Lesson : Preludes To The Industrial Revolution

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Table of Contents

13.1 MEANING OF THE TERM "INDUSTRIAL REVOLUTION"

The beginning of Industrialization in Britain by 1760 marked the advent of industrialism capitalism in Europe. It is important to note that there were high possibilities of potentialities of capitalist development in Britain, France and Germany but imminent changes could take place only in Britain. British Marxist historian Rodney Hilton argued that class struggle gave rise to agrarian capitalism in Britain and competitive, capitalist markets of sellers and buyers emerged: class struggle 'explained' the transition to industrial capitalism. In this phase the industrialist replaced the merchant as a dominant actor in the capitalist system and affected the decline of the traditional handicraft skills of artisans, guilds, and journeymen. Also during this period, capitalism marked the transformation of relations between the British landowning gentry and peasants, giving rise to the production of cash crops for the market rather than for subsistence on a feudal manor. The surplus generated by the rise of commercial agriculture encouraged increased mechanization of agriculture leading to the rise of industrial capitalism. The term *Industrial Revolution* is normally reserved for a set of events unleashed in Britain roughly from 1760 to 1830.The historical events in question consisted of a set of technological, economic, and social changes that in the long run revolutionized not just the British economy but that of the rest of Western Europe, North America, and eventually much of the rest of the world. For E.J.Hobsbawm this is a period of technological and industrial advancement that takes place in the second half of the 18th and first half of the 19th centuries. It is marked by a major increase in production capacity, the expansion of markets and trade, and the transformation of an agricultural and local economy to an international industrial economy. The Industrial Revolution brought about a "modern" economy in which technological progress did not just happen from time to time in isolated sectors but became a sustained and continuous process, resulting eventually in unprecedented economic growth and increases in living standards in much of the world. As per the *Oxford English Dictionary* the term Industrial Revolution is generally seen as the rapid development of industry that occurred in Britain in the late eighteenth and nineteenth centuries, brought about by the introduction of machinery. It was characterized by the use of steam power, the growth of factories, and the mass production of manufactured goods". It was the emergence of the factory system of production, in which workers were brought together in one plant and supplied with tools, machines, and materials with which they worked in return for wages. The Industrial Revolution was spearheaded by rapid changes in the manufacture of textiles, particularly in England about 1770 and 1830. More broadly, the term applies to continuing structural economic change in the world economy. *Encyclopedia Britannica* see this in modern history, the process of change from an agrarian, handicraft economy to one dominated by industry and machine manufacture. This process began in England in the eighteenth century and from there spread to other parts of the world.

This term "Industrial Revolution" was first popularized by the English economic historian Arnold Toynbee (1852–83) to describe England's economic development and refer to the period of rapid social, economic, demographic, and technological change which took place in Britain from the latter half of the eighteenth century to the first half of the nineteenth century. However it had been used earlier by a French diplomat in 1799 who claimed that his own country had already embarked on '*la révolution industrielle*'. Clearly he saw this as a parallel to the political revolution in France. Yet it is misleading to treat these two movements as the same *type* of revolution. The Industrial Revolution was a set of *cumulative* changes in Britain's

economic and social structure. The long time- scale has led some historians to question the word revolution and substitute evolution instead. However, arguably such an enormous change merits the title of revolution as it was a change in world history comparable to the Neolithic revolution in Mesopotamia c. 10,000 BC. There is much debate and disagreement over the precise characteristics of the Industrial Revolution, but broadly speaking it defines the transformation of Britain from a predominantly rural and agrarian society to an increasingly urban one based on manufacturing and industry. Although the term always refers to Britain (usually England), which was the first industrial nation, the phrase 'Second Industrial Revolution' is sometimes used to refer to the industrialization of other countries, especially Germany and the USA, during the latter part of the nineteenth and early twentieth centuries.

The period of time covered by the Industrial Revolution varies with different historians. Eric J.Hobsbawm believe that it 'broke out' in the 1780s and was not fully felt until the 1830s or 1840s,while T. S. Ashton held that it occurred roughly between 1760 and 1830. Some twentieth century historians such as John Clapham and N.C.R. Crafts have argued that the process of economic and social change took place gradually and the term *revolution* is not a true description of what took place. This is still a subject of debate amongst historians

The shift from Non-Industrial to Industrial age could be marked by the main features in technological, socio-economic, and cultural terms. The technological changes included the following: (1) the use of new basic materials, chiefly iron and steel, (2) the use of new energy sources, including both fuels and motive power, such as coal, the steam engine, electricity, petroleum, and the internal-combustion engine, (3) the invention of new machines, such as the spinning jenny and the power loom that permitted increased production with a smaller expenditure of human energy, (4) a new organization of work known as the factory system, which entailed increased division of labour and specialization of function, (5) important developments in transportation and communication, including the steam locomotive, steamship, automobile, airplane, telegraph, and radio, and (6) the increasing application of science to industry. These technological changes made possible a tremendously increased use of natural resources and the mass production of manufactured goods.

There were also many new developments in non-industrial spheres, including the following: (1) agricultural improvements that made possible the provision of food for a larger non- agricultural population, (2) economic changes that resulted in a wider distribution of wealth, the decline of land as a source of wealth in the face of rising industrial production, and increased international trade, (3) political changes reflecting the shift in economic power, as well as new state policies corresponding to the needs of an industrialized society, (4) sweeping social changes, including the growth of cities, the development of working-class movements, and the emergence of new patterns of authority, and (5) cultural transformations of a broad order. The worker acquired new and distinctive skills, and his relation to his task shifted; instead of being a craftsman working with hand tools, he became a machine operator, subject to factory discipline. Finally, there was a psychological change: man's confidence in his ability to use resources and to master nature was heightened.

13.2 TRANSITION FROM FEUDALISM TO CAPITALISM

It was the decline of feudalism in Britain by the beginning of sixteenth century that paved the way for industrial Revolution in the 18th century. The process was marked by multiple changes in the realms of economy, society, polity and culture.Over the centuries of feudal society, as the surplus grew to some extent, trade also grew. Around that trade grew towns where merchants enjoyed some political power. These merchants chafed under certain feudal restrictions and irrationalities. Since trade suffered under the multiple authorities and taxes of various feudal lords, it was in the interest of the merchants to promote a strong central *nation-state*, as developed from the fifteenth century. Yet the merchants were hardly an anti-feudal force: they fed off the declining feudal order and prospered under it, enjoying official monopolies and high margins. Merchant capital did not lead to industrial capital through its *own* development.

Nevertheless, the money power of the towns' well-to-do, the relative political freedom of the towns, and the contact with ideas from distant lands (such as the vibrant Arab civilizations), helped germinate far-reaching changes in religious doctrines and philosophy, mathematics and science. On the one hand religious movements, known as the Protestant Reformation, arose against the authority of the Catholic Church (which, located in Rome, was itself a great feudal landlord throughout Europe, irksome to rising nation- states like England). Even more radical was the revolution in mathematics, science and philosophy brought about by Francis Bacon, Copernicus, Galileo, Descartes, Leibniz and Newton now men learnt that the universe did not revolve around the earth, rather the earth revolved around the sun, and the laws governing its motion were discovered and propagated.

The associated change in the world- view of the intelligentsia has been termed the Enlightenment; in the new ideology, the force of human Reason now unseated established authority, such as the Church and the King. The State itself was now no longer seen as God-given, but the product of Man, a 'social contract' among men for their benefit. It implied that if the state were not functioning for their benefit, it was justified to overthrow it and replace it with a new one. When the bourgeoisie seized power from the feudal class, it was generally a violent affair in which the bourgeoisie needed the help of the masses, and so the masses were stirred up with slogans of liberation. Thus it was that the British waged a civil war and eventually beheaded their King in 1649; and the French in 1789 began a far more profound revolution, not only decapitating their royalty but sweeping away feudalism much more comprehensively.

From the middle of the sixteenth century, landed and mercantile interests pooled their wealth in privateering and exploration for international trade. Following social conflict culminating in the 'bourgeois revolution' of the mid-seventeenth century overseas capital freed itself from feudal control and the rate of return on capital became the dominant economic ethic. This capital from trade flowed back onto the land, bringing with it the capitalistic rate of return mentality. Harnessing this to capitalistic farming produced the modern capitalist mentality. In short, capitalism resulted from the fusion of the calculative mentality of the capitalistic farmer, itself derived from the feudal lord seeking the maximum feudal surplus from labour in production, and the calculative mentality of merchant capitalists seeking the maximum feudal rate of return on their capital. Early capitalism also engendered new methods of production. The earliest was the 'cottage industry', which saw individual

homes become mini factories, with production directed by the capitalist. The cottage industry model became so widespread in the woollen textile industry that it became a method of mass production. In turn, the wool trade became Britain's most important industry by the end of the seventeenth century. At first the merchants, or "buyer uppers", as they became known, were a link between the consumer and producer. However, gradually, they began to dominate the latter, first by placing orders and paying in advance, then by supplying the raw materials, and paying a wage for the work done in producing finished goods. The concept of a waged worker signalled a crucial stage in the development of capitalism. Its introduction was the final stage in the "buyer uppers" transition from merchant, (making money from trade), to capitalist (deriving wealth from the ownership and control of the means of production). The first stage of capitalism had come into being. This stage saw one new class, the primitive capitalists, exerting power over another new class, the waged workers. It was only when the costs involved in expanding rural putting out began to rise- as a result of the geographic spread of the rural industry, because of the loss of raw materials stolen by the domestic producers, and because of the difficulties in disciplining the labour force- that putters-out began to turn to factory production. This transition appears to have come about on a large scale only with the enormous build-up of demand which emanated from the new world in the latter part of the eighteenth century, and put intolerable pressures on the old domestic mode. It was of course immensely speeded up by the rapid availability of new inventions which allowed for dramatic cutting of costs.

Importantly, transition from feudalism to primitive capitalism had strong state support. The regionally based feudal economies and the power of the aristocracy ran counter to the interests of the alliance between capitalism and the increasingly centralised state. The state gained the wealth it desperately needed to maintain its growing bureaucracy and standing army, by tapping into capitalism through taxes, customs, duties and state loans. In return, it conquered colonies, fought for dominance of the world's markets, and took measures against foreign competition and the power of the aristocracy. Such measures included bans on the import of manufactured goods, restrictions on the export of raw materials destined for competitors, and tax concessions on the import of raw materials. Restrictions on exporting raw materials hit the aristocracy particularly hard as agricultural produce is, by its very nature, raw materials. Thus, bureaucrats and capitalists defeated the aristocracy- though a section did survive the transition from feudalism by forming an alliance with the new capitalists.

Marxist historians viewed the seventeenth century as crucial to the transition from 'feudalism' to capitalism. The defining event was the long English Revolution that began in the late 1620s and culminated in the substitution of a Dutchman for King James II in 1688. To English Marxist historians, the six decades represented the original 'bourgeois' revolution, which instituted political preconditions for capitalism. The crucial preconditions were the expropriation of the peasantry by Parliamentary acts of enclosure and the creation of a free labor market by the enactment of laws and judgments limiting the right of rural laborers to seek work outside their home parishes and the removing the right of all workers to combine in defense of wages and working conditions. Relieved of paternalistic regulations promulgated by Tudor and Stuart monarchs intended to protect peasants and maintain social stability, English landlords and businessmen could create a subservient force of free labor exploitation that was the source of the capital on which rested England's later industrial supremacy. Christopher Hill writing on the English Revolution points out that the ending of feudal tenures because of the revolution meant that no one in England after the mid-17th century went hungry because of a lack of food. He

argues that there was a great deal of capital in England which merchants, yeomen and gentlemen were anxious to invest in the freest possible industrial, commercial and agricultural development. This was continually thwarted by feudal survivals in town and country, and by government policy deliberately endeavouring in the interests of the old landed ruling class to restrict production and the accumulation of capital. Thus, in attacking the feudal landlords' state and the oligarchy of big merchants in alliance with the Court who were trying to monopolize business profits, the struggle of the bourgeoisie was progressive, representing the interests of the country as a whole.England in 1640 was still ruled by landlords and the relations of production were still partly feudal, but there was this vast and expanding capitalist sector, whose development the Crown and feudal landlords could not for ever hold in check. There were few proletarians (except in London), most of the producers under he putting-out system being also small peasants. But these peasants and small artisans were losing their independence. They were hit especially hard by the general rise in prices, and were being brought into ever closer dependence on the merchants and squires. A statute of 1563 forbad the poorer 75 per cent. of the rural population to go as apprentices into industry. So there were really three classes in conflict. As against the parasitic feudal landowners and speculative financiers, as against the government whose policy was to restrict and control industrial expansion, the interests of the new class of capitalist merchants and farmers were temporarily identical with those of the small peasantry and artisans and journeymen. But conflict between the two latter classes was bound to develop, since the expansion of capitalism involved the dissolution of the old agrarian and industrial relationships and the transformation of independent small masters and peasants into proletarians. The crisis of the seventeenth century planted the seeds of capitalism and the industrial revolution. In a variant of this argument Immanuel Wallerstein argued that the capital-creating surplus was extracted not so much from domestic labor, but from serfs and slaves in peripheral regions. Economics followed politics.

13.3 THE CAUSES OF THE "INDUSTRIAL REVOLUTION"

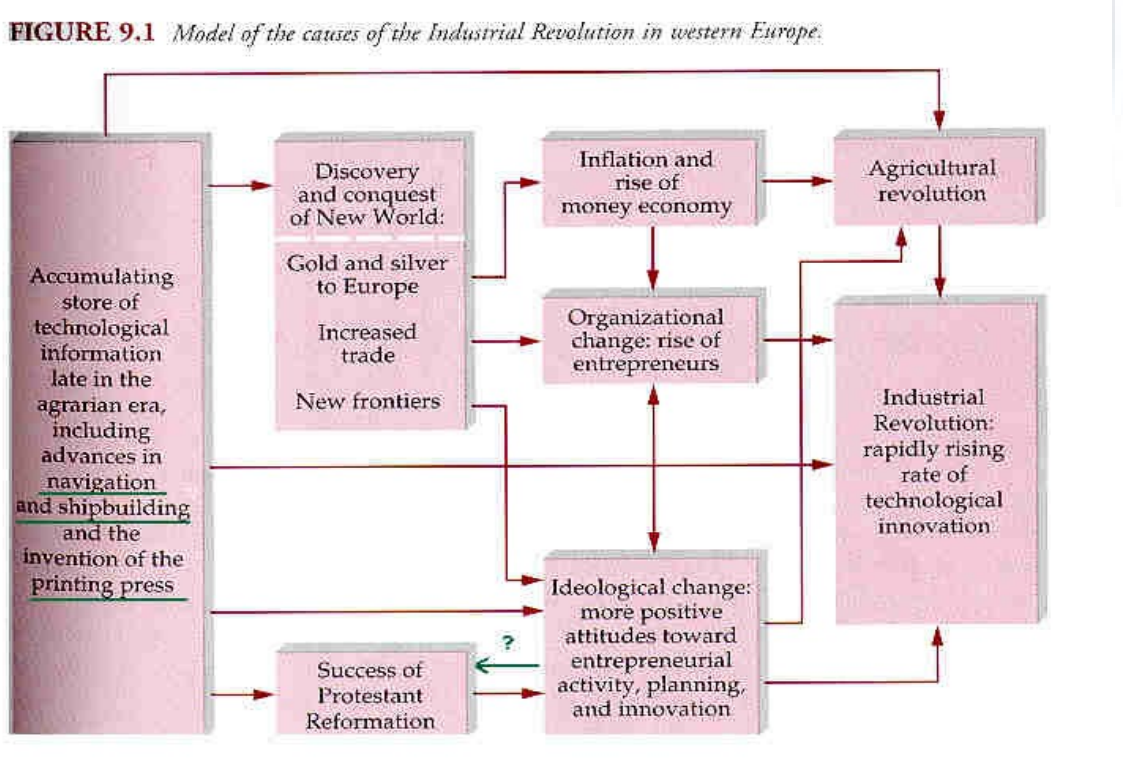
In this context the European Industrialization of the late eighteenth and early nineteenth centuries was revolutionary in the sense because it changed- revolutionized- the productive capacity of England and Europe. Industrial Revolution was the product of on going changes. Alongside there were also some igniting factors. These became evident in the 18th century. But the revolution was something more than just new machines, smoke- belching factories, increased productivity and an increased standard of living. It was a revolution which transformed English and European societies down to their very roots. No one was left unaffected. Everyone was touched in one way or another- peasant and noble, parent and child, artisan and captain of industry. In other words, firstly England, then the European Continent, witnessed a shift from a traditional, pre-modern, agrarian society to that of an industrial economy based on capitalist methods, principles and practices. Without a radical transformation of the agrarian economy, the activities of merchants and manufacturers would have remained strictly confined. By no inexorable logic of their own were mercantile and industrial activities capable of fundamentally transforming the essential relations of pre-capitalist society. Rather, the changes in agrarian economy, which drove rural producers from their land, forced them onto the labour market as wage labourers for their means of subsistence, and refashioned farming as an economic activity based upon the production of agricultural commodities for profit on the market, established the essential relations of modern capitalism. In what

follows, these processes are described in terms of the emergence of *agrarian capitalism*.

The Industrial Revolution serves as a key to the origins of modern Western society. As Harold Perkin has observed, "the Industrial Revolution was no mere sequence of changes in industrial techniques and production, but a social revolution with social causes as well as profound social effects" [*The Origins of Modern English Society, 1780-1880* (1969)]. The Industrial Revolution began in England sometime after the middle of the eighteenth century. England was the "First Industrial Nation." As W.W.Rostow the economic historian commented in the 1960s, it was England which first executed "the takeoff into self-sustained growth." And by 1850, England had become an economic titan. Its goal was to supply two- thirds of the globe with cotton spun, dyed, and woven in the industrial centers of northern England. England proudly proclaimed itself to be the "Workshop of the World," a position that country held until the end of the nineteenth century when Germany, Japan and United States overtook it. The origins of the Industrial Revolution in England remains complex and varied and, like the French Revolution, the Industrial Revolution is still a matter of a vast historical debate over origins, developments, growth and end results. This debate has raged among historians since 1884, when Arnold Toynbee (1852-1883), the English historian and social reformer, published the short book, *Lectures on the Industrial Revolution in England*.

Value addition: Chart

Model for the Causes of the Industrial Revolution



Source: http://www.unc.edu/~nielsen/soci111/m13/soci111m13.htm

The Industrial Revolution raised many questions: was the revolution in industry simply an issue of new machinery or mechanical innovation? did young boys and girls work and live shoulder to shoulder for more than twelve hour a day? was industrial capitalism nothing more than a clever system devised by clever capitalists to exploit the labor of ignorant workers? was the revolution in industry the product of conscious planning or did it appear spontaneously? These issues standing for there sake, what the Industrial Revolution accomplished was nothing less than a structural change in the economic organization of English and European society. This is what made the Revolution revolutionary.

13.3.1 European Proto-Industrialization and British Conditions

The word- proto- industrialization- seems to suggest or imply acceptance of a relationship between industrialization- meaning manufacturing by mechanical means- and certain kinds of manufacturing that went before. It assumes a belief that proto-industrialization is a form of organization that necessarily precedes, paves the way for, makes possible, causes, industrialization. Historians favour this term "protoindustrialization" to describe the form of industrial organization that emerged in the sixteenth century. The word was initially applied to cottage industries in the countryside. In spite of the opposition of urban guilds, rural residents were performing many industrial tasks. Agricultural labour did not occupy the peasants during the entire year, and they devoted their free hours to such activities as spinning wool or weaving and washing cloth. Peasants usually worked for lower remuneration than urban artisans. Protoindustrialization gave rural residents supplementary income, which conferred certain immunity from harvest failures; it enabled them to marry younger and rear larger families; it prepared them, socially and psychologically, for eventual industrialization. The efforts of urban guilds to limit rural work enjoyed only limited success; in England, for example, the restrictions seem rarely to have been enforced. Cottage industries certainly existed in the middle ages, but the economic expansion of the 16th century diffused them over much larger areas of the European countryside, perhaps most visibly in England and western Germany. As per Franklin F. Mendels who used this term for the first time in 1970, Proto-industrialization means: "the rapid growth of traditionally organized but market-oriented, principally rural industry. It was also accompanied by changes in the spatial organization of the rural economy". The pattern of European agricultural production, created a massive but short-lived, seasonal demand for labour during the harvest. Journeymen were underemployed during the year, they were an available workforce for the labour- intensive textile industry which needed a lot of workers as its productivity had hardly increased since the twelfth century.

This concept of proto-industrialization became an influential one in economic history in the 1970s and 1980s. This manner of organizing manufactures managed through the "putting-out system," is an awkward translation of the German Verlags system. It was seen as a system of rural manufacture that was intermediate between autarchic feudal production and modern urban factory production. Variously described as rural manufacturing, domestic manufacture, cottage industry, and a "putting-out" system, it was a dispersed system of production that used traditional methods of production and extensive low-paid rural labor to produce goods for the market, both domestic and international. Unlike modern capitalist manufacturing, proto-industrialization did not depend on rising labor productivity as a source of higher profits; instead, merchants increased the scale of their businesses by extending production to additional households and workers. The key to its operation

was the entrepreneur, who purchased the raw materials, distributed them among the working families, passed the semi finished products from one artisan to another, and marketed the finished products. He was typically a great merchant resident in the town. As trade routes grew longer, the small artisan was placed at ever-greater distances from sources of supply and from markets. Typically, the small artisan would not have the knowledge of distant markets or of the preferences of distant purchasers and rarely had the money to purchase needed raw materials. The size of the trading networks and the volume of merchandise moving within them made the services of the entrepreneur indispensable and subordinated the workers to his authority.

As per Mendels the system had its limitations: workers were not making a lot of money and manufacturers had to put up with the fact that industry was merely a secondary activity after agriculture which severely limited production. Moreover, monitoring workers was next to impossible. These obstacles eventually created the necessity for the centralized factories of the Industrial Revolution. But meanwhile entrepreneurs had been able to accumulate enough capital to start the late eighteenth- early nineteenth mechanization. Another result was to create a rural demand for agricultural goods that was met by regions having specialized in commercial agriculture. These agrarian surpluses were to prove crucial for the nineteenth century industrial take off. By the time handicraft was replaced by machines, the proto-industrial regions had a large workforce that was to be used in the factories (Lorraine, Rhineland, Lille). But other became de-industrialized (Brittany, Ulster, Silesia, Flanders). The abundance of natural resources (coal, iron ore) or lack thereof often determined the fate of a region's transition). The Industrial Revolution did not mean the end of handicraft, it adapted to the new environment. It is important to mark the difference between early modern proto-industries and rural industrial by-employment that has always existed. Some criterions are essential segregate the two: proto- industry reached far beyond the local market. For instance, Northern Bohemian textiles were exported to Poland, Hungary and Austria. Proto-industry also supposed a spatial division of labour with some region specialized in industrial production and other dedicated to feed them *)*.The shift from rural industry to proto-industry has been explain in various manners by historians, like Jan De Vries believed that population growth increased the supply side of the labour market, which started the mechanism. Eric Jones argues that the fall of grain prices forced the inhabitants of the least productive regions to look for additional sources of income. But Eric Hobsbawm believes that the integration to markets altered the consumption and production patterns of the rural population, creating new needs and opportunities that the proto-industries met.

Value addition: Interesting Facts
Family Working under Putting- Out or Cottage Industry System

Prior to the Industrial Revolution, and even during its early years, entrepreneurs provided poor families with raw materials for spinning, weaving, and garment making in their own homes. Early 19th-century print of English family sewing uniforms for the British army under the domestic, or putting-out, system that preceded the factory system.

Source: http://www.unc.edu/~nielsen/soci111/m13/soci111m13.htm

In Flanders, where proto-industry developed, nuptiality and, to a lesser extend, natality, reacted to the ratio of grain to linen prices. In some cases– contrary to the **Old Regime crisis model** developed by Ernest Labrousse– the correlation was stronger between marriages and linen prices than between marriages and rye prices. Thus "cottage industry affected population trends. The development of a labour-intensive industry by the peasants made it possible for them to multiply in their villages without corresponding increase in arable surface." But in some cases, proto-industry was a response to rather than a cause of population growth, but it is likely that in a second phase proto-industry made that growth sustainable. During proto-industrialization phases, there was no withdrawn of a part of the workforce from the agrarian sector to the industrial one, as cottage industries were only using labour surplus made available by seasonal underemployment. There was no opportunity cost, nor risk of food scarcities, unlike during the urban migrations caused by the Industrial Revolution. On the level of capital, the most important difference between proto-industry and modern industry was the fact that capital was circulating under the form of primary materials and wages and was not immobilized as capital-intensive machinery. The result was a simple and fluid mechanism where investments were not so important as to significantly influence performances and business cycles. The importance and the resilience of the proto- industry after 1800 gives credit to the partisans of a gradual move toward industrialization rather than an Industrial Revolution. For instance, Markovitch assumes that by 1789, the share of industry in France's GDP was already larger than the one of agriculture. It is even possible that a significant share of the French economic growth well after 1800 was fuelled by traditional industries.

Peter Kriedte, Hans Medick, and Jurgen Schlumbohm's work *Industrialization Before Industrialization* provided an extensive historical and theoretical treatment of the

phenomenon in 1977.They argued that it has long been known that industrial commodity production in the countryside for large inter- regional and international markets was of considerable importance during the formative period of capitalism. They located the chief economic characteristics of a stylized proto-industrialization system of production

1. Rural labor, often sideline activities beside agricultural work
2. Production for a market, often through urban-based merchants
3. Extremely low returns to labor- squeezed labor
4. Low technology, very low rate of technological change
5. Extensive rather than intensive growth

In order for rural industry to develop on a large scale in a region, several factors needed to be present: extensive demand for manufactured goods by concentrated populations and developed patterns of trade; a concentration of merchant wealth; and a population of under-employed rural householders who could be recruited into sideline manufacturing employment. Peter Kriedte explained the regional pattern of emergence of proto-industrialization in terms of the different forms of power possessed by lords in different parts of Europe. The power- constellations and their impact on the spatial expansion of industrial commodity production were different in east-central and eastern Europe. Peasants were more directly and more firmly dominated by their lords, and there was little room for the development of rural industries.

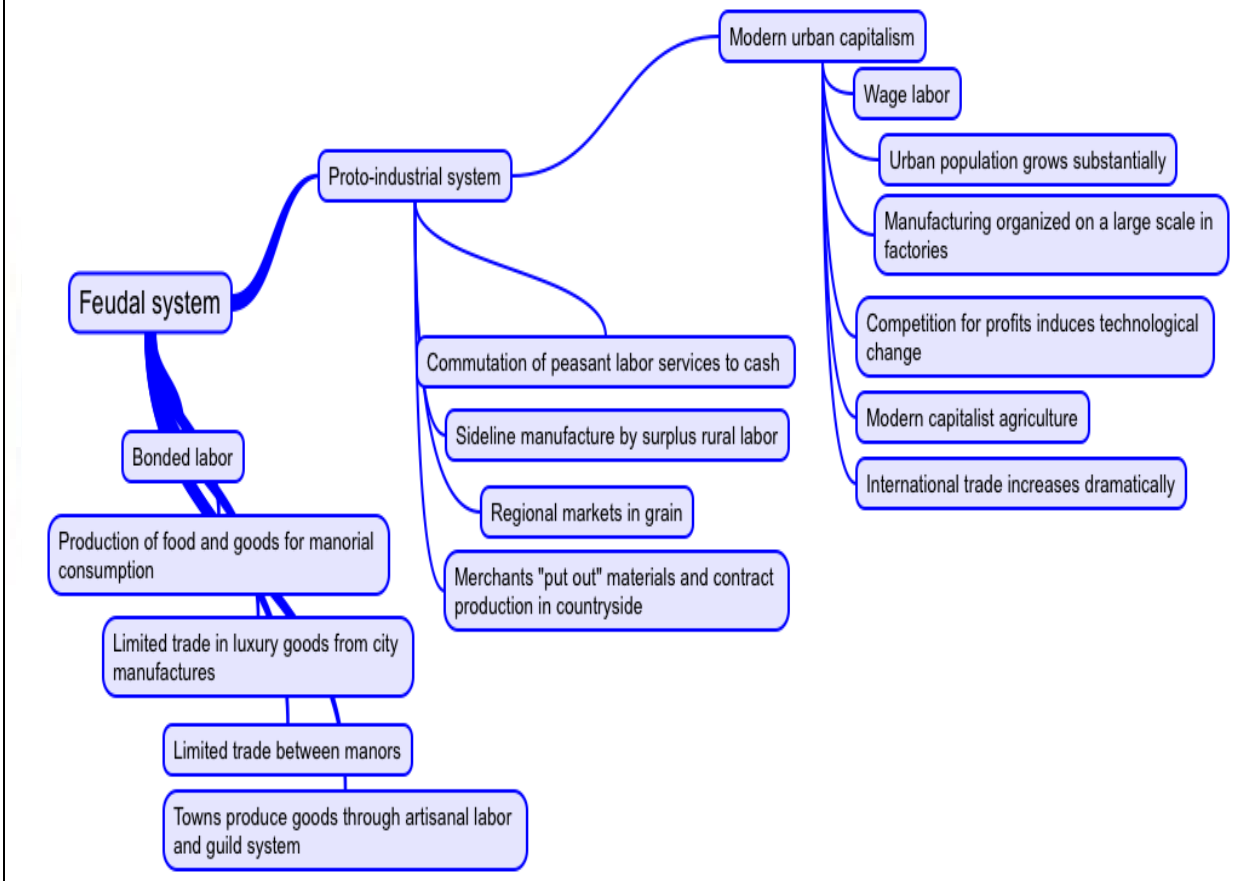
But whether a region developed rural industries or not was determined not so much by the extent of feudal charges as by the form in which peasants paid them. And the form of payment was determined not only by the social relationship in the narrow sense between the feudal lord and his dependent peasants but also by the overall relations of production. This argument is similar to that offered by Robert Brenner in his explanation of different courses that agricultural development took in different parts of Europe. The regions where proto- industrialization developed earliest, according to Peter Kriedte, were in western Europe, the first regions of relatively dense rural industry had developed in England, the southern Low Countries, and southern Germany in the late Middle Ages. The decisive thrust which brought about the phase of proto-industrialization came at the end of the sixteenth and in the seventeenth centuries.... Quantitative changes in supply and demand combined to produce a cumulative process which led to a new phase. Generally speaking, a region that has made the transition to commercial agriculture is barren soil for rural manufacturing, for the simple reason that commercial farmers earn a sufficient income through farming. However, some areas of commercial agriculture also became significant concentrations of rural manufacturing. When proto-industrialization gained a foothold in a region of commercial agriculture despite these basic assumptions, special circumstances are usually responsible. First of all, commercial agriculture, generally, could only develop in a highly urbanized region. The concentrated demand of a large town or a whole network of towns was necessary in order to induce the self-sufficient peasant family holding to enter on the path of specialization.

Hans Medick emphasizes the micro-side of the equation- the economics of the peasant household in the late Middle Ages. The central feature of the 'rationality' underlying the family economy is the fact that its productive activity was not governed primarily by the objective of maximizing profit and achieving a monetary surplus. The maximization of the gross produce rather than the net profit is the goal

of family labour. In other words, the peasant household is governed by the dynamic that leads to "self-exploitation" in the sense described by Chayanov- use of family labor to the point approaching a marginal product of zero (The Theory of Peasant Economy Under these circumstances, it is economically rational to expend some family labor on sideline manufacturing if there is some income associated with this activity- no matter how low the wage. Proto- industrialization is described as transitional because its economic possibility was created by the political situation of urban centres- specialized manufacture in cities under a regulated guild system, self-production in the countryside. And, it is sometimes claimed, proto- industrialization prepared the ground for full modern systems of capitalist industry.

Value addition: Diagram

Proto-Industrialization as prelude to Capitalist Industrialization

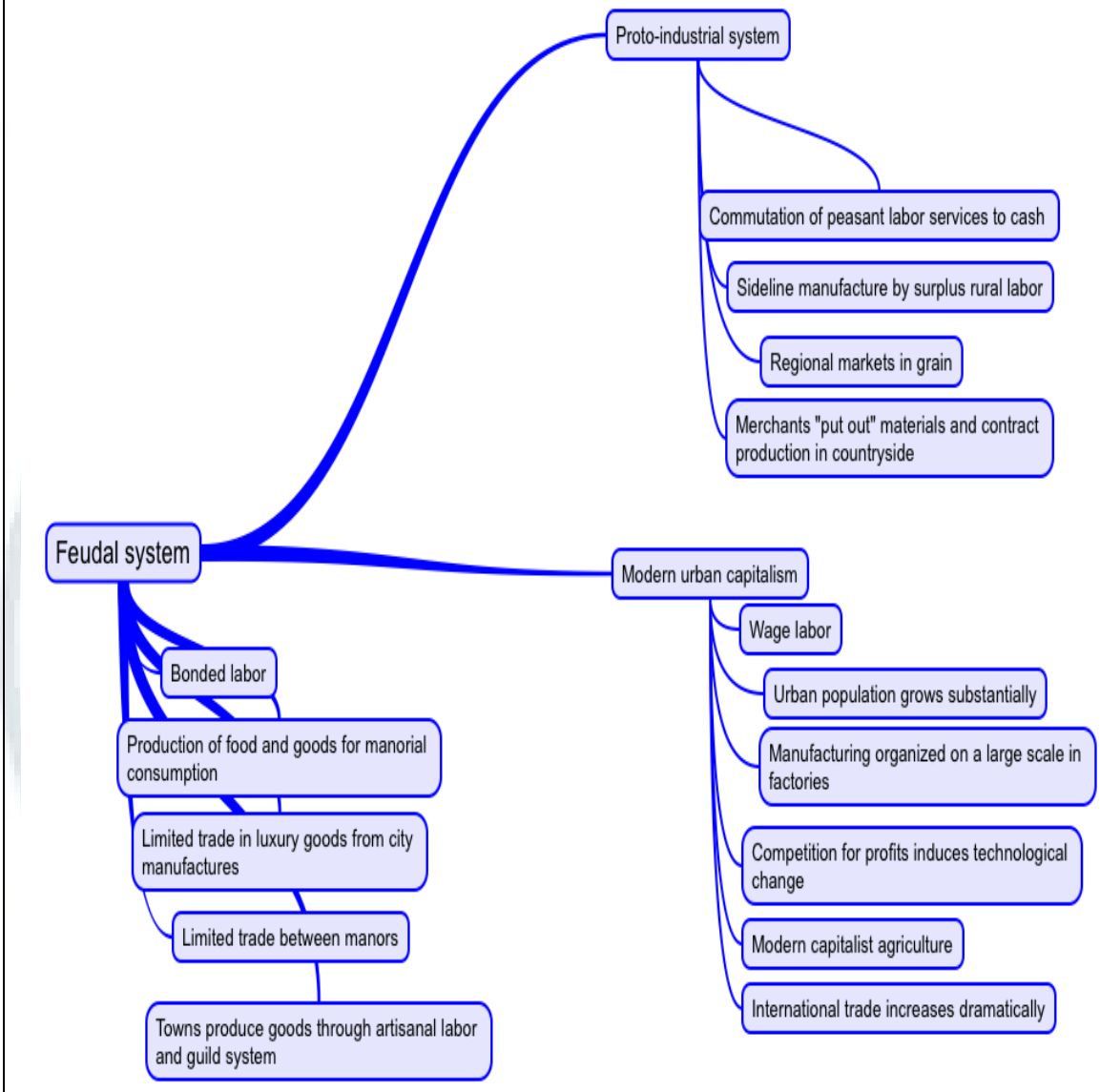


Source: http://understandingsociety.blogspot.com/2010/09/proto-industrialization.html

Some historians have also suggested that that proto-industrialization was an alternative to capitalist development- a cousin rather than a grandparent. By now a generation's research has made it clear that important parts of the eighteenth century European countryside teemed with non- peasants and hummed with manufacturing. Furthermore, "cottage industry" was not simply a pale anticipation of "real" industry, and not simply a casual supplement to agriculture; but a powerful system with its own logic. Here the diagram would look differently:

Value addition: Diagram

Proto-Industrialization as per Alternative Route



Source: http://understandingsociety.blogspot.com/2010/09/proto industrialization.html

Proto- industrialization is a significant historical phenomenon, we might say, because it represented a large and marked change in the organization and volume of production of goods from the medieval period to the early modern period. Towns and cities were already economically active locations, representing both concentrated demand and concentrated production. But the rural population was almost entirely involved in farming and sideline production for home use. The emergence of a significant level of production in rural hinterlands was a shift, and so it is worth

asking why this change occurred in the circumstances in which it did. The change dynamics Peter Kriedte, Hans Medick, and Schlumbohm describe include population change; urban economic regulations; incentives for feudal rights- holders to transition to cash obligations; and the existence of inter- regional trade and markets that extend beyond the local village.

It is tempting to frame this problem in the terms offered by Von Thunen's *Isolated State* and early economic geographers in "modeling" the economic changes that would be predicted on a featureless plane populated by economically rational agents Imagine a sort of "SimCity" simulation that begins with a sprinkling of mid- sized towns and cities with given levels of production and trade regulated by guilds, located within a countryside consisting of manors with serfs and small peasant farms. There is trade between town and country, since the towns must import food for the urban population, and there are some goods needed in the countryside that cannot be produced there. But trade is limited, labor mobility is limited, and the market economy is only a small fraction of all economic production. The actors in this story are merchants, lords, bonded serfs, free peasants, and officials. Now postulate that the actors respond rationally to some set of changing circumstances. Which of various initial scenarios lead to a proliferation of rural manufacture? We might postulate that merchants had only a few accessible strategies for achieving a return on their wealth. Investing in production and trade was one such strategy. Town- based production was heavily regulated, however, and the opportunities for profits were limited. A large under- employed labor force was available in the rural periphery of the towns. So a strategy of "putting- out" materials and paying low wages to rural producers was an attractive one.

The British pre-Industrial period of change experienced increases of output in agriculture where "both output per hectare and output per person rose" and also in manufacturing industry where "there was spectacular growth in output and labour productivity in two industries, cotton textiles and iron smelting". The growth increases in these two sectors lead to greater specialization in terms of trade, and also spurred an accelerated rate of growth in the economy as a whole. It is misleading to make a rigid distinction between industrial Britain and pre-industrial Britain. Before the industrial revolution, domestic industrial production was widespread in Britain. It was dominated by cloth manufacture based on wool and woolen products such as worsteds. Spinning and weaving in the home provided an important addition to the family budget. In 1700 more than half of Britain's exports were of woolen cloth. In Scotland linen was the main manufacturing industry. The cottage industry proved to be profitable for the urban merchants, since they could sell the finished cloth for far more than they paid the farmers to make it. The cottage industry helped to prepare the country for the Industrial Revolution by boosting the English economy through the increase of trade that occurred as the country became well- known overseas for its high- quality and low- cost exports. Previously, tradesmen had done all the manufacturing themselves, so the idea of subcontracting was new and appealing. The cottage industry was also a good source of auxiliary funds for the rural people. However, many farming families came to depend on the enterprise; thus, when industrialization and the Agricultural Revolution reduced the need for farm workers, many were forced to leave their homes and move to the city.

Great expansion was also apparent in the metal trades before the onset of the Industrial Revolution. Iron had been smelted with coke since 1709 at Coalbrookdale, where the Quaker ironmaster, Abraham Darby I, perfected the process. In 1759 the Carron ironworks at Scotland became a major manufacturing centre. In the eighteenth century Britain experienced significant urban development, though not all of it was attributable to manufacturing. Ports expanded rapidly to cater for both

overseas and domestic trade. Newcastle supplied London with coal. West coast ports developed quickly because of trade with America. Urban society demanded an increased number of consumer goods. These factors provided some of the preconditions for industrial expansion. In the late eighteenth century the economy was already well-developed. In 1750 income per head was £12 per annum - higher in real terms than any other country. This led to a rising demand for manufactured goods, which was clearly one of the factors behind industrialization.

13.3.2 The Role of Agrarian Revolution

The Industrial Revolution would not have been possible without a series of improvements in agriculture in England. There is no doubt that English agricultural productivity grew during the second half of the eighteenth century yet no agreement on how much. Regional variations certainly played the significant role. In spite of the difficulties of getting the data, it seems that the British agricultural base was more efficient than in other European countries. Recent estimates put French agricultural productivity in 1801 at half that of England. Beginning in the early1700s, wealthy landowners began to enlarge their farms through enclosure, or fencing or hedging large blocks of land for experiments with new techniques of farming. These scientific farmers improved crop rotation methods, which carefully controlled nutrients in the soil. They bred better livestock, and invented new machines, such as Jethro Tull's seed drill that more effectively planted seeds. The larger the farms and the better the production the fewer farmers were needed. Farmers pushed out of their jobs by enclosure either became tenant farmers or they moved to cities.

Enclosure movement played a very important role in the whole process. Basically it was the replacement of open fields whose strips were owned individually by smaller individually owned fields. Enclosure is defined as, "the process of inclosing (with fences, ditches, hedges, or other barriers) land formerly subject to common rights". This meant that the land that peasants had been cultivating on their own was returned to the control of the landowners and redistributed. Scavenging on someone else's land became illegal, and small farmers (who had no political influence and were generally given the poorer plots) often lost access to wood and water. Although the process was not standardized until the General Enclosure Act of 1801, many private acts had been passed since the 1750's and enclosure had been common for well over a century before. It transformed a traditional method of agriculture into a system of holdings by physically separating one person's land from another's. It also meant the subdivision of commons, heaths and wastes into separate landholdings and again involved the abandonment of obligations, privileges and rights. Eighteenth-century parliamentary enclosure was only part of a long movement. It has been estimated that only about a quarter of England and Wales remained to be enclosed after 1700. The south-west, the border counties and the south-east were hardly affected. But the traditional open-field areas in the south and east Midlands (Oxfordshire, Northants, Cambridgeshire) saw a huge change in the eighteenth century. To many historians the enclosure movement was seen as a form a class expropriation of the landed interest. The loss of the common rights was certainly a blow to the very poor, and substantially added to the number of landless labourers. In pre-enclosure times there seems to have been a reasonable prospect of farm servants saving enough to gain some sort of holding, which, with common grazing rights, was more or less adequate to support a family. The hardships caused by enclosure were condemned by the agriculturalist Arthur Young. To an unknowable extent, enclosure must have added to the numbers of those seeking waged employment. Large numbers were reduced to total wage dependency. This did not

necessarily mean a huge rural exodus to the towns (there was still plenty of work in the countryside), but the contribution of the agricultural sector towards the feeding of the growing population was made with a declining share of the total labour force.

One reason output grew was through new farming systems involving the rotation of turnips and clover, although these were part of the general intensification of agricultural production, with more food being produced from the same area of land. Intensity was also increased by land reclamation, especially the draining of the fenlands of eastern England, from the seventeenth century onwards, when a low-intensity agricultural system based on fishing and fowling was replaced by a high-intensity system based on arable crops. Other examples include the clearing of woodland and the reclamation of upland pastures. This extent of this activity is impossible to quantify, but may have affected some 30 per cent of the agricultural area of England, from the mid- seventeenth to the mid- nineteenth centuries. The mix of crops also changed, replacing low-yielding types, such as rye, with higher-yielding types such as wheat or barley. The balance between arable and permanent pasture also changed, so that more productive arable land was replacing permanent pasture. This does not mean that fodder supplies were falling, quite the reverse, for the loss of permanent pasture was made good by new fodder crops, especially turnips and clover, in arable rotations. Not only did these crops result in an increase in fodder yields, but they were also instrumental in the reclamation of many lowland heaths from rough pasture to productive arable farms. The most important new crop in this context is the turnip, because it meant that the area of fallow land could be reduced. This was because one of the purposes of the fallow was to clear the land of weeds by ploughing, but a crop of turnips sown in rows could be hoed to remove weeds while it was growing. Thus fallow land was about 20 per cent of the arable area in England in 1700, and steadily declined to reach only 4 per cent in 1871. One of the earliest pieces of evidence we have, concerning the cultivation of turnips for animal fodder, is the inventory taken for probate purposes, in 1638, of the possessions of a Mr. Pope, of Burgh Castle in Suffolk. But turnips were not common until the mid- eighteenth century, and not widespread as part of the new Norfolk four- course rotation until the nineteenth century. Cereal yields also increased. Wheat yields increased by about a quarter between 1700 and 1800, and then by about a half between 1800 and 1850, and the most recent research emphasises the early nineteenth century as the period of crucial change. The key to increasing cereal yields was nitrogen, which we now know was the 'limiting factor' in determining cereal yields before about 1830. Livestock breeders improved their methods too. In the 1700s, for example, Robert Bakewell increased his mutton (sheep meat) output by allowing only his best sheep to breed. Other farmers followed Bakewell’s lead. Between 1700 and 1786, the average weight for lambs climbed from 18 to 50 pounds. Better nutrition boosted England's population, creating the first necessary component for the Industrial Revolution-manual labour. An increasing population also boosted the demand for food and goods such as cloth.

Before this time, farmers did not know formally of the existence of nitrogen, but one can interpret many of their actions in terms of the conservation of existing stocks of nitrogen, and the addition of new nitrogen to the soil. Existing stocks were exploited, for example, by ploughing up permanent pasture to grow cereals. Available nitrogen was conserved by feeding bullocks in stalls, collecting their manure (which is rich in nitrogen), and placing it where it was needed. Also, most importantly, new nitrogen was added to the soil using legumes- a class of plants that have bacteria attached to their roots, which convert atmospheric nitrogen into nitrates in the soil that can be used by whatever plants are grown there in the following few years Legumes had

been sown since the Middle Ages in the form of peas, beans and vetches, but from the mid- seventeenth century farmers began to grow clover, both white and red, for the same purpose, and by the nineteenth century had dramatically increased the quantity of nitrogen in the soil available for cereal crops. In Norfolk, for example, between 1700 and 1850, the doubling of the area of legumes and a switch to clover tripled the rate of symbiotic nitrogen fixation. Livestock husbandry also seems to have been important, both as a source of manure and of power. England had perhaps 700,000 farm horses, compared with France which had a million horses to work an arable area approximately four times as large. French travellers commented on the numbers of cattle, sheep and horses in England.

This new system of farming was remarkable because it was sustainable; the output of food was increased dramatically, without endangering the long-term viability of English agriculture. But just as a sustainable agriculture had been achieved, the development of chemical fertilizers and other external inputs undermined this sustainability. An essentially organic agriculture was gradually replaced by a farming system that depended on energy- intensive inputs dependent on the exploitation of fossil fuels. Exactly how those working on the land were able to produce more food remains something of a mystery. More animal power was available to English farmers than to their counterparts elsewhere and from the 1820s and 30s a wide variety of machinery was developed, which was particularly important for improving the efficiency of the cutting and threshing of grain. The improvement in labour productivity, however, had begun long before this. The key probably lies in the way the English workforce was organized and employed. The development of agrarian capitalism in England, with those involved in agriculture divided into landowners, capitalist tenant farmers and labourers, saw the development of better farm management and more efficiency in using the workforce.

Due to the above reasons also why we can claim an agricultural revolution in the century after 1750 is that as each agricultural worker produced more food, so the proportion of the workforce in agriculture fell. This falling proportion of workers in agriculture enabled the proportion working in industry and services to rise, in other words improved agricultural production made the industrial revolution possible, and many would regard the industrial revolution as the beginning of the modern world. By 1850 only 22 per cent of the British workforce was in agriculture; the smallest proportion for any country in the world. The urbanization of the English population was largely fueled by dispossessed peasants who moved to the city in the hopes of finding new work

Debate about the agricultural revolution in England is still full of controversy. Some historians, particularly those using the techniques of economics to derive indices of output and productivity from prices, completely dismiss the idea of an agricultural revolution after 1750 and argue that the major changes happened earlier. Since no national agricultural statistics were produced until 1866 it is understandable that historians search for techniques that purport to give them the information they want: but it is difficult to avoid the overwhelming mass of evidence from a wide variety of sources that points to the period after 1750 as witnessing an agricultural revolution.

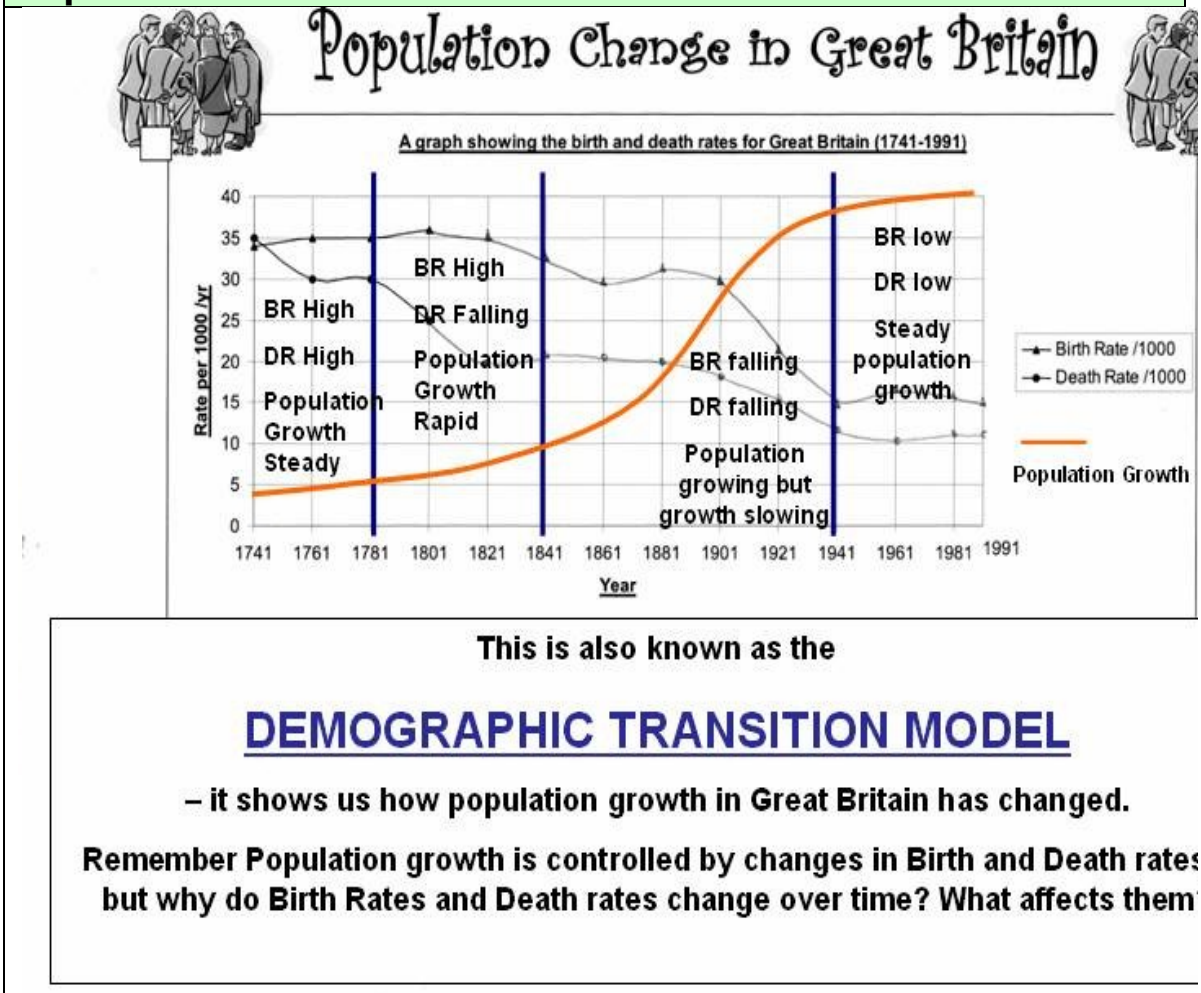
13.3.3 Role of Population

It is still argued that an English agricultural revolution happened in the century or so after 1750. One obvious reason behind the argument is the fact that an expanding population from this time on was largely fed by home production. In 1750 English population stood at about 5.7 million. It had probably reached this level before, in the Roman period, then around 1300, and again in 1650. But at each of these periods the population ceased to grow, essentially because agriculture could not respond to the pressure of feeding extra people. Contrary to expectation, however,

population grew to unprecedented levels after 1750, reaching 16.6 million in 1850, and agricultural output expanded with it. The British population grew substantially from *c*. 11 million in 1760 to c. 16 million in 1801. (A possible cause was a lowering of the age of marriage for women.) This provided a potential work force and alsorising demand. But it came to be seen as a problem.

Value addition: Common Misconceptions

Population Patterns in Britain:1741-1991



Source: http://geoblogbytes.wordpress.com/year-8/

In 1798 Malthus's *Essay on the Principle of Population* argued that demographic growth must, sooner or later, overtake the resources available to sustain it. The inevitable outcome will be famine or social catastrophe. Malthus's pessimism was a reversal of earlier thinking, which tended to assume that a rise in population was beneficial. He wrote at a time of economic crisis. Population had risen progressively since the mid-century and food prices had reached unprecedented peaks, accentuated by war and harvest failure. Wages had not kept pace with prices and the 1790s was a decade of widespread distress. But Malthus proved a false prophet and his threatened crisis did not emerge. Even in the bad years of 1795 and 1800 no part of the British Isles experienced famine comparable to that of France in the 1780s.

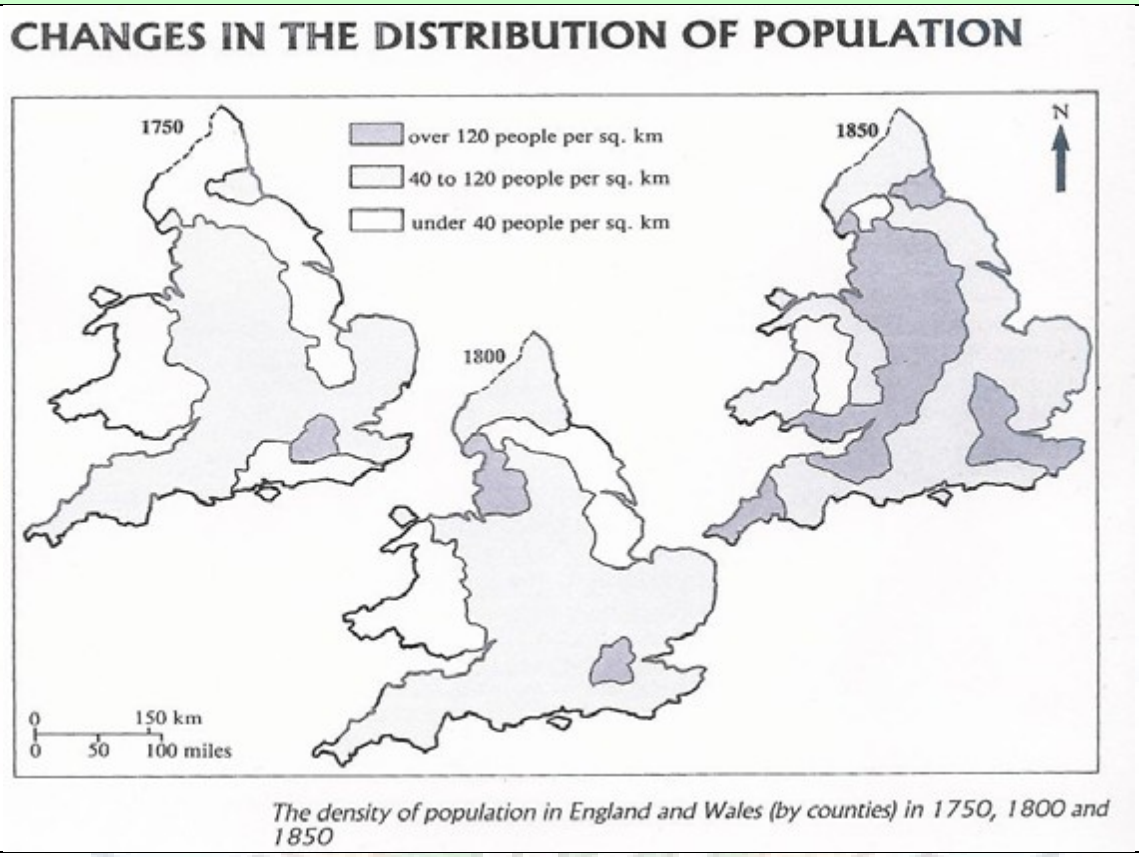
E.A. Wrigley and R.S. Schofield published a book called *The Population History of England 1541- 1871: A Reconstruction* in 1981 to establish that starting from the early eighteenth century, and accelerating rapidly from about 1740, English population surged rapidly. In 1680– 1820 the growth rate was 133%, and in 1820–1900 it was 166%, with rates in France in these periods of 29% and 26% respectively. The growth was particularly marked in the period 1791– 1831, during which it was 1.36% per annum– an increase overall from 7.74 million to 13.28 million. The work of Wrigley and Schofield established that the dominant characteristic of the English demographic regime that allowed this growth was a rise in the level of fertility during this period – the gross reproduction rate (GRR) went from 1.98 in the 1670s/80s to 2.94 in the 1810s/20s. Wrigley and Schofield say that if mortality had remained unchanged over this period (the "long" eighteenth century) and fertility had run its historic course, the intrinsic growth rate of the population would have risen by 1.25%. If the converse had happened, the rise would only have been 0.5%. Because marital fertility did not rise during this period, the most significant factor is incidence and timing of marriage.

What was the cause for the rise in population? Certainly a partial answer can be found in the fall in the death rate in the middle decades of the eighteenth century, no doubt the result of improved sanitation, piped water, cotton clothes that were easily washable, cheaper soap, vaccinations for children, and improved child and mother nutrition that reduced infant mortality. This lowered death rate was accompanied by a simultaneous increase in the birth rate that could be attributed to a number of factors including improved nutrition resulting from improved agricultural methods and improved methods of drainage that increased crop productivity and brought heretofore-unusable marshlands under cultivation. Moreover, the Enclosure Acts beginning in 1709 and ending in 1869, which had the general effect of turning previously unused common-lands to intensive agricultural and increased the total acreage in Britain under cultivation by almost fifty percent. J.A. Goldstone sees the problem of explaining English population growth in this period as primarily one of explaining the reasons people were marrying earlier. The conundrum is now a social and economic one, rather than simply a demographic one. Like many other writers, Goldstone thinks proletarianization was a major contributing factor to the decline in the age of marriage. As more people moved into the economic group which subsisted by wage labour, more people found the determinants of marriage favouring earlier nuptiality. Prior to proletarianization most people had worked as farm labourers on a one year contract or live-in servants-in-husbandry and they had continued working in these conditions until they accumulated enough capital to marry and set up their own household, perhaps with their own piece of land. The proletarian, on the other hand, saw no prospects of further development in his social position and had only to establish an income base before marrying. The segment of the population in proletarian wage labour which paid well enough and with sufficient regularity to marry early was, by this thesis, increasing in the eighteenth centuries.

This population growth was in itself a stimulus for capital investment, for it increased the demand for goods and supplied labour for production. Not only did the gross population figures for Britain show a significant rise, the figures also show a dramatic shift to an urban environment as new industries required cheap labour and placed a value on large families. This demand for labour even reached the point where some employers such as the Arkwrights advertised for families willing to relocate. In only a decade between 1811 and 1821, Manchester grew by more than 40 percent, and by 47 percent in the following ten years. Liverpool and Leeds also grew by more than 40 percent. Under the influence of the mechanization of agriculture, the Enclosure Acts

which forced thousands from lands held in common before 1709 and later with the conspicuous prosperity of the Victorian age, the balance moved rapidly in favour of the towns and by 1881, urban districts claimed almost 70 percent of the population of England and Wales.

Value addition: Concept Map



The density of population in England and Wales (by counties) in 1750, 1800 and 1850

Source: http://www.comenius-promise.eu/Magazine/Gallesi/Blaengwawr_1.pdf

13.3.4 Geography and Natural Resources

As Namier put it, A great deal of what is peculiar in English history is due to the obvious fact that Great Britain is an island. One of the consequences of being an island has been that international trade has been a defining factor in Britain's history. With a good Atlantic location, close to yet physically separate from continental Europe and with a good coastal water system and good harbours, international trade assumed a new importance during the period of transition to industrialization. In fact, no place in Britain is more than fifty miles from navigable water. Britain had certain other innate geographical advantages. She was a small country with fertile land and plenty of navigable rivers to facilitate movements of bulky goods. Access to the sea is easy from most parts of the country. The fast flowing streams of the north and north Midlands, Wales and Scotland provided motive power for the early mills. When water gave way to steam, coal was available in South Wales, the East Midlands, South Yorkshire, the North-east and central

Scotland. The climate of the North-west was conducive to the processing of raw cotton. Britain's varied topography enabled a rich variety of agricultural specialisation to develop. Each single advantage could be replicated in other European countries, but no other nation enjoyed such a rich combination.

Another consequence of Britain's island geography was its relative isolation from the many continental wars. War was an almost continuous in Europe for two hundred years starting with the Thirty- Years War in 1618 to the end of the Napoleonic War in 1815. At the same time, Britain enjoyed a virtual absence of hostilities on its own soil. Not since 1066, did Britain suffer the ignominy of a successful foreign invasion, and the only battles fought within its own borders were those that were self-inflicted. Therefore, whereas the leaders of continental nations could survey devastation wrought on their lands by the ravages of war, those of Britain saw their country virtually untouched. In fact, as Paul Kennedy pointed out, Britain seemed to flourish during periods of continental hostilities. For example, during the Seven Years' War (1756-63), trade increased every year and shipping rose by over 32,000 tons to well over 500,000 tons annually, or about one- third of Europe's total tonnage. Not only was the impact felt at home but also in countries with which Britain traded. The cotton industry, in particular, enjoyed the double advantage of revolutionary innovation in the manufacture of the finished product at home as well as in the processing of raw material abroad. The favourable combination of technical innovation and expanded markets had a self generating effect, driving the price of the finished product down at the same time as it improved its quality. The production of superior quality merchandise at prices within the reach of an ever- widening market led to innovations making it possible to achieve tremendous savings in labour, thus releasing capital for more innovation and more machines in the production of more goods. This combination, T.S. Ashton has called the *Acentre* of the Industrial Revolution.

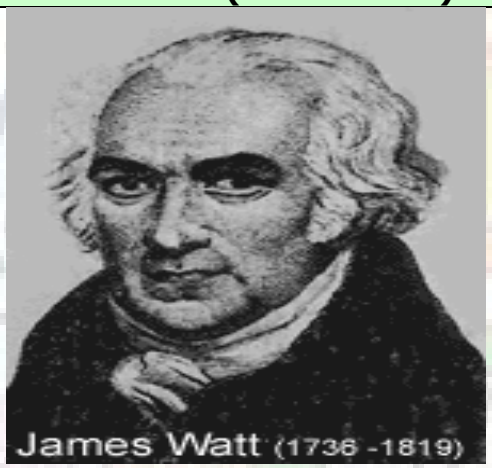
13.3.5 Technological Revolution

England also was the first to experience a technological revolution, a series of inventions built on the principles of mass production, mechanization, and interchangeable parts. Josiah Wedgwood developed a mold for pottery that replaced the potters' wheel, making mass production of dishes possible. Many experimented with machinery to speed up human labor, and interchangeable parts meant that machines were more practical and easier to repair. Technology was at the core of everything. An anonymous schoolboy, immortalized in a classic 1948 book by T. S. Ashton, called the *Industrial Revolution* "a wave of gadgets" that swept Britain. Technology may have been an engine that propelled the economy forward, but it took its fuel from a society and an economy that were exceptional, not just relative to non- European nations but even in comparison to its close European competitors and enemies such as France and the United Provinces. Eighteenth-century Britain was what we may call a technologically competent society. It was teeming with engineers, mechanics, millwrights, and dexterous and imaginative tinkerers who spent their time and energy designing better pumps, pulleys, and pendulums. Even wealthy landowners and merchants displayed a fascination with technical matters. Men such as John Smeaton, often called the first modern engineer, Joseph Bramah, thought of as the originator of hydraulic power, and the prodigiously gifted engineer Richard Roberts could turn to almost any technical question and resolve it as well as could be done. Britain had an unusual number of such people. One famous quote from a Swiss visitor in Britain in 1766 declared that for a thing to be perfect it had to be invented in France and worked out in England. As it turned out, some of the great inventions of the Industrial Revolution were produced in Britain, whereas others came from the Continent. Yet in the kind of society that Britain was in these years

the question of "where it came from" was not important. "Does it work?" and "Can it make money?" were what mattered. The most famous invention of the Industrial Revolution was the steam engine. Strictly speaking, the steam engine was the result of work carried out, mostly on the Continent, in the last third of the seventeenth century. The first steam engine prototype was built by a Frenchman named Denis Papin, but there is no question that the first useful atmospheric steam engine was built in 1712 by a Cornish mechanic named Thomas Newcomen. For half a century Britain used Newcomen engines, which, though noisy and voracious in their fuel use, served mostly as pumps. The conversion of the steam engine into a source of industrial power was the handiwork of Scottish inventor James Watt, who introduced a number of famous improvements to the steam engine, such as a separate condenser, the principle of double- acting expansion, improved gears, and regulators.

Value addition: Biographic Sketches

James Watt (1736-1839)



James Watt was born on January 19, 1736, in Greenock, Scotland. He was a Scottish instrument maker, mechanical engineer and inventor, who contributed to the Industrial Revolution with his improvements of the steam engine. At the age of 17, while becoming intrigued with Thomas Newcomen's steam engine, he decided to become a maker of mathematical instruments. Two years later, he became interested in improving the Newcomen-Savery steam engines that were used to pump water from mines at the time.

By the age of 29, Watt created a separated condenser for steam engines. He determined the properties of steam, especially the relation of its density to its pressure and temperature. Having this in mind, he designed a separate condensing chamber for the steam engine, which seized great losses of steam in the cylinder and improved the vacuum conditions. In 1767, he built an attachment that made telescopes suitable for the measurement of distances. In 1768, he associated with John Roebuck of the Carron, a British inventor who had financed Watt's researches, and received a patent the next year for his method of lessening the consumption of fuel and steam in an engine and for other enhancements on Newcomen's device. In 1772, John Roebuck became bankrupt and, three years later, Matthew Boulton, a British manufacturer who owned the Soho Engineering Works at Birmingham, became Watt's new associate. Watt and Boulton began the manufacture of steam engines.

James supervised the installation of pumping engines in copper and tin mines

from 1776 to 1781. His study on engines continued and he received many patents for other important inventions, which included the sun-and-planet gear, the rotary engine, the double-action engine, and the steam indicator. In 1785, he was chosen as a fellow of the Royal Society of London. In 1788, he invented the centrifugal or flyball governor that regulated the speed of an engine automatically and, in 1790, the pressure gauge. In the nineteenthh century, he retired from the firm and dedicated himself to his research work. James Watt was sometimes mistaken by the actual creator of the steam engine. This was due to the great contributions he has done on the development of this device. The Watt, the electrical unit (or unit of Power), was named in his honor. Besides being an inventor and a mechanical engineer, Watt was also a civil engineer and made various surveys of canal routes.He died on August 19, 1819, in Heathfield, England.

Source:http://library.thinkquest.org/C006011/english/sites/watt_bio.php3?v=2

Watt turned steam power from an atmospheric pump to a true steam engine. When his patent expired in 1800 after thirty one years, a new principle in steam power, the high- pressure engine, was developed, which soon threatened the Watt engine's monopoly. High- pressure engines provided increased power from engines lighter and smaller than older counterparts, and were thus ideal for transportation; and after years of experimentation they were successfully adapted to locomotives by Robert and George Stephenson, in 1825. Yet the steam engine, its psychological impact and technological future aside, had a relatively minor impact on the British economy before the advent of the railroad. Of about twenty- two hundred machines operating in Britain in 1800, almost half were employed in mining and quarrying, and about 40 percent in manufacturing. By 1835 Lancashire had switched over to steam, but the cotton industry in the rest of Britain still depended on water mills for about half its horsepower. The Industrial Revolution witnessed enormous progress in the utilization of waterpower, above all Smeaton's breast wheel (which combined the advantages of over- and undershot wheels), and the growing use of iron in the manufacturing of water wheels. Even more than did steam, waterpower benefited from the growing scientific understanding of its principles, especially among hydraulic engineers in France. In other nations, especially the United States, France, and Switzerland, waterpower remained of central importance.

A second industry often identified with the most dynamic aspects of the technology of this time is textiles. By the middle of the eighteenth century, cotton was a small and rather unimportant sideshow in the British textile industry, famous for its woolens. Cotton's growth during the Industrial Revolution was truly amazing. Value added in cotton went from less than half a million pounds in 1760 to around 25 million in the mid-1820s. It is no wonder that some economic historians have thought of this industry as the "leading sector" in the Industrial Revolution. The reason for this success was cotton's physical characteristics. It lent itself uniquely to mechanization and mass production and produced a good that was of even quality, attractive, and above all inexpensive.

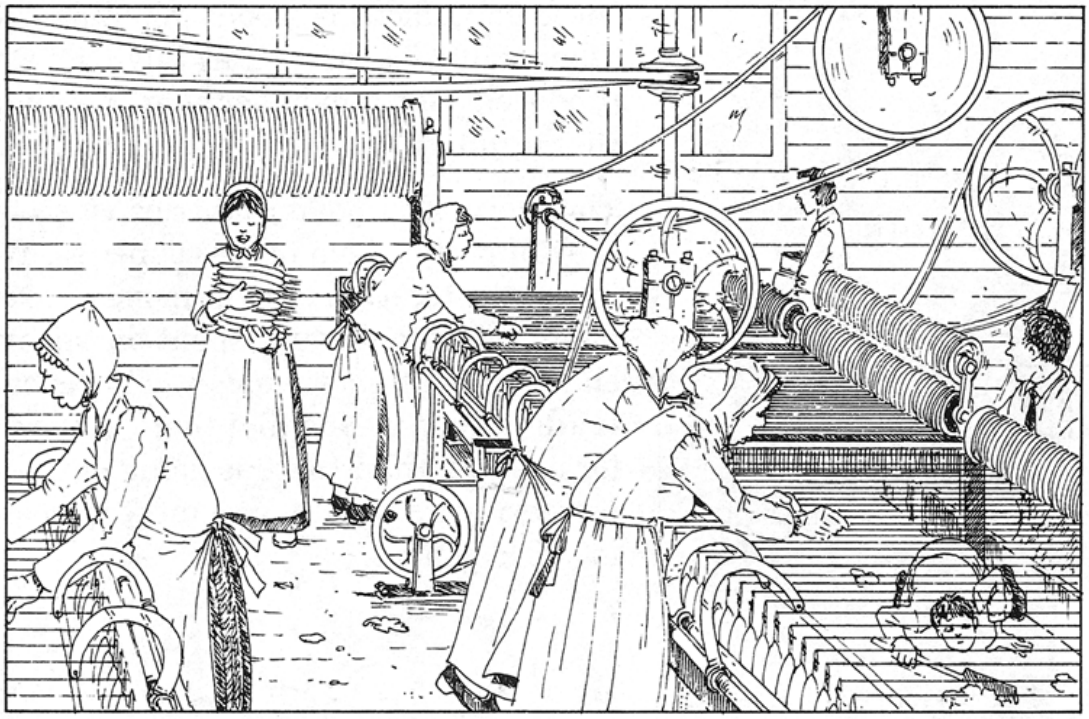
By 1800, several major inventions had modernized the cotton industry. One invention led to another. In 1733, a machinist named John Kay made a shuttle that sped back and forth on wheels. This flying shuttle, a boat-shaped piece of wood to which yarn was attached, doubled the work a weaver could do in a day. Because spinners could not keep up with these speedy weavers, a cash prize attracted contestants to produce a better spinning machine. Around 1764, a textile worker named James Hargreaves invented a spinning wheel he named after his daughter.

His spinning jenny allowed one spinner to work eight threads at a time. At first, textile workers operated the flying shuttle and the spinning jenny by hand. Then, Richard Arkwright invented the water frame in 1769. This machine used the waterpower from rapid streams to drive spinning wheels. In 1779, Samuel Crompton combined features of the spinning jenny and the water frame to produce the spinning mule. The spinning mule made thread that was stronger, finer, and more consistent than earlier spinning machines. Run by waterpower, Edmund Cartwright's power loom sped up weaving after its invention in 1787.

Value addition: Timeline
Growth of Textile Machinery
• **1733** Flying shuttle invented by John Kay - an improvement to looms that enabled weavers to weave faster. • **1742** Cotton mills were first opened in England. • **1764** Spinning jenny invented by James Hargreaves - the first machine to improve upon the spinning wheel. • **1764** Water frame invented by Richard Arkwright - the first powered textile machine. • **1769** Arkwright patented the water frame. • **1770** Hargreaves patented the Spinning Jenny. • **1773** The first all-cotton textiles were produced in factories. • **1779** Crompton invented the spinning mule that allowed for greater control over the weaving process.
Source: http://inventors.about.com/library/inventors/blindustrialrevolutiontextiles.htm

As long as spinning remained a manual process, the yarn produced remained both costly and of uneven quality. As referred above this bottleneck was resolved by a string of brilliant mechanical inventions between 1765 and 1779, which led to the famous mule (so-named because it consisted of a combination of the 1765 spinning jenny and the throstle), patented in 1769. The mule became the industrial machine par excellence, and within a few years it was coupled to the steam engine, so that the first truly "modern" factory (or "mill" as it was known at the time) was born. The mule was perfected in 1825 by making it automatic through the introduction of the self-actor. An indication of the magnitude of the improvements attained is shown by the number of hours needed to spin a hundred pounds of cotton. The "old" technology employed an Indian hand spinner, who took about 50,000 hours. The mule brought that number down to around 300 hours in the 1790s, and three decades later the self-actor reduced the figure to 135.

Value addition: Sketch
A Textile Factory during the Industrial Revolution



Source:
http://assets.cambridge.org/97805216/80660/excerpt/9780521680660_excerpt.pdf

Many of the other processes used in manufacturing cotton were also mechanized to some extent, though some of the problems proved more difficult than others. Carding, the process that prepared the cotton for spinning was mechanized early on; ginning, the removal of the seeds from the raw cotton, was mechanized in 1793. Weaving by machine turned out to be more difficult, and power looms did not become successful until after 1820, though their use then spread rapidly. Calico printing was mechanized by the invention of copper rollers that printed patterns on finished cloth. Bleaching was revolutionized by the introduction of chlorine- based bleaching agents in the 1790s. By 1830 only the extremes of the upstream and the downstream of the industry were not mechanized; raw cotton was still grown and picked by hand in American fields, largely by black slaves; and finished clothes were still sewn together by hand by apparel makers, seamstresses, and tailors. Growth in the mechanization of textiles was not confined to cotton, but the other textiles inevitably lost a great deal of market share. Worsted (combed wool) yarns were easily adapted to the cotton spinning machinery, but the combing process itself was not mechanized successfully until the middle of the nineteenth century. In the heavy woolen industry, the labor-intensive preparation and finishing processes were successfully mechanized early on, but spinning and weaving proved more difficult and were not fully mechanized until the 1840s. Linen, the other major textile, made from the stem of flax, was also hard to spin mechanically. A French inventor, Philippe De Girard, tempted by a large prize promised by the Emperor Napoleon, solved the problem in about 1810; and his "wet spinning" process was introduced into the flax-spinning industry in Britain in about 1825. One of the most interesting inventions of the Industrial Revolution was the loom invented by Joseph- Marie Jacquard in 1801, which automated the weaving of patterns in a piece of fabric. Used for up market

silks and worsteds, this machine was the first to code information using a binary code; and it inspired the work of Charles Babbage, a British mathematician who pioneered the first digital calculating machine.

A third area in which the Industrial Revolution achieved major advances was iron making. One important innovation was the use of new fuels in the smelting of iron ore in blast furnaces. The replacement of charcoal by coke (purified coal) in blast furnaces remedied the costly need to access remote forest areas. Blast furnaces became bigger, hotter, and more efficient as more powerful machinery was used to blow air into the furnaces. In 1828 a Scotsman, James Neilson, discovered that by using the blast furnaces' own gases he could cut fuel usage by up to a factor of three. The problem remained, however, to refine the end product of the blast furnace, known as pig iron, into the more malleable and usable wrought iron. After decades of experimentation and searching, a British ironmaster named Henry Cort solved the problem in 1785, through what became known as the paddling and rolling process, a truly epochal breakthrough of the Industrial Revolution. Cort's process took Britain (and soon after that, the rest of Europe) by storm. In one dramatic stroke, the bottleneck that had occupied thousands of small-time forges and smithies was resolved. Even in steelmaking, a difficult art in which specialists fiercely kept their trade secret, there was progress, Benjamin Huntsman, a Sheffield steelmaker, perfected what became known as crucible steel, a high quality product that became famous the world over. Steel remained expensive, however, and would not be mass produced until the second half of the nineteenth century.

Value addition: Interesting Facts

Henry Cort and Iron

Born in Lancaster, England, in 1740, Henry Cort was one of many individuals who were central to the development of the iron and steel industries before and during the Industrial Revolution. From 1765 Cort developed an interest in iron while he was in the Royal Navy, where he was in charge of improving wrought-iron ordnance. In 1775, after years of experimenting with improved methods for wrought-iron production, Cort purchased a forge and slitting mill at Fontley. He tried to find an easy way to convert cast iron into wrought iron; traditionally a smith had hammered the iron in a forge. He patented grooved rollers in 1783 which replaced most of the hammering. By 1784 Cort worked out a process of pudding, whereby molten pig iron was stirred in a reverberatory furnace. As the iron was decarbonized by air, it became thicker, and balls of "puddled" iron could be removed as a pasty mass from the more liquid impurities still in the furnace. Puddled iron, like wrought iron, was tougher and more malleable than pig iron and could be hammered and finished with the grooved rollers. He also devised a process whereby red-hot iron was drawn out of the furnace through grooved rollers which shaped the puddled iron into bars, whose dimensions were determined by the shape of the grooves on the rollers. The rollers also helped squeeze out impurities, and preliminary shaping into bars made the iron more readily utilizable for the final product.There were many advantages to these processes. Puddling used the plentiful coke, instead of the expensive charcoal. The combination of puddling and grooved rollers was a process that could be mechanized, for example, by the steam engine, which had just been introduced. The result was that production of wrought iron was increasingly carried out in a group of coordinated processes in a single economic unit, with reverberation processes in a single economic unit, with reverberation and blast furnaces operating side by side. This increased production at a greatly reduced cost, and for the first time iron became one of England's exports.

Source: http://biography.yourdictionary.com/henry-cort

These three sectors- energy, textiles, and iron- are rightly famous for their bold and path breaking innovations. Yet the period witnessed a large number of other industries that in some way or another modernized, either by revolutionizing the manufacturing process itself or by adopting some form of machinery. In chemicals, two major inventions stood out. The first was the manufacturing of alkalis (used in industries such as soap-boiling and glassmaking) by means of a soda-making process perfected by Nicholas LeBlanc in 1787. This process dominated world production until the 1860s. Even more revolutionary was the second invention, the use of a new chemical (discovered only in 1774), chlorine, for the bleaching of textiles. Long, expensive processes of bleaching were replaced, almost overnight, by a fast and reliable alternative.

13.3.6 Improvements in Transportation

As an integral part of determining the cost and availability of manufactured products and as a means of improved communications, and as an industry unto itself, the improvement of transportation stimulated the course of the Industrial Revolution. Finished products, raw materials, food and people needed a reliable, quicker and less costly system of transportation.

1. Road Transportation

Internally, a vital contribution to the movement and circulation of goods and services was the improvements to the transportation system. British roads improved, too, thanks largely to the efforts of John McAdam, a Scottish engineer. Working in the early 1800s, McAdam equipped road beds with a layer of large stones for drainage. On top, he placed a carefully smoothed layer of crushed rock. Even in rainy weather heavy wagons could travel over the new "macadam" roads without sinking in mud. Private investors formed companies that built roads and then operated them for profit. People called the new roads turnpikes because travelers had to stop at tollgates (turnstiles or turnpikes) to pay tolls before traveling farther. At the end of the seventeenth century, turnpike trusts set up under private acts of Parliament began to appear and by 1750 there were 143 of them, responsible for the maintenance of 3400 miles of roadway. Initially progress was slow and limited primarily to areas around London, but by the last quarter of the eighteenth century, turnpikes had crossed the Pennines and had linked most parts of the country with over 1500 miles in more than 500 trusts in England and Wales. The turnpike era saw a marked increase in the volume, speed and reliability of wheeled traffic. By 1700 stage wagons were a common sight in the South and were usual throughout the Midlands by 1750. By 1770, weekly services were in place, joining London, Leeds and Manchester, and by 1800, wagon services were numerous enough in most parts of the country to warrant timetables with longer distances covered in stages. On the fringes, towns throughout the north of England and into Scotland were served by wagons from Newcastle as frequently as two to three times per week. Improved road construction and maintenance methods were pioneered by the likes of 'Blind Jack' Metcalf and John McAdam whose legacies remain to this day. Realizing the importance of these roads to commercial traffic, Parliament saw fit to pass legislation such as the General Highway Act of 1767, restricting wagon weights, wheel widths and numbers of horses. Together, these improvements in methods and means

resulted in an estimated ten- fold increase in carrier trips and a thirty- fold increase in ton- miles for one carrier from London between 1715 and 1840.

2. Water Transportation

Canals and rivers had long been used as a means of internal transportation. The mid-1700s began the first construction of canals between industrial districts. The construction of trunk lines opened the central industrial districts in the 1770s. The major thrust of financial backing came from the merchants and industrialists, who had a great stake in their construction. The problem of moving bulk goods overland was addressed, at least for the time being, by canals. Complementing the road system was a good system of natural navigable waterways with which Britain had been blessed. The Humber, Severn, Cambridgeshire, Ouse, Mersey and Thames Rivers were all major waterways connecting smaller tributaries such as the Trent, the Calder, the Aire, the Don and the Yorkshire Ouse. These are, for most of their course, broad and slow, ideal for two- way barge traffic. Goods of all descriptions traveled up and down the river systems from suppliers to markets on 20 to 80-ton barges pulled by horses, or by work gangs of men, known as 'halers.' By the mid-1700s, the potential of the natural river systems had been exhausted and it was necessary to deliberately make waterways with the construction of canals. Acts of Parliament dating back to the Restoration enabled navigation through the building of locks, dredging and the digging of new cuts. Although some manmade improvements had been made to natural river systems, principally in the rivers serving Liverpool and Manchester, the first truly original canal route was that constructed by the Duke of Bridgewater (the 'Canal Duke') connecting his mines at Worsley to Manchester in 1748. This first legitimate 'deadwater' link, involving aqueducts and tunnels, virtually eliminated the limitations to water transportation. Now the application of water to industrial and trade sector was imminent. Ships which plied the high seas were larger, needed deeper water, and took longer to turn around. Moreover, because raw material imports during this period exceeded those of finished manufactured products, there was a marked increase in volume over value. This increase in volume meant that ports handling foreign trade were, as a group, coping with four times as much cargo in 1800 as they had been in 1700, and perhaps two and a half times as much as just fifty years earlier. The impact fell most heavily on a small number of ports that accounted for approximately 87 percent of the total tons handled by 1785. It was London, Bristol, Hull, Liverpool and Glasgow where the most fundamental need for improvements existed. The most basic requirements were for an increased area of water that would be made possible by the provision and enlargement of wet-docks and basins. The most striking example is that of the port of Liverpool, the commerce of which expanded almost four times as fast as any other in the country. A new tidal basin was opened in 1743, a second wet-dock in 1753, and three more between 1771 and 1796. A commercial purpose was available and proved to be a potent technology in Britain's early economic advancement. The growth in both coastal and international trade that began in the latter part of the eighteenth century also necessitated improvements to the nation's harbours with the most significant developments coming to those few ports which dominated the overseas Progress in the textile industry spurred other industrial improvements. By the mid-1800s, 4,250 miles of inland channels lashed the cost of transporting both raw materials and finished goods

3. The Railway Age

The principles of rail transport were already in use in the late 1700s. Tramways, using cast iron rails, were being employed in a number of mines in England. By 1800

more than 200 miles of tramway served coal mines. It is not surprising, then, to find a number of engineers connected with coal mines searching for a way to apply the steam engine to railways. The first such development, the steam engine, stemmed from the search for a cheap, convenient source of power. As early as 1705, coal miners were using steampowered pumps to remove water from deep mine shafts. But this early model of a steam engine gobbled great quantities of fuel, making it expensive to run. A number of men were involved in experimentation concerning the development of railroads in England. Between 1804 and 1820 we find a few partially successful attempts at developing a practical means of rail transport, Richard Trevithick's "New Castle," a steam locomotive that proved to be too heavy for the rails, John Blenkinsop's locomotive, which employed a toothed, gear-like wheel, and William Hedley's "Puffing Billy," which was used for hauling coal wagons from the mines.

One of these early railroad engineers was George Stephenson. He had gained a solid reputation by building some 20 engines for mine operators in northern England. In 1821, Stephenson began work on the world's first railroad line. It was to run 27 miles from the Yorkshire coal fields to the port of Stockton on the North Sea. In 1825, the railroad opened. It used four locomotives that Stephenson had designed and built. News of this success quickly spread throughout Britain. The entrepreneurs of northern England wanted a railroad line to connect the port of Liverpool with the inland city of Manchester. The track was laid. In 1829 the Liverpool and Manchester Railway sponsored a competition to determine the best type of locomotive. This contest took place on the Rainhill level at Lancashire from October 6 to 14, 1829. Three steam locomotives participated in the Rainhill Trials; Timothy Hackworth's "Sans Pareil," John Braithwaite and John Ericsson's "Novelty," and Stephenson's "Rocket." It is interesting and ironic to note here that the first railroad accident death occurred at these trials. None could compare with the *Rocket*, designed by Stephenson and his son. Smoke poured from the *Rocket*'s tall smokestack, and its two pistons pumped to and fro as they drove the front wheels. The locomotive hauled a 13- ton load at an unheard-of speed- more than 24 miles per hour. The Liverpool- Manchester Railway opened officially in 1830. It was an immediate success. The invention and perfection of the locomotive had at least four major effects. First, railroads spurred industrial growth by giving manufacturers a cheap way to transport materials and finished products. Second, the railroad boom created hundreds of thousands of new jobs for both railroad workers and miners. These miners provided iron for the tracks and coal for the steam engines. Third, the railroads boosted England's agricultural and fishing industries, which could transport their products to distant cities. Finally, by making travel easier, railroads encouraged country people to take distant city jobs. Also, railroads lured city dwellers to resorts in the countryside. Like a locomotive racing across the country, the Industrial Revolution brought rapid and unsettling changes to people's lives. Railroads dominated the transportation scene in England for nearly a century. Railroads proliferated in England, from 1,000 miles in 1836 to more than 7,000 miles built by 1852. The development of reliable, efficient rail service was crucial to the growth of specific industries and the overall economy.

As production increased, entrepreneurs needed faster and cheaper methods of moving goods from place to place. Britain was able to establish communications and transport relatively cheaply due to its easy accessibility to the sea. The rivers supplied water power and allowed the canals to be built. Canals increased accessibility for trade and were crucial in the process of bringing goods to markets. Capitalists invested in turnpikes, or private roads built by entrepreneurs who cared travelers a toll, or fee, to use them. Turnpikes linked every part of Britain and

created goods traveling faster. Canals connected inland towns with coastal ports and stronger bridges and harbors were created to help the expanding overseas trade. Entrepreneurs created canals for profit and not all canals that were built had enough traffic to support them. Therefore, bankruptcy occurred and canals lost their important as steam locomotives made railroads the new preferred form of transportation. The invention of the steam locomotive made the growth of railroads possible which meant that tracks could go places where rivers did not. This allowed factory owners and merchants to ship goods smoothly and cheaply over land.

13.3.7 Role of State; Colonialism

European nations had already begun to acquire wealth by mining gold and silver at home and overseas. For example, Spain had sent explorers to colonise the Americas and to seize the silver and gold mines of the Aztecs and the Incas. With the growth of mercantilism there was a growing need for more and more gold and silver and for other valuable Raw Material. This was the beginning of European colonialism. European nations took control of other areas of the world with brute force and extracted valuable raw materials which were used by merchants and industrialists back in Europe. Colonies served a definite purpose in the mercantilist system. They were both the source of raw materials that Europeans lacked in their own countries, and they also provided markets in which to sell the finished goods produced in Europe. If a country had a strong navy, like the Netherlands, it could take over colonies. Therefore, companies based in such countries were very successful, and the countries themselves became very rich. Economic historian David Landes, for example, writes that in 1760 "Britain imported some 2 ½ million pounds of raw cotton…" and that by 1787, this increased to 22 million pounds. With raw materials from the colonies, European countries were able to produce all the manufactured goods they needed. They also used these manufactured goods for trade – selling manufactured goods to other countries, as well as buying goods that other countries produced. But remember that the main idea of mercantilism was that countries should accumulate wealth. To accumulate wealth, European countries needed to export more goods than they imported from other countries. Why? If they sold lots of goods, then they received a lot of money in return. And if this amount was more than the amount spent on imported goods, then the country ended up with more money. This is called a favourable balance of trade, which means that there is more money coming in, as earnings for exports, than there is money going out, as payment for imports. By increasing its wealth, a country increased its power and its influence in world affairs.

Three major components of colonial exploitation from the sixteenth to the eighteenth century must be distinguished- the Spanish mining of silver with forced labour in the Americas; the forcible transfer of millions of Africans as slaves across the Atlantic; and the levying of tribute on Asian shipping and land. England came in time to be the major beneficiary from all these three practically simultaneous processes of forcible subjugation and destruction of non- European economies. colonial tribute comprised wage- goods (tea, tobacco, rum, calico) and raw materials (silk, indigo), largely obtained 'free' at the level of national accounts, it enlarged industrial capital, by simply reducing costs. The navigation Acts of 1651 and 1660 gave Britain a trade monopoly with its colonies. The government not only provided shipping and monopolised colonial trade but issued tariffs in order to promoted exports and discourage imports in its effort to keep a positive trade balance. British Mercantilism provided substantial capital to finance the increasing industries at home. Exportation

of Britain's raw materials was discouraged and bounties were paid to stimulate home industries and manufacturing of new textiles such as silk and sail- cloth. Increased production led to the attempt at colonialism to increase trade, which ultimately made Britain the first naval, commercial, and colonial power in Europe. A war with the Dutch in 1652 forced them to accept the navigation Acts. The march of trade and imperialism led up to the Industrial Revolution culminating in the Seven Years War. Other countries put up similar barriers but English new markets in America and Caribbean kept up demand. With European markets closed Britain sought markets in the Ottoman Empire, the East and the West Indies. Britain's subsequent control of India meant the relative ease Britain enjoyed for the importation of the increasing demand of cotton. There is little dispute that England annually obtained large revenues out of external sources: About the closing years of the eighteenth century, William Pitt put it at £ 17 million per annum. E.J.Hobsbawm put it in his now- classic study *Industry and Empire*, "The British Industrial Revolution cannot be explained in purely British terms, for this country formed part of a wider economy, which we may call the 'European economy' or the 'world economy of the European maritime states.' It was part of a larger network of economic relationships, which included several 'advanced' areas, some of which were also areas of potential or aspiring industrialization, and areas of 'dependent economy,' as well as the margins of the foreign economies not yet substantially involved with Europe. These dependent economies consisted partly of formal colonies (as in the Americas) or points of trade and domination (as in the Orient), partly of regions which were to some extent economically specialized in response to the demands of the 'advanced' areas (as in some parts of Eastern Europe). The 'advanced' world was linked to the dependent world by a certain division of economic activity- a relatively urbanized area on the one hand, zones producing and largely exporting agricultural products or raw materials on the other. These relations may be described as a system of economic flows of trade, of international payments, of capital transfers, of migration and so on".The consequence was that the subject country integrated a bigger economic system in a subaltern position, emulating the countryside, which demands manufactured goods and offers raw materials, while the colonial power stressed its urban posture, providing goods and importing food. British colonies were sources for raw materials for manufacturing in Britain (raw cotton), food (wheat, rice), and markets for goods produced in Britain (cotton goods, hardware, iron and steel products) .colonies also proved as source of profitable investment for example British built railways in India fostered trade and economic growth as well as facilitating British political and economic power in the sub-continent. A classical example of this mechanism is said to be the triangular trade, which involved England, southern United States and western Africa. Critics argue that this polarity still affects the world, and has deeply retarded industrialisation of what is now known as the Third World.

13.3.8 Role of Bourgeoisie

The bourgeoisie class consisted of people of common birth that traded and did other capitalist things. There were several middle classes. The wealthiest bourgeois were bankers, owners of factories and mines, merchants, shopkeepers, managers, lawyers and doctors. The middle classes were ambitious hard workers. There were people however that felt that the bourgeois were materialistic, selfish, callous, smug and conventional. When the industrial revolution started the society was agrarian and was dominated by landowning and labor controlling aristocracy. When during the 18th century an industry developed, the middle class grew. It took a while for the middle class to stop the political, economical, and social discrimination, which it had

to deal with. Eventually the middle class gained political power and social respect and made changes. The bourgeois held the highest offices in Western Europe by the end of the 18th century. The new elite of society during the industrial age were not the aristocrats, but the wealthy bourgeois.

13.4 THE HISTORIOGRAPHY OF THE "INDUSTRIAL REVOLUTION"

Historians have debated the nature, extent and ramifications of the Industrial Revolution for more than a century. The volume of evidence unearthed from primary sources on economic and social change covering the period from the end of the Seven Years War in 1763 to the Revolutions of 1848 is awesome. No consensus has, or indeed could now emerge. The Industrial Revolution has been endlessly 'reconfigured', 'reconceptualized' and 'deconstructed' down the generations and so much so that a radical minority of iconoclasts are now recommending that the category or label be expunged from historical discourse. The large areas of economic and social change that contemporaries emphasized, deplored and praised have been reconstituted as validated historical evidence and interpretations. The discipline of economic and social history has represented the discontinuities, continuities and predictions for the future associated with the Industrial Revolution in modern conceptual vocabularies, but uses statistical trends and hindsight that were obviously not available to even the most percipient of English and foreign observers of the day. Its more recent conceptions of the Industrial Revolution have entailed the rejection of traditional assumptions about the nature and speed of Britain's economic upsurge. For more than a century before and after the Second World War (when Britain was clearly in relative decline) British historians proudly accepted the canonical status bestowed upon their nation's First Industrial Revolution by the godfathers of social science (Tocqueville, St. Simon, List, Marx, Engels, Comte, Durkheim and Weber) and a long line of neo- classical economists including Jevons, Marshall, Hicks, Kindleberger, Rostow, Kuznets, North, Landes and other Americans in search of a mother country.The industrial market economy along with liberty, democracy and benign hegemony have long been perceived by '*les Anglo-Saxons*' as their bequest to modern civilisation. Unfortunately for this myth, historical research has now all but demolished the notion of a 'British' Industrial Revolution as the 'bridge' from ancient economic and social regimes to the modern world.

13.4.1 Technological Creativity

For the great Prussian philosopher, Friedrich Engels, the industrial revolution was the culmination of a series of technical improvements in the textiles industry, small improvements individually but collectively giving rise to profound and far-reaching change. The process started with James Hargreaves' spinning jenny, invented in 1764. Engels explained "this invention made it possible to deliver more yarn than heretofore. Whereas, though one weaver had employed three spinners, there had never been enough yarn, and the weaver had often been obliged to wait for it, there was now more yarn to be had than could be woven by the available workers… Now that the weaver could earn more at his loom, he gradually abandoned his farming, and gave his whole time to weaving… By degrees the class of farming weavers wholly disappeared, and was merged in the newly arising class of weavers who lived wholly upon wages, had no property whatever … and so became working men, proletarians". Engels highlighted both the transformative role played by new

machinery and drew parallels between England's and France's very different revolutions. 'The industrial revolution,' he wrote, 'is of the same importance for England as the political revolution for France … the difference between England in 1760 and in 1844 is at least as great as that between France under the ancien régime and during the revolution of July'. But the character of the Engels' industrial revolution was also quite different from that of French intellectuals, owing to the emphasis he placed upon the emergence of a new class of landless workers with nothing to their name but the wages they were able to earn by their own labour. This was, he argued, 'a revolution which altered the whole civil society'. Admittedly, this account of 'revolution' within British society was built upon a somewhat rosy description of life for the workers prior to mechanisation– according to Engels, they had lived 'a passably comfortable existence, leading a righteous and peaceful life in all piety and probity'. Nonetheless, Engels' account amounted to a complete interpretation of the British industrial revolution, emphasising the transformative role played by technology.

New technologies of course had long held a central position in interpretations of the industrial revolution. They had lain at the heart of French and German definitions of the industrial revolution in the nineteenth century, and had also been integral to English uses of the expression, once it became commonplace in the early twentieth century. The 1926 edition of the *Oxford English Dictionary* (the earliest to include a definition of the industrial revolution) described it as: 'rapid development of industry owing to the employment of machinery'. In the late 1940s, T. S Ashton memorably equated the industrial revolution with a 'wave of gadgets' and David Landes' influential work of the 1960s echoed the view that technological change had played a vital role in powering the industrial revolution. In true revisionist fashion, the stress that previous generations of historians had placed upon technology was out of fashion by the 1980s. The highly respected French historian Fernand Braudel, for example, considered that 'if there is one factor which has lost ground as a key explanation of the Industrial Revolution, it is technology'. Yet N.C.R. Crafts' new estimates for national growth coincided with renewed interest in the role of technology, innovation, and creativity in the manufacturing sector. Although Crafts rejected the notion of widespread technological change, slower growth rates did not in themselves disprove the importance of technology, since the large investments required to purchase new technologies may result in several years elapsing before significant gains are realised, and several historians consequently sought to demonstrate the breathtaking range and extent of inventive creativity that lay beneath Crafts' rather flat growth curves. So significant was inventive activity in the century after 1750 that Joel Mokyr, has concluded, 'it is appropriate to think about the Industrial Revolution primarily in terms of accelerating and unprecedented technological change'.

13.4.2 Social and Supply Factors

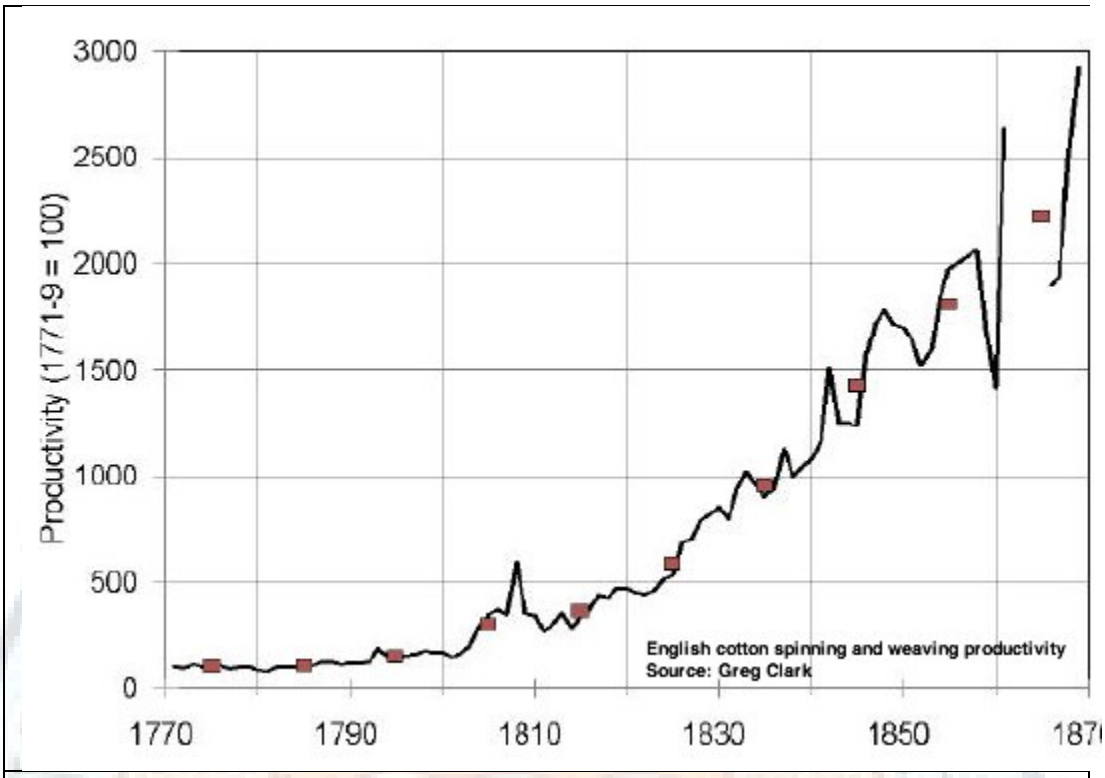
It was not until the end of the nineteenth century, with the work of the social reformer and historian, Arthur Toynbee, that the term an 'industrial revolution' decisively entered the English language. Toynbee's lectures, originally delivered to Oxford undergraduates between October 1881 and May 1882 under the title 'On the Economic History of England, 1760-1840' were re- titled Lectures on the Industrial Revolution in England for publication. In his view, the period 1760-1840 marked a fundamental transformation of the English economy, comprehending changes in population, agriculture and industry, as well as in the social lives of the poor. The 'essence of the industrial revolution', he concluded, was the replacement of medieval guilds and regulation with capitalist competition. In emphasising that industrialization

brought in its wake a number of deleterious consequences for the labouring poor, Toynbee shared considerable common ground with Engels, though there is no evidence that he had ever read Engels', as yet untranslated, Condition of the Working Classes. The Industrial Revolution is regarded by the Social Change School to have been first and foremost a change in the way economic transactions between people took place. The emergence of formal, competitive, and impersonal markets in goods and factors of production is the basis of this view. Toynbee writes that "the essence of the Industrial Revolution is the substitution of competition for the medieval regulations which had previously controlled the production and distribution of wealth". Karl Polanyi judges the emergence of the market economy as the truly fundamental event, to which everything else was incidental. A more recent contribution in this spirit, which emphasizes the emergence of competitive markets in manufacturing, is N.M. Wijnberg (1992). Most modern social historians probably would view the central social changes as having to do with labor and the relation of workers with their work environment, other laborers, employers, and capitalists. An enormously influential work in this regard is E. P. Thompson (1963).

The most complete and persuasive attempt to provide a social explanation of the Industrial Revolution based on this idea has been provided by Herold Perkin (1969). Perkin dates the creation of the type of society that was most amenable to an Industrial Revolution to the Restoration of 1660 and the social and political changes accompanying it. He points out that the principle upon which society was established following the Civil War was the link between wealth and status. Status means here not only political influence and indirect control over the lives of one's neighbors but also the houses to which one was invited, the partners that were eligible for one's children to marry, the rank one could attain (that is, purchase) in the army, where one lived, and how one's children were educated. In Perkin's view, the quality of life was determined not just by "consumption", as usually defined by economists, but by the relative standing of the individual in the social hierarchy. Whether this social relativity hypothesis is still a good description of society is an open question, but a case can be made, as Perkin does, that it is an apt description of Britain in the eighteenth century. In Perkin's own words, "To the perennial desire for wealth, the old society, [i.e., Britain after 1600] added more motivation which gave point and purpose to the pursuit of riches. Compared with neighbouring and more traditional societies it offered both a greater challenge and a greater reward to successful enterprise. . . . the pursuit of wealth *was* the pursuit of social status, not merely for oneself but for one's family".

Most analyses of the British industrial revolution have tended to look at supply– to focus upon how improvements in technology or increases in capital, energy, or raw material enabled the economy to grow. In a departure from this tradition, Jan de Vries has argued that it is necessary to consider rising demand along side changes in supply in order to understand British industrialization. According to de Vries, this rise in demand stemmed from a twofold change in the way in which families earned and spent their income. Firstly, workers had traditionally exhibited a preference for leisure over goods, that is, they had worked just so long as was necessary in order to procure life's essentials– housing, food and clothing– and then abandoned work (and the possibility of buying small luxuries with those extra wages) for leisure.

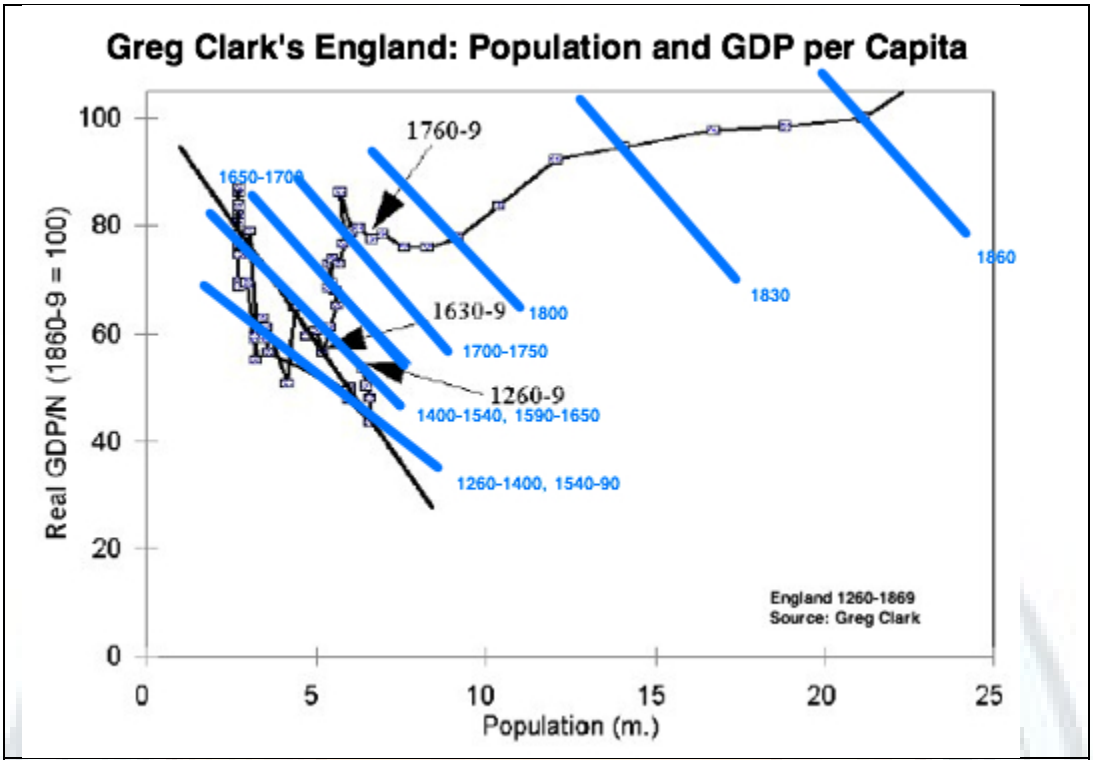
Value addition: Diagram
English Cotton Spinning and Weaving



Source: http://delong.typepad.com/sdj/2008/03/delong-econ-2-1.html

In the second half of the seventeenth century, this traditional working pattern gave way to a more recognizably 'modern' pattern, in which individuals worked longer hours in order to earn the wherewithal to purchase a few luxuries– tea, sugar, new cotton clothing, a decorative plate, or whatever else the consumer desired. Secondly, early modern workers had tended to produce much of what they consumed within the home rather than buying it at the market place, so a household got by growing a few potatoes in the garden, baking their own bread, brewing their own beer, and making their own clothes– cheaper alternatives to buying such goods and services from others. At the same time as families began to work harder in order to purchase small consumer goods, they also abandoned this domestic production in favour of buying goods readymade at the market, or even in one of the nation's rapidly growing number of shops. Although this change in household behaviour proceeded slowly, it gradually led to a rise in demand over the eighteenth century, which helped in turn to stimulate industrial growth. It constituted, de Vries argued, an "industrious revolution" … which preceded and prepared the way for the industrial revolution'.

Value addition: Common Misconceptions
Population and Growth



Source: http://delong.typepad.com/egregious_moderation/2008/03/greg-clark-the.html

Was the correlation between wealth and social status stronger in Britain than elsewhere? Holland was an urban, capitalist, bourgeois society, indicating that having the "right kind of society" is not a sufficient condition for a successful Industrial Revolution. But what about France? In the eighteenth century aristocratic titles could be bought, and much of the nobility was a *noblesse de robe*, i.e., of bourgeois origins. Was the aversion to parvenus among the upper class stronger in France than in England? Although the latter question cannot readily be answered, there were two important differences between the two countries in this respect. First, in France, too, money could enhance social status, but the respectable local country gentleman who ran the affairs of the parish was a wholly British institution. Second, in France social status was often literally bought. The price of a noble title reflected a tax exemption, so that the sale of titles was not a one-way street by which the crown soaked up wealth. But nobility implied high standards of consumption in the noblesse oblige tradition. In England, by contrast, wealth was correlated with influence and respect, but one did not necessarily have to part with the former to attain the latter.

13.4.3 National versus Regional Approach

Is Lancashire, England, Great Britain, or the United Kingdom to be used for comparative purposes, and what are their appropriate counterparts? Ought one compare a small country, such as England, to a large one, such as France with a population four times as large. In as much as the Industrial Revolution was essentially a regional phenomenon, the state is not necessarily the proper spatial unit of analysis. Economic and social historians, Pat Hudson, John K. Walton, John Rule and A.E. Musson have written extensively on the subject, arguing the causes and nature of the revolution, why it occurred first in Britain, whether the machines or

the markets came first, and even, if in fact, there was a revolution. Despite differing on various issues, historians seem to be in general agreement with Pat Hudson who argues that industrialization occurred on a regional basis. That is, different industries developed at different times in separate regions for a number of reasons including proximity to port and transportation services, climate (the damp climate of Lancashire was considered ideal for cotton spinning), natural resources such as water, coal or other minerals, land ownership and the politics of favouratism and nepotism in investment. Because of this regionalization, it is possible to look for instance cotton in isolation from other industries that developed in other regions.

The issue of Industrial Revolution occurring firstly in Britain rather than in some other country has been revisited by the historians. For, the Industrial Revolution was not so much a national as a regional affair. This has been stressed again in a collection by Pat Hudson, 1989). The regional argument was presented most cogently by Sidney Pollard (1981, 1985). Instead of dividing the European continent into "economies", Pollard prefers to look at regions that transcended national boundaries and shared a common economic fate. Thus one ought to prefer a comparison of, say, a region consisting of Lancashire and the West Riding of Yorkshire with a region consisting of southern Belgium and the northern *départements* of France. Pollard's criticism of the national economy as the unit of analysis is not likely to remain unchallenged itself. The best arguments for the choice of nation- state as the appropriate unit of analysis are still in Simon Kuznets, who pointed out that nations share common heritages and histories, and thus people tend to be more interested in their national history than in regional histories. Moreover, a nation- state has a common government that is the major legislative and policy-making body, and insofar as it affects economic development, the unit under its jurisdiction should be the unit of analysis. The state was also, in most instance, the agency that collected economic statistics. Consequently, for better or worse, most of our data (e.g., foreign trade statistics, fiscal returns, price and wage figures) come on the national level.

According to Francois Crouzet, the "industrial revolution was not made in England but in a few small districts of England - south Lancashire, some sectors of the East Midlands and Yorkshire, Birmingham, and the Black Country". East Anglia, Westmoreland, and Cornwall did not industrialize. Moreover, Herbert Kisch's regional studies of industrialization showed how far advanced German industry was in the eighteenth century, and demonstrated the conceptual weakness of equating the Industrial Revolution with a few innovations in the textile sector. He concluded, that historians "failed to appreciate the achievements" of the industrial enclaves in Krefeld, the Rhineland, Saxony and Silesia. Crouzet argued similarly that French economic development commanded more respect than it is usually accorded.

It might be debated whether Britain was a unified economy or not on the eve of the Industrial Revolution .Yet it was certainly becoming more of one after 1760, and with the possible exception of the United Provinces, it was the most unified economy in Europe. Above all, it is hazardous to disavow comparisons of national units on account of *intra*national variances because the regional differences were themselves a *consequence* of the process of national development. As Rick Szostak (1991) has emphasized, no nation can devote itself entirely to one industry. With the improvements in transportation, interregional specialization became an inevitable part of the phenomenon that we are trying to analyze, namely the concentration of some industries in the Northwest of the country. The rise of the Yorkshire woolen industry was the mirror image and the "cause" of the demise of its counterpart in the West Country. The south of England remained largely unaffected by the Industrial Revolution because it specialized in agriculture.

13.4.4 Culmination of the Long Process of Growth

E. M. Carus- Wilson argued that innovations to the fulling mill in the thirteenth century amounted to an 'industrial revolution … destined to alter the face of medieval England'. John Nef's researches on the coal industry led him to conclude that an 'industrial revolution' had occurred there in the century between 1540 and 1640.He later expanded this theory into a broader account of technological change throughout the economy in the century after 1540. The developments he discerned in this period were so striking; it led him to reject the eighteenth-century historians' claim to an 'industrial revolution': 'the concept of an "industrial revolution"', he argued, 'would seem to be especially inappropriate as an explanation of the triumph of industrial civilization in Great Britain. It gives the impression that the process was especially sudden, when it was in all probability more continuous than in any other country'. After all, examples of technological creativity abound: thousands of water- driven machines had provided inanimate source of power in fuelling mills, in mines, and in iron works since the middle Ages. Already in 1066, there were 6,000 water mills in operation in Britain. These developments even led some to argue that there was an "industrial revolution of the thirteenth century". An example of a subsequent invention is the spinning wheel, which increased labor productivity manifold after 1530. Mines in the early seventeenth century used wooden railways, suction pumps, and water- driven bellows; forge hammers and stamp-mills were some of the sophisticated mechanized technologies in use. The increase in coal production in England from 0.2 to 3 million tons per annum between the 1550s and 1680 led J.U.Nef to write of "an early industrial revolution" of the sixteenth century. Technological progress was clearly visible: by the first days of the eighteenth century, copper, tin, and lead were smelted in reverbatory furnaces using coke as fuel, preparing the way for their adoption in the iron industry.

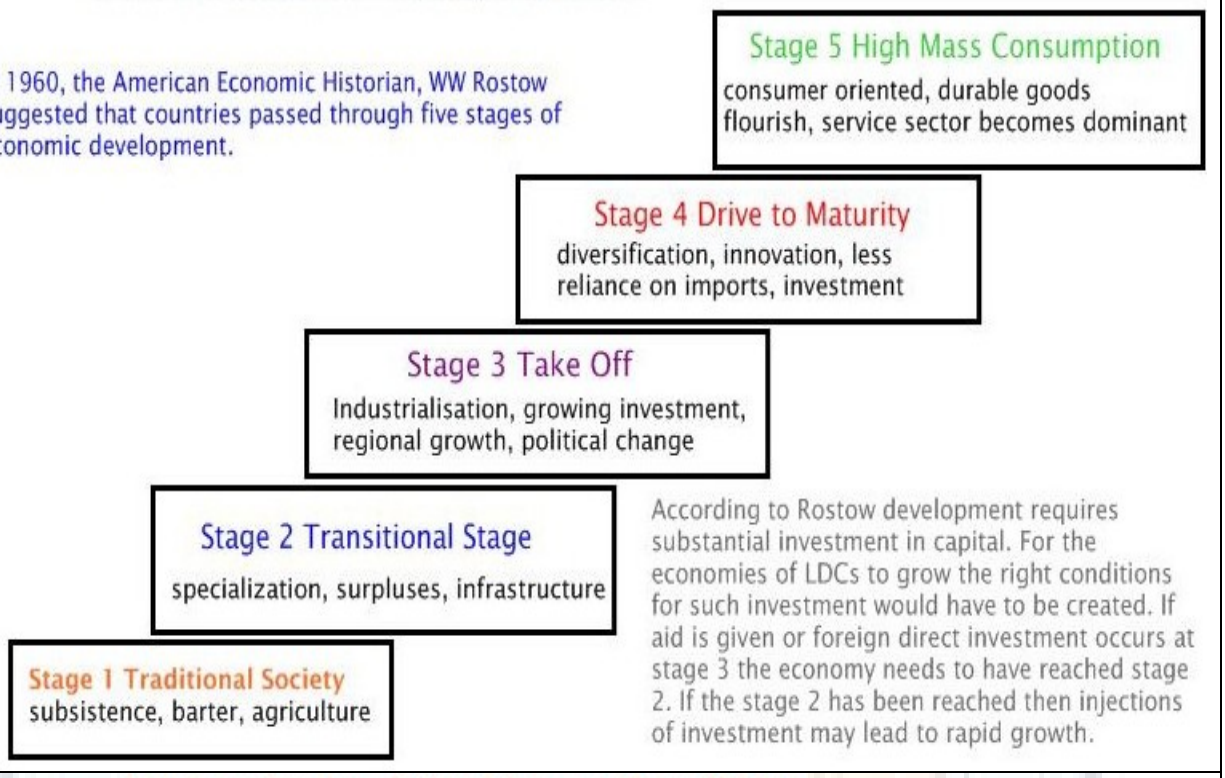
There was "gradual metamorphosis and considerable elements of continuity with the past. Thus, the origins of the Industrial Revolution are sought in the eighteenth century in vain. Instead, its roots are imbedded in the long- run continuity of economic processes, and in the discoveries, inventions, and accomplishments of prior centuries. "Ordinarily we believe that growth won only once, in the `industrial revolution' ", asserts Eric Jones, but we fail to appreciate the extent to which "the pressure for growth was there all the time". From this vantage point, economic growth becomes a typical component of human experience, and the absence of growth atypical. Indeed, the recognition that Western Europe in the eighteenth century was wealthy in many respects (even by today's third-world standards), and that the economies were already complex, with widespread specialization, implies that intensive growth, even if slow and intermittent, must have been going on for a long time prior to 1760.A growing number of scholars have followed Eric Jones (1988) in arguing that the Industrial Revolution was the culmination of a long process of modernization that started in Britain many centuries before (though opinions vary to when, exactly, this process started. The most influential economic historian of British medieval agriculture (Campbell, 1997) maintains that by the thirteenth and fourteenth centuries Britain was a market economy in which production decisions were sensitive to factor and commodity prices. Gregory Clark, in a number of papers (1997) as well as the essay below, has argued that medieval agriculture was as productive and sophisticated as British agriculture was on the eve of the Industrial Revolution and that markets for grain were well-functioning. Foreign travelers visiting Britain commented in living colors about the luxury and extravagance of British living standards in the last third of the eighteenth century. Graeme Snooks (1994) has argued forcefully that economic growth was not unique

to the period of the Industrial Revolution and that by the late seventeenth century Britain was an advanced and sophisticated economy. MacFarlane (1978) was one of the first scholars to pinpoint the beginning of Britain's modernity to the late middle ages. It is clear by now that far from being a "traditional" and "static" society; Britain was on the eve of the Industrial Revolution a country of sophisticated markets, in which profit- hungry *homines economici* (economic agents)did what they are supposed to do to help a country develop. Yet while this does explain Britain's wealth on the evolution of the Industrial Revolution, it raises as many difficulties as it solves. Is it so obvious that an urbanized, literate, market- oriented society leads inevitably to an Industrial Revolution? The Dutch economy, had many elements of modernity and yet turned out to be one of the last economies to jump the bandwagon of modern manufacturing in Western Europe, whereas Switzerland, a relatively remote and simple highland economy had by 1850 a progressive modern sector.

13.4.5 Take-Off to Great Change

In many minds the Industrial Revolution is practically synonymous with technological change. As per David Landes, "the technological changes that we denote as the "Industrial Revolution" implied a far more drastic break with the past than anything since the invention of the wheel". Walt Rostow's *The Stages of Economic Growth* was hugely influential on post-war conceptions of industrialization. Rostow not only held that an industrial revolution, the world's first, had occurred in Britain somewhere between 1790 and 1850, but even argued that it represented the lynchpin of modern history: the economic step-change that all nations had to emulate in order to thrive. Rostow defined the industrial revolution as a period of rapid economic growth, or 'take off'– he dated 'take-off' in Britain between 1783 and 1802– followed by sustained higher levels of economic growth.

Value addition: Chart
W.W. Rostow' s Model for the Industrial Take-Off



Source: http://www.bized.co.uk/virtual/dc/copper/theory/th9.htm

His account was not of course simply swallowed wholesale by British economic historians, but it did seem to provide them with a meaningful framework for the study of industrialization, and in the years that followed, the focus switched from downplaying the significance of change during the period to identifying the moment of 'take- off'. The most influential work in this vein was produced by the economic historians Phyllis Deane and W. A. Cole, who returned to the economic records collected at the time in order to provide groundbreaking estimates for the size and rate of growth of the economy between the late seventeenth and mid-twentieth centuries. Whilst considering the concept of take- off to be a 'dramatic simplification' and taking great care to stress the deep roots of economic change, Deane and Cole nonetheless spoke of a 'crucial breakthrough', and it was this theme that seemed to resonate most widely amongst scholars. Throughout the 1960s and 1970s, the existence of an 'industrial revolution' was widely held as an article of faith. One of the leading historians of the 1960s, Eric Hobsbawm, saw fit to declare that the `Industrial Revolution marks the most fundamental transformation of human life in the history of the world recorded in written document'. Elsewhere, the nation's pre-eminent historians spoke of 'one of the great watersheds in the history of human society'; a 'great upheaval'; and a 'great discontinuity'. It all amounted to a total revision of the pre-war generation's account of industrialization. Carlo Cipolla argued that mankind's economic history can be written in terms of two revolutions that fundamentally altered human endeavour; the Agricultural Revolution of the eighth millennium B.C., which by 1500 to 2000 B.C. had changed man from a hunter/gatherer to a farmer, and the Industrial Revolution beginning in the eighteenth century, which in 200 years radically reduced the percentage of the

world's population engaged in agriculture from 80 to 90 percent in 1750 to 50 to 60 percent in 1950 and changed man increasingly from a farmer to a provider of services and a maker of manufactured goods.

According to R.M.Hartwell the great discontinuity would not have been possible without a sustained increase in per capita real incomes and he cites a number of factors, working in concert, necessary for this increase to take place. They include the ability to accumulate capital which could be reinvested in plant, improved transportation, innovations such as new and improved machinery, divisions of labour and larger-scale production. It is also necessary to be blessed with endowments such as the availability of minerals necessary for industrialization, good geographical location with natural resources such water supply for power or transportation and access to markets, suppliers and a labour source. A favourable political, legal and scientific climate is also necessary, as is the ability for market expansion through increased foreign trade, increased domestic consumption and relatively lower prices compared to competitors. To this list, Pat Hudson has added agricultural change necessary for the economy to support an increasing non-agricultural workforce, an increase in population required to purchase goods and services and to supply cheap labour, and finally, a shift in consumer attitudes represented by a new desire to possess material goods as well as a new entrepreneurship aimed to create and intensify demands.

One of the weaknesses of this point of view is that it compares the rate of change during the Industrial Revolution with that of the century just preceding it, and those were years of relative stagnation. Thus, the growth after 1760 does appear discontinuous. However, the upswing phase of a business cycle is always impressive compared to the preceding trough. In order to make a balanced judgment, one needs to evaluate the Industrial Revolution in the perspective of the previous long-run development.

13.4.6 Geographical Advantages and Role of Energy

Britain's geographical advantages over other economies have often seemed to be good explanations for its economic success after 1750. Britain's geographic good luck was that it was an island and thus had not been successfully invaded since 1066. Being an island also provided it with access to a cheap form of transportation (coastal shipping). Yet being an island does not seem to have done much for Ireland, and good internal transportation was not very helpful to the Dutch economy in generating a phenomenon similar to the Industrial Revolution. Moreover, geography had to be aided by capital and technology. A social historian David Levine states it as self- evident that "England is built [*sic*] upon an underground mountain of coal. Its exploitation was the motor- force in the revolution in production that created modern industrial society". Tony Wrigley placed critical emphasis on the emergence of a new source of fuel- coal. Prior to the industrial revolution the economy was dependent upon the power provided by wood, wind, water, horses, and humans, and only limited growth was achievable by these means. Power provided by the wind was unreliable and water power could only be provided by fast- flowing rivers, which effectively restricted its use to a finite number of locations. The power provided by horses and wood could be more actively expanded, but increasing power from either of these sources required land, either to grow the fodder for the horses, or to grow woodlands to provide the timber. Yet, as Wrigley points out, the landmass of Britain was fixed, so extending the amount of land to be put to industrial purposes effectively required taking it out of cultivation for human consumption, and that in turn would restrict the possibilities of demographic growth. You could therefore have either industrial growth or population growth: you could not have both. Yet we know

that at some point during the period 1700-1850, Britain entered a new era of sustained economic growth combined with population growth, breaking free from this centuries' old pattern of limited growth. According to Wrigley, the switch to coal provides the key to understanding this process. Switching to coal tapped a massive new source of energy that enabled industry to grow to a previously unimaginable extent, growth moreover which did not occur at the expense of feeding and housing the population. This process, he argued, provides the key to understanding the British industrial revolution.

13.4.7 Role of Government and Politics

British political institutions differed greatly from those of most European countries, Aggressive colonial acquisition and protection policies from the British government which, in turn, saw major support from Parliament for the Royal Navy necessary for the implementation of those policies- support that would increase substantially during the Revolutionary and Napoleonic Wars with France. In fact, it resulted in a symbiotic relationship between the merchant seamen and the Royal Navy, whereby increased shipping to more destinations resulted in the need for a larger and better-equipped fleet and support facilities. The combination of improvements in production methods at home during the Industrial Revolution combined with an increase in markets abroad led to a staggering rise in overseas trade that made the previous steady levels of imports and exports appear negligible by comparison. Paul Kennedy provides a table of statistics for England and Wales for this period that gives a general picture of this rise. According to Eric J. Hobsbawm, this spectacular growth in export output of more than 326 percent in twenty years was a consequence of British naval dominance and the government's aggressive support of its merchants' efforts to monopolize the markets of the world. The situation was so dynamic that it made industrialization not only practicable for entrepreneurs, but sometimes virtually compulsory.

Douglass C. North (1981) has argued that the British Industrial Revolution was facilitated by better- specified property rights, which led to more efficient economic organization in Britain. The link between property rights and economic growth consists of the greater efficiency in the allocation of resources resulting from the equalization of private and social rates of return and costs. Property rights in innovation (patents and trademarks), better courts and police protection, and the absence of confiscatory taxation are examples of how the same phenomenon could raise the rate of innovative activity and capital accumulation. North points out that well- specified property rights are not the same as laissez- faire. The former were by far more important because they reduced transaction costs and thereby allowed more integrated markets, higher levels of specialization, and the realization of economies of scale. Britain on the eve of the Industrial Revolution was far from a laissez- faire economy, but the net effects of the policies and regulations on the Industrial Revolution remain a matter of dispute. What is clear is that by the time of the Industrial Revolution Britain's government was one of, by, and for private property. Such property rights should be contrasted, not with chaos and anarchy, but with traditional and customary rights, often disputed, undocumented, and hard to establish. Patrick K. O'Brien (1991) insists that in the eighteenth century the British government came down hard and persistently "in favour of property and against customary rights". Yet as the case of the Dutch Republic demonstrates, a well-defined system of property rights too, was not sufficient cause for an Industrial Revolution.

British state exhibited a degree of tolerance for deviant and heterodox ideas that was unusual, though not unique. Although tolerance was quite different from equal

rights, Britain developed in the seventeenth century the ability to accommodate a high level of acceptance of different modes of thinking. The intolerance on the Continent toward dissidents led to the hemorrhage of technical talents from the southern Netherlands and France to countries where they were more welcome. As David Landes (1983) recounts it, after 1685 (when the Edict of Nantes was revoked) French industry was "crippled by the exodus of some of its best practitioners fleeing a wave of anti-Protestant bigotry and persecution." In many industries, France's loss was England's gain. The Belfast linen industry was, if not founded, certainly enhanced and developed by the technical know-how of Huguenot refugees, especially Louis Crommelin. Nicholas Dupin was an active promoter of companies and operated a number of paper mills in England. The great hydraulic engineer and lecturer John (Jean) Desaguliers, too, came from a Huguenot family as did Denis Papin, who had as much ground for claiming to be "the" inventor of the atmospheric engine as anyone. Francois Crouzet, who has studied the financial activities of these refugees, states that the "persecution of the Huguenots [was] not only a crime, [it] was also a blunder, as France was impoverished by a brain drain which brought wealth to her rivals and enemies".

The idea of "Industrial Revolution" has not been immune from attacks on the usefulness of the concept. Such attacks are to be welcomed simply because they force a reconsideration and reevaluation of the conventional wisdom. The Industrial Revolution may not, in fact, have been nearly as abrupt and as sudden as some of its historiography suggests. Furthermore, there has been a tendency among some economic historians to identify the economic history of Britain in the century after 1750 *as* the Industrial Revolution. Such identification is misleading and a-historical. Much, perhaps most, of what happened in the British economy at that time had little or nothing to do with the Industrial Revolution. Before 1830, most of Britain's land and the majority of its population were only affected by it in a roundabout way, many perhaps were not affected by it at all. Yet its importance as an event in economic history stands undiminished. Before the Industrial Revolution technological change and economic growth did occur sporadically in the experience of Europe and Asia but were invariably checked by stronger forces. Much of the growth that other scholars observe in Europe before the Industrial Revolution was due to the expansion of commerce, itself largely a function of institutional change and propitious political circumstances. Such cases were usually slowed down or even reversed by institutional breakdowns or military events. Technology, by its very nature, is much less reversible and less likely to run into diminishing returns that commercial expansion. What the Industrial Revolution meant, therefore, was that after 1750 the fetters on sustainable economic change were shaken off. There were lags and obstacles to overcome before technological creativity and entrepreneurship could be translated into sustained economic growth and higher living standards, but the secular trend pointed clearly upward. What ultimately matters is the irreversibility of the events. Even if Britain's relative position in the developed world has declined in recent decades, it has remained an urban, sophisticated society, wealthy beyond the wildest dreams of the Briton of 1750 or the bulk of the inhabitants of Africa or Southern Asia in our own time. Britain taught Europe and Europe taught the world how the miracles of technological progress, free enterprise, and efficient management can break the shackles of poverty and want. Once the world has learned that lesson, it is unlikely to be forgotten.

Summary

- The term "Industrial Revolution" was first popularized by the English economic historian Arnold Toynbee (1852–83) to describe England's economic development and refer to the period of rapid social, economic, demographic, and technological change which took place in Britain from the latter half of the eighteenth century to the first half of the nineteenth century.
- It was the decline of feudalism and rise of agrarian capitalism in Britain by the beginning of sixteenth century that paved the way for industrial Revolution in the 18th century. The process was marked by multiple changes in the realms of economy, society, polity and culture.
- The word- proto- industrialization- seems to suggest or imply acceptance of a relationship between industrialization- meaning manufacturing by mechanical means- and certain kinds of manufacturing that went before.
- Britain seemed to possess all of the preconditions necessary to lead the world in one of its few great revolutions.
- It had the good fortune of witnessing agricultural changes that led to population increase and migration coincidental with industrial innovation that benefited from those changes.
- It had an ideal location and an island geography that made it possible to protect industries in their infancy while at the same time aggressively capturing new markets abroad. It possessed the natural endowments of location, rivers suitable for both navigation and power, abundant mineral resources in coal and iron to feed the burgeoning industries.
- These were all combined with what seemed to be a unique entrepreneurial and innovative quality in a number of its people that produced an inordinate quantity of useful inventions that were able to revolutionize traditional industries, It had the means and desire to accumulate capital, and a favourable political environment to direct that capital to acquire more wealth.
- Most Historiographical analyses of the British industrial revolution have tended to look at supply – to focus upon how improvements in technology or increases in capital, energy, or raw material enabled the economy to grow.
- Recently scholars have started questioning the idea of a sudden change in form of the "Industrial Revolution".

Exercises

1 How 'modern' was Britain's economy in 1700?
2 What are the benefits and costs of studying Britain's industrial revolution within the national accounts framework?
3 Why and with what consequences did Britain's population grow between 1750 and 1830?
4 What were the main determinants of the geography of Britain's industrial revolution?
5 What does the timing and forms of improved communications tell us about the nature of economic change in eighteenth-century Britain?
6 What was the significance of enclosure to agricultural change in England before 1830?
7 What was the importance of technological change to the revolutions in the coal, iron and cotton industries?
8 Was technological change more the product of new science or new culture?
9 How did changing patterns of consumption influence the industrial revolution in Britain?

10 Why and with what consequences was the family firm the dominant form of business in Britain before the railway age?
11 How did war hinder and help economic activity in Britain between 1689 and 1815?
12 What did the empire contribute distinctively to economic change in Britain before 1830?
13 Were ideas or interests more important in influencing economic regulation in eighteenth-century Britain?
14 How did patterns of work within families change during the early industrial revolution?
15 Was Britain a class society by 1830? In what ways did standards of living improve, and in what ways worsen, in Britain between 1750 and 1830?
16 In what ways did contemporaries comprehend the industrial revolution?
17 How differently did England, Scotland and Wales experience the industrial revolution?
18 Has the concept of the 'industrial revolution' outlived its useful purpose?
19 How far should we explain the first industrial revolution in terms of British exceptionalism?
20 Why and with what consequences was the industrial revolution experienced first in Britain?
21 Did the British economy become more or less stable between 1660 and 1830?

Glossary

Agricultural Revolution: Period of major change in British agricultural practices that partly preceded and partly overlapped the Industrial Revolution. Land enclosures in the 18th century brought an end to medieval methods and encouraged large-scale farming, with consequent improvement in scale and methods.

Factory system: Intensification of all of the processes of production at a single site during the Industrial Revolution; involved greater organization of labor and increased discipline.

James Watt: Devised a steam engine in the 1770s that could be used for production in many industries; a key step in the Industrial Revolution.

Luddites: Workers in Britain who responded to the replacement of their labor by machines during the Industrial Revolution by attempting to destroy machines; named after the fictional worker Ned Ludd.

Mass leisure culture: An aspect of the later Industrial Revolution; decreased time at work and offered opportunities for new forms of leisure time, such as vacation trips and team sports.

Population revolution: Huge growth in population in Western Europe beginning about 1730; prelude to industrialization.

Proto-industrialization: Preliminary shift away from an agricultural economy; workers become full-or-part-time producers who worked at home in a capitalist system in which materials, work, orders, and sales depended on urban merchants; prelude to the Industrial Revolution.

Putting-out system: It was a means of subcontracting work. It was also known as the workshop system. In putting-out, work was contracted by a central agent to artisans who completed the work in their own facility, usually their own home.

Spinning Jenny: an early spinning machine having more than one spindle and enabling a person to make a number of yarns simultaneously.

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3. Web Links

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