spain.

- **2.4. Industrialization in Spain.**
- Prados (1988, 169) Table 4.10. Industrialization per capita in various European countries, 1800-1910 (in \$US, at parity purchasing power).

Country	1800	1830	1860	1890	1910
Great Britain	89	139	257	391	458
France	59	92	164	250	356
Germany	--	--	102	134	391
Sweden	--	--	46	97	198
Italy	--	--	35	63	145
Hungary	--	--	--	--	157
Spain	34	29	50	93	122

- **2.5. Conclusions.**
- Which are the key concepts of Unit 2?
- What do you highlight, as the most relevant ideas?

