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Chapter 1 : Industrial Revolution: Definition and Inventions | theinnatdunvilla.com - HISTORY

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Jeremy, Transatlantic Industrial Revolution: Blair and Rives, ; U. Government Printing Office, Instead, this ingenuity rested on fundamental assets: The peddler distribution system provided efficient sales channels into the mids, but, after that, firms took advantage of more traditional wholesaling channels. In some sectors, such as the brass industry, firms followed the example of the large Boston-core textile firms, and the brass companies founded their own wholesale distribution agencies in Boston and New York City. Difficulty of Duplicating Eastern Methods in the Midwest The East industrialized first, based on a prosperous agricultural and industrialization process, as some of its entrepreneurs shifted into the national market manufactures of shoes, cotton textiles, and diverse goods turned out in Connecticut. These industrialists made this shift prior to , and they enhanced their dominance of these products during the subsequent two decades. Manufacturers in the Midwest did not have sufficient intraregional markets to begin producing these goods before ; therefore, they could not compete in these national market manufactures. Eastern firms had developed technologies and organizations of production and created sales channels which could not be readily duplicated, and these light, high-value goods were transported cheaply to the Midwest. When midwestern industrialists faced choices about which manufactures to enter, the eastern light, high-value goods were being sold in the Midwest at prices which were so low that it was too risky for midwestern firms to attempt to compete. Instead, these firms moved into a wide range of local and regional market manufactures which also existed in the East, but which cost too much to transport to the Midwest. These goods included lumber and food products e. The American Manufacturing Belt The Midwest Joins the American Manufacturing Belt after Between and , Midwestern manufacturers made strides in building an industrial infrastructure, and they were positioned to join with the East to constitute the American Manufacturing Belt, the great concentration of manufacturing which would sprawl from the East Coast to the edge of the Great Plains. This Belt became mostly set within a decade or so after , because technologies and organizations of production and of sales channels had lowered costs across a wide array of manufactures, and improvements in transportation such as an integrated railroad system and communication such as the telegraph reduced distribution costs. Thus, increasing shares of industrial production were sold in interregional markets. Lack of Industrialization in the South Although the South had prosperous farms, it failed to build a deep and broad industrial infrastructure prior to , because much of its economy rested on a slave agricultural system. In this economy, investments were heavily concentrated in slaves rather than in an urban and industrial infrastructure. Local and regional demand remained low across much of the South, because slaves were not able to freely express their consumption demands and population densities remained low, except in a few agricultural areas. Thus, the market thresholds for many manufactures were not met, and, if thresholds were met, the demand was insufficient to support more than a few factories. By the s, when the South had recovered from the Civil War and its economy was reconstructed, eastern and midwestern industrialists had built strong positions in many manufactures. And, as new industries emerged, the northern manufacturers had the technological and organizational infrastructure and distribution channels to capture dominance in the new industries. In a similar fashion, the Great Plains, the Southwest, and the West were settled too late for their industrialists to be major producers of national market goods. Manufacturers in these regions focused on local and regional market manufactures. Some low wage industries such as textiles began to move to the South in significant numbers after , and the emergence of industries based on high technology after led to new manufacturing concentrations which rested on different technologies. This essay is based on David R. Johns Hopkins University Press, To Their Own Soil: Agriculture in the Antebellum North. Iowa State University Press, Barker, Theo, and Dorian Gerhold. The Rise and Rise of Road Transport,

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Cambridge University Press, A History of Banking in Antebellum America: The Diffusion of Information in Early America, Oxford University Press, The Roots of Rural Capitalism: Cornell University Press, Harvard University Press, Canals and American Economic Development. Columbia University Press, From the American System to Mass Production, Economic Development in the Philadelphia Region, Dairying Families and Agricultural Change, An Agricultural History of the Genesee Valley, University of Pennsylvania Press, Economic Culture along the Upper Susquehanna, Wages and Labor Markets in the United States, University of Chicago Press, The Middlesex Canal, From Market-Places to a Market Economy: The Transformation of Rural Massachusetts, The Textile Manufacture at Philadelphia, A Study of Chicopee, Massachusetts. Gallman and John J. Evidence from Patent Records, Evidence from the American Northeast, Engerman and Robert E. A Study in Industrial Beginnings. Stanford University Press, Agricultural Output per Worker, Labor Force Estimates and Economic Growth, Gallman and John Joseph Wallis, Chicago University of Chicago Press, The Turnpikes of New England. The Radicalism of the American Revolution. Fogel and Stanley L. Net Encyclopedia, edited by Robert Whaples. Net - Economic History Services.

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Encyclopedia of Business and Finance, 2nd ed. According to the Small Business Administration , the total number of businesses in the United States in was somewhere between 16 million and 24 million, of which approximately 15, were large. In , there were an estimated 8. For any business to be successful, an adequate level of funding must be furnished. The amount needed varies according to the scope and nature of the business. Another key factor in the success of an entrepreneurial organization is planning, including planning for the marketing, management, and financial aspects of the business. From a personal perspective, becoming an entrepreneur is not a simple task. It certainly has its drawbacks. However, it can also be quite rewarding. Long hours, poor pay, and an unclear future are only three of the challenges a budding entrepreneur must face. And, of course, losing everything one invests in a business is a very real risk. In fact, while , new employer firms were created in , as reported by the U. Department of Labor, , businesses were terminated during the same year, with 53, of these being bankruptcies and 83, being failures. Failures and bankruptcies are business closures that occur while the business owes debts. However, the potential rewards are unlimited. Business owners can profit greatly. Another reward entrepreneurs tend to appreciate is independence. The work of the business must be completed, and often the entrepreneur is the one who must perform the most complex tasks of the business. Although others may work for the owner and manager of the business, it is ultimately the responsibility of the entrepreneur to make sure that the work gets done. Other rewards cited by entrepreneurs include personal satisfaction gained while performing the duties of the business and the resulting prestige. A business plan helps to guide the decision making needed to operate a business. The first decision is to choose what sort of business to own. The business may be: A retail business that markets a tangible product such as clothing, houses, food A wholesale business that acquires goods from a producer and distributes requested quantities to retailers A service business that offers an intangible product such as insurance, haircuts, consultant services, construction, financial services A manufacturing business that produces a product Of course, a business may perform more than one of these functions. The scope of the business will also be dependent on the breadth and depth of the products or services offered as well as the geographic region served. One option available to someone interested in purchasing a business is a franchise. Another early decision involves choosing the legal form of ownership. Three options are sole proprietorship, partnership, and corporation. In a sole proprietorship, a single person owns and operates the business. The owner assumes all risks and responsibilities for the business, including debts. Two or more individuals may form a partnership and serve as co-owners of the business. If the partnership is a general partnership, all partners assume unlimited liability. However, if the partnership is a limited partnership, one or more of the partners assumes unlimited liability while the remaining partner s do es not. Instead, they may lose up to the amount of their investment, while having limited involvement in the business. The third form of ownership is the corporation. A corporation is a group of individuals who obtain a charter giving the organization formed by the group legal rights and privileges. This organization can perform such functions as buying and selling, as well as owning property, as if the group were an individual person. The corporation is actually owned by individuals who purchase stock. A major advantage of this form of ownership is that the stockholders themselves have limited liability, thus minimizing financial risks. The Small Business Administration reports that in , according to the Internal Revenue Service, 16,, sole proprietorships, 1,, partnerships, and 5,, corporations filed nonfarm business tax returns. A business plan often contains three major sections: Marketing Plan Marketing is a process in which the decisions of the business are based upon the goals of the organization. One of these goals is usually that of satisfying the needs and wants of potential customers or a target market. Potential customers can be divided into specific market segments that represent groups based on specified characteristics. For

example, a business may strive to serve those in their late teens and early twenties who live primarily in large cities. Narrowing the segment even further, the business may offer goods or services for those interested specifically in sportsâ€"both as active players and as spectators or fans. Thus the business may sell athletic shoes and clothing, sports equipment, and how-to books. The owner s would locate this business in an area with a large number of people in that age group. Other factors to consider when defining a target market include such demographic factors as income level, sex, marital status, and ethnic group, and such geographic factors as climate and region of the country. Part of the marketing plan is the marketing mix. A marketing mix has four basic components: A travel agent may offer the service of arranging any type of trip to anywhere in the world or may specialize specifically in cruises. Choosing products is dependent on the market segment the business intends to serve. Other considerations include the amount of physical space available for storing the product, the amount of funds needed to purchase the product from the wholesaler or manufacturer, and the profitability potential of offering the product. A life cycle has four sections: When a new product is introduced to the market, it is in the introduction phase. Over time, it may grow in popularity and sales, reaching a point of maturity. Maturity is then followed by decline. An entrepreneur must be careful to avoid offering products or services that are in decline. That is one of the reasons for continually monitoring the sales of products and adjusting the product mix to reflect such changes in the product life cycle. Place Another factor in the marketing mix is place. Marketers often say that the success of a business is dependent upon "location â€¦ location â€¦ location. The place function also includes business activities that involve physical distribution, such as transporting goods, handling the goods, storing the goods, and keeping track of the goods inventory. An increasing number of businesses are locating on the Internet. Entrepreneurs create World Wide Web pages on which they promote their offerings. Consumers may either telephone the business to order the product or service or use a credit card to purchase the item over the Internet. The actual location of the business is less important since the Web is available throughout the country and, indeed, the world. However, the location still must be considered relative to business expenses e. Businesses can also be located in the home. In fact, home-based businesses represent a large portion of businesses in the United States. Many entrepreneurs begin their businesses in the home and eventually outgrow the space available there, at which point the owner usually seeks an outside facility. Price Price is the third component of the marketing mix. A pricing structure must be developed that includes specific goals and reflects policies of the business. A goal may reflect an intended image of the business or a particular profit margin that is sought. Factors to consider when identifying goals and policies related to price are: Promotion The fourth component of the marketing mix is promotionâ€"the activities of the business that are intended to inform potential customers about the product or service and persuade them to purchase it. Methods include personal selling, advertising, visual merchandising the coordination of all physical elements in a business such as displays, counters, offices, windows, signs, fixtures, lighting, and such , and publicity. The effectiveness of promotional strategies must be monitored so that promotional dollars are spent on strategies that are contributing to the achievement of business goals. Management Plan Another major section of a business plan is the management plan. The four basic functions of management are planning, organizing, directing, and controlling. Planning involves the determination of goals and objectives for the business, including the actual results sought by the firm. A set of policies and procedures are determined that guide the identification of specific activities that will lead to these goals. Planning does not end with the creation of a business plan, however, as it continues throughout the life of the business. To implement the plan, the entrepreneur organizes the personnel and other resources of the business. An organizational chart is created that shows the hierarchy of the people working in the business. After the number of employees and their qualifications are determined, applicants are recruited and, once hired, are trained. Other types of resources that are organized by management are facilities, equipment, materials, and supplies. The third management function is directing. Managers direct the work of the business by applying leadership and management skills. They model desired behavior while supervising, motivating, and evaluating their employees. Finally, comparing the plan with the actual results is called controlling. By observing and

studying financial statements, managers can understand the status of the business and adjust activities where necessary to contribute toward the achievement of the business goals. The controlling function also includes evaluation of employees. Financial Plan The financial aspects of the business must also be planned. The financial plan includes several financial statements. One of these statements is the statement of financial requirements, which identifies the projected expenses and the assets they will create for a specified time period. Among the expenses listed are those for rent, insurance, telephone, and inventory. The entrepreneur also needs money to meet personal expenses as the business grows. These expenses are also included in this statement.

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Another key to the rapidly changing economy of the early Industrial Revolution were new organizational strategies to increase productivity. This had begun with the "outwork system" whereby small parts of a larger production process were carried out in numerous individual homes.

Agricultural history of the United States In the 17th century, Pilgrims , Puritans , and Quakers fleeing religious persecution in Europe brought with them plowshares , guns , and domesticated animals like cows and pigs. These immigrants and other European colonists initially farmed subsistence crops like corn , wheat , rye , and oats as well as rendering potash and maple syrup for trade. Early American farmers were not self-sufficient; they relied upon other farmers, specialized craftsman, and merchants to provide tools, process their harvests, and bring them to market. American artisans developed a more relaxed less regulated version of the Old World apprenticeship system for educating and employing the next generation. Despite the fact that mercantilist , export-heavy economy impaired the emergence of a robust self-sustaining economy, craftsman and merchants developed a growing interdependence on each other for their trades. Silver working[edit] Colonial Virginia provided a potential market of rich plantations. At least 19 silversmiths worked in Williamsburg between and The best-known were James Eddy â€" and his brother-in-law William Wadill, also an engraver. Most planters, however, purchased English-made silver. The most prosperous were merchant-artisans, with a business outlook and high status. Most craftsmen were laboring artisans who either operated small shops or, more often, did piecework for the merchant artisans. The small market meant there was no steady or well-paid employment; many lived in constant debt. Silver and other metal mines were scarcer in North America than in Europe, and colonial craftsmen had no consistent source of materials with which to work. The purity of these sources was not regulated, nor was there an organized supply chain through which to obtain silver. As demand for silver increased and large-scale manufacturing techniques emerged, silver products became much more standardized. For special-order objects that would likely only be made once, silversmiths generally used lost-wax casting , in which a sculpted object was carved out of wax, an investment casting was made, and the wax was melted away. The molds produced in this manner could only be used once, which made them inconvenient for standard objects like handles and buckles. Permanent mold casting , an industrial casting technique focused on high-volume production, allowed smiths to reuse molds to make exact replicas of the most commonly used items they sold. In creating these molds and developing standardized manufacturing processes, silversmiths could begin delegating some work to apprentices and journeymen. These changes, in tandem with new techniques and requirements defined by changing social standards, led to the introduction of new manufacturing techniques in Colonial America that preceded and anticipated the industrial revolution. Late in the colonial era a few silversmiths expanded operations with manufacturing techniques and changing business practices They hired assistants, subcontracted out piecework and standardized output. The coexistence of the craft and industrial production styles prior to the industrial revolution is an example of proto-industrialization. Factories and mills[edit] In the mids, Oliver Evans invented an automated flour mill that included a grain elevator and hopper boy. By the turn of the century, Evans also developed one of the first high-pressure steam engines and began establishing a network of machine workshops to manufacture and repair these popular inventions. In , the widow of Nathanael Greene recruited Eli Whitney to develop a machine to separate the seeds of short fibered cotton from the fibers. The resulting cotton gin could be made with basic carpentry skills but reduced the necessary labor by a factor of 50 and generated huge profits for cotton growers in the South. Between and , new industrial tools that rapidly increased the quality and efficiency of manufacturing emerged. Simeon North suggested using division of labor to increase the speed with which a complete pistol could be manufactured which led to the development of a milling machine in In , Thomas Blanchard created a lathe that could reliably cut irregular shapes, like those needed for arms manufacture. By , Captain John H. Hall had developed a system using machine tools ,

division of labor, and an unskilled workforce to produce a breech-loading rifle â€”a process that came to be known as " Armory practice " in the U. The textile industry , which had previously relied upon labor-intensive production methods, was also rife with potential for mechanization. In the late 18th century, the English textile industry had adopted the spinning jenny , water frame , and spinning mule which greatly improved the efficiency and quality of textile manufacture, but were closely guarded by the British government which forbade their export or the emigration of those who were familiar with the technology. The Beverly Cotton Manufactory was the first cotton mill in the United States, but it relied on horse power. Samuel Slater , an apprentice in one of the largest textile factories in England, immigrated to the United States in upon learning that American states were paying bounties to British expatriates with a knowledge of textile machinery. At nearly the same time as the canal was completed, Francis Cabot Lowell and a consortium of businessmen set up the clothing mills in Waltham, Massachusetts making use of water power from the Charles River with the concept of housing together production of feedstocks complete consumer processes so raw materials entered, and dyed fabrics or clothing left. For a few decades, it seemed that every lock along the canal had mills and water wheels. In , Boston Manufacturing Company built a major expansion in East Chelmsford, which was soon incorporated as Lowell, Massachusetts â€" which came to dominate the cloth production and clothing industry for decades. Slater went on to build several more cotton and wool mills throughout New England , but when faced with a labor shortage, resorted to building housing, shops, and churches for the workers and their families adjacent to his factories. Lowell looms were managed by specialized employees, many of the employed were unmarried young women " Lowell Mill Girls " , and owned by a corporation. The corporation also looked out for the health and well being of the young women, including their spiritual health, and the hundreds of women employed by it culturally established the pattern of a young woman going off to work a few years and saving monies before returning home to school and marriage. It created an independent breed of women uncommon in most of the world. Turnpikes and canals[edit] A lock on the Erie Canal. USA canals circa Highways in the USA circa Even as the country grew even larger with the admission of Kentucky , Tennessee , and Ohio by , the only means of transportation between these landlocked western states and their coastal neighbors was by foot, pack animal, or ship. Recognizing the success of Roman roads in unifying that empire, political and business leaders in the United States began to construct roads and canals to connect the disparate parts of the nation. Nevertheless, the road became a primary overland conduit through Appalachian Mountains and was the gateway for thousands of antebellum westward-bound settlers. Numerous canal companies had also been chartered; but of all the canals projected, only three had been completed when the War of began: It remained for New York to usher in a new era in internal communication by authorizing in the construction of the Erie Canal. This bold bid for Western trade alarmed the merchants of Philadelphia, particularly as the completion of the national road threatened to divert much of their traffic to Baltimore. In , the legislature of Pennsylvania grappled with the problem by projecting a series of canals which were to connect its great seaport with Pittsburgh on the west and with Lake Erie and the upper Susquehanna on the north. Like the turnpikes, the early canals were constructed, owned, and operated by private joint-stock companies but later gave way to larger projects funded by the states. The Erie Canal , proposed by Governor of New York De Witt Clinton , was the first canal project undertaken as a public good to be financed at the public risk through the issuance of bonds. The success of the Erie Canal spawned a boom of other canal-building around the country: But the only contribution of the national government to internal improvements during the Jeffersonian era was an appropriation in of two percent of the net proceeds of the sales of public lands in Ohio for the construction of a national road, with the consent of the states through which it should pass. Because this appropriation was to be met by the moneys paid by the National Bank to the government, the bill was commonly referred to as the "Bonus Bill". But on the day before he left office, President Madison vetoed the bill because it was unconstitutional. The policy of internal improvements by federal aid was thus wrecked on the constitutional scruples of the last of the Virginia dynasty. Having less regard for consistency, the House of Representatives recorded its conviction, by close votes, that Congress

could appropriate money to construct roads and canals, but had not the power to construct them. In , a bill to authorize the collection of tolls on the Cumberland Road had been vetoed by the President. In an elaborate essay, Monroe set forth his views on the constitutional aspects of a policy of internal improvements. Congress might appropriate money, he admitted, but it might not undertake the actual construction of national works nor assume jurisdiction over them. For the moment, the drift toward a larger participation of the national government in internal improvements was stayed. Two years later, Congress authorized the President to institute surveys for such roads and canals as he believed to be needed for commerce and military defense. No one pleaded more eloquently for a larger conception of the functions of the national government than Henry Clay. He called the attention of his hearers to provisions made for coast surveys and lighthouses on the Atlantic seaboard and deplored the neglect of the interior of the country. Of the other presidential candidates, Jackson voted in the Senate for the general survey bill; and Adams left no doubt in the public mind that he did not reflect the narrow views of his section on this issue. Crawford felt the constitutional scruples which were everywhere being voiced in the South, and followed the old expedient of advocating a constitutional amendment to sanction national internal improvements. President Jefferson had recommended many of these in for Congress to consider for creation of necessary amendments to the Constitution. Adams seemed oblivious to the limitations of the Constitution. In March , the general assembly declared that all the principles of the earlier resolutions applied "with full force against the powers assumed by Congress" in passing acts to protect manufacturers and to further internal improvements. That the administration would meet with opposition in Congress was a foregone conclusion. Despite the new efficiencies introduced by the turnpikes and canals, travel along these routes was still time-consuming and expensive. The idea of integrating a steam boiler and propulsion system can be first attributed to John Fitch and James Rumsey who both filed for patents or state monopolies on steamboats in the late s. However, these first steamboats were complicated, heavy, and expensive. It would be almost 20 years until Robert R. Livingston contracted a civil engineer named Robert Fulton to develop an economical steamboat. By , steamboat services had been established on all the Atlantic tidal rivers and Chesapeake Bay. The shallow-bottomed boats were also ideally suited navigating the Mississippi and Ohio Rivers and the number of boats on these rivers increased from 17 boats to boats between and Livingston and Fulton had obtained monopoly rights to operate a steamboat service within the state of New York, but Thomas Gibbons, who operated a competing New Jersey ferry service, was enjoined from entering New York waters under the terms of the monopoly. In , the Supreme Court ruled in Gibbons v. Ogden that Congress could regulate commerce and transportation under the Commerce Clause which compelled the state of New York to allow steamboat services from other states. Because the physics and metallurgy of boilers were poorly understood, steamboats were prone to boiler explosions that killed hundreds of people between the s and s.

Chapter 4 : Economic Growth and the Early Industrial Revolution [theinnatdunvilla.com]

business - Industrial Revolution - theinnatdunvilla.com Once reserved for large corporations, Industrial Development Bonds are now a source of growth capital for entrepreneurs.

Americans integrated the technologies of the Industrial Revolution into a new commercial economy. Steam power, the technology that moved steamboats and railroads, fueled the rise of American industry by powering mills and sparking new national transportation networks. The revolution reverberated across the country. More and more farmers grew crops for profit, not self-sufficiency. Vast factories and cities arose in the North. A new middle class ballooned. And as more men and women worked in the cash economy, they were freed from the bound dependence of servitude. But there were costs to this revolution. As northern textile factories boomed, the demand for southern cotton swelled, and American slavery accelerated. Northern subsistence farmers became laborers bound to the whims of markets and bosses. Some workers, often immigrant women, worked thirteen hours a day, six days a week. Others labored in slavery. Massive northern textile mills turned southern cotton into cheap cloth. And although northern states washed their hands of slavery, their factories fueled the demand for slave-grown southern cotton and their banks provided the financing that ensured the profitability and continued existence of the American slave system. And so, as the economy advanced, the market revolution wrenched the United States in new directions as it became a nation of free labor and slavery, of wealth and inequality, and of endless promise and untold perils. Americans increasingly produced goods for sale, not for consumption. Improved transportation enabled a larger exchange network. Labor-saving technology improved efficiency and enabled the separation of the public and domestic spheres. Class conflict, child labor, accelerated immigration, and the expansion of slavery followed. These strains required new family arrangements and transformed American cities. American commerce had proceeded haltingly during the eighteenth century. American farmers increasingly exported foodstuffs to Europe as the French Revolutionary Wars devastated the continent between and But in the wake of the War of , Americans rushed to build a new national infrastructure, new networks of roads, canals, and railroads. State legislatures meanwhile pumped capital into the economy by chartering banks. The number of state-chartered banks skyrocketed from 1 in , in , and in to 1, in Depressions devastated the economy in , , and Each followed rampant speculation in various commodities: Eventually the bubbles all burst. The spread of paper currency untethered the economy from the physical signifiers of wealth familiar to the colonial generation, namely land. Counterfeit bills were endemic during this early period of banking. Prostitutes and con men could look like regular honest Americans. Advice literature offered young men and women strategies for avoiding hypocrisy in an attempt to restore the social fiber. Intimacy in the domestic sphere became more important as duplicity proliferated in the public sphere. Fear of the confidence man, counterfeit bills, and a pending bust created anxiety in the new capitalist economy. But Americans refused to blame the logic of their new commercial system for these depressions. Her trip was less than five hundred miles but took six weeks to complete. The journey was a terrible ordeal, she said. At Wheeling, Virginia, her coach encountered the National Road, the first federally funded interstate infrastructure project. The road was smooth and her journey across the Alleghenies was a scenic delight. If a transportation revolution began with improved road networks, it soon incorporated even greater improvements in the ways people and goods moved across the landscape. New York State completed the Erie Canal in Soon crops grown in the Great Lakes region were carried by water to eastern cities, and goods from emerging eastern factories made the reverse journey to midwestern farmers. Robert Fulton established the first commercial steamboat service up and down the Hudson River in New York in Soon thereafter steamboats filled the waters of the Mississippi and Ohio Rivers. Downstream-only routes became watery two-way highways. By , more than two hundred steamboats moved up and down western rivers. State and local governments provided the means for the bulk of this initial wave of railroad construction, but economic collapse following the Panic of made governments wary of such investments. Government supports continued

throughout the century, but decades later the public origins of railroads were all but forgotten, and the railroad corporation became the most visible embodiment of corporate capitalism. By Americans had laid more than thirty thousand miles of railroads. Railroad development was slower in the South, but there a combination of rail lines and navigable rivers meant that few cotton planters struggled to transport their products to textile mills in the Northeast and in England. Such internal improvements not only spread goods, they spread information. The transportation revolution was followed by a communications revolution. The telegraph redefined the limits of human communication. By Samuel Morse had persuaded Congress to fund a forty-mile telegraph line stretching from Washington, D. Within a few short years, during the Mexican-American War, telegraph lines carried news of battlefield events to eastern newspapers within days. This contrasts starkly with the War of , when the Battle of New Orleans took place nearly two full weeks after Britain and the United States had signed a peace treaty. The consequences of the transportation and communication revolutions reshaped the lives of Americans. Farmers who previously produced crops mostly for their own family now turned to the market. They earned cash for what they had previously consumed; they purchased the goods they had previously made or went without. Market-based farmers soon accessed credit through eastern banks, which provided them with the opportunity to expand their enterprise but left also them prone before the risk of catastrophic failure wrought by distant market forces. In the Northeast and Midwest, where farm labor was ever in short supply, ambitious farmers invested in new technologies that promised to increase the productivity of the limited labor supply. The years between and witnessed an explosion of patents on agricultural technologies. Most visibly, the market revolution encouraged the growth of cities and reshaped the lives of urban workers. In , only New York had over one hundred thousand inhabitants. By , six American cities met that threshold, including Chicago, which had been founded fewer than two decades earlier. The steamboat turned St. Louis and Cincinnati into centers of trade, and Chicago rose as it became the railroad hub of the western Great Lakes and Great Plains regions. The geographic center of the nation shifted westward. The development of steam power and the exploitation of Pennsylvania coalfields shifted the locus of American manufacturing. By the s, for instance, New England was losing its competitive advantage to the West. Meanwhile, the cash economy eclipsed the old, local, informal systems of barter and trade. Income became the measure of economic worth. Productivity and efficiencies paled before the measure of income. Cash facilitated new impersonal economic relationships and formalized new means of production. Young workers might simply earn wages, for instance, rather than receiving room and board and training as part of apprenticeships. Moreover, a new form of economic organization appeared: States offered the privileges of incorporation to protect the fortunes and liabilities of entrepreneurs who invested in early industrial endeavors. A corporate charter allowed investors and directors to avoid personal liability for company debts. The legal status of incorporation had been designed to confer privileges to organizations embarking on expensive projects explicitly designed for the public good, such as universities, municipalities, and major public works projects. The business corporation was something new. Many Americans distrusted these new, impersonal business organizations whose officers lacked personal responsibility while nevertheless carrying legal rights. Woodward the Supreme Court upheld the rights of private corporations when it denied the attempt of the government of New Hampshire to reorganize Dartmouth College on behalf of the common good. By the early nineteenth century, states north of the Mason-Dixon Line had taken steps to abolish slavery. Vermont included abolition as a provision of its state constitution. Gradualism brought emancipation while also defending the interests of northern masters and controlling still another generation of black Americans. In New Jersey became the last of the northern states to adopt gradual emancipation plans. There was no immediate moment of jubilee, as many northern states only promised to liberate future children born to enslaved mothers. But escape was dangerous and voluntary manumission rare. Congress, for instance, made the harboring of a fugitive slave a federal crime as early as Hopes for manumission were even slimmer, as few northern slaveholders emancipated their own slaves. Roughly one fifth of the white families in New York City owned slaves, and fewer than eighty slaveholders in the city voluntarily manumitted slaves between and By , census

data suggests that at least 3, people were still enslaved in the North. Elderly Connecticut slaves remained in bondage as late as , and in New Jersey slavery endured until after the Civil War. A free black population of fewer than 60, in increased to more than , by Growing free black communities fought for their civil rights. In a number of New England locales, free African Americans could vote and send their children to public schools. Most northern states granted black citizens property rights and trial by jury. African Americans owned land and businesses, founded mutual aid societies, established churches, promoted education, developed print culture, and voted. Nationally, however, the slave population continued to grow, from less than , in to more than 1.

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on industrialization on a sample of countries that have undertaken liberalization and structural reform in early s. The empirical evidence shows that the experience.

Could it end our addiction to fossil fuels? Thanks to a dramatic increase in global mobile connectivity and the incorporation of sensors, robots and powerful data analytics across both manufacturing and service industries, we are seeing the emergence of technologies that have the power to drive a whole new cycle of global economic activity. The growth this enables could be profound, but we are also faced with new or more intense worries compared with previous industrial revolutions â€" particularly with regard to how benefits are distributed, how externalities are managed and how to ensure that increasing productivity and efficiency does not result in deflationary pressure and mass unemployment. The Fourth Industrial Revolution as the convergence of digital, human and physical domains: Another way to frame the Fourth Industrial Revolution is to appreciate the extent to which new technologies are causing three previously separate domains to rapidly converge, in the process challenging the way we see the world. Continuous feeds of data from billions of connected objects are giving us new ways to perceive and understand patterns in the physical world. The third domain is us as human beings â€" the third industrial revolution began the process by which personal, interactive technologies became commonplace, and the fourth industrial revolution is giving the opportunities to truly merge and adapt our bodies with technology. This convergence across the physical, digital and human worlds is being driven not just by new technologies, but also by the advent of platforms and systems that create the opportunity for more and more people to experiment with them. A good example of this is the increasingly widespread ability to edit genes. The Fourth Industrial Revolution as a disruptor of existing power structures. The question of who gains and who loses is far from settled. Meanwhile the very existence of global platforms to enable such distribution by lowering transaction costs also suggests huge gains for those who own the platforms and related infrastructure, creating new concerns for exacerbated inequality within countries. A corresponding concern is inequality between countries. Here, both public policies and the current development stages of countries will have a huge impact on how gains are realised. And it is not clear that catching up to the innovation will be any easier in the world of the fourth industrial revolution. Another area that is being disrupted is the relative power between governments and citizens. The widespread use of digital communication, cryptography and public sensor networks such as GPS and satellite imagery has granted huge powers to citizens keen to hold governments to account, while global social media allows new movements to coalesce, organise and innovate alongside government to influence and even co-create public policy. A critical question for the world in the fourth industrial revolution is therefore not whether or to whom power will shift, but rather to ensure that the inevitable shifts do not inadvertently create unmanageable inequality or critical security risks. The Fourth Industrial Revolution as a radical shift in the future of work, education and skills. What is unprecedented in history is that this shift is anticipated over the next 20 years: Two sets of strategies seem reasonable in order to prepare ourselves and our children for these shifts. In this way we can reinforce and highlight essential sources of the value created by and within communities that is often completely overlooked in economic measurement â€" the act of caring for one another. The Fourth Industrial Revolution as the trigger for a new set of norms around technology and humanity. We change technology, technology changes us. One last framework that might be useful in understanding the fourth industrial revolution starts from the perspective that technology is socially constructed and that the words we use to describe it matter. It would be a shame for this to be the dominant narrative of the fourth industrial revolution. The truth is that every day we, as individuals, members of families and communities and as citizens, make choices to adopt or use technologies in ways that influence aspects of the fourth industrial revolution. This decision-making power is particularly concentrated in certain individuals and groups, including the companies that manage global digital platforms and governments that have the power to enable or block the development,

commercialisation or adoption of emerging technologies. Yet the fact remains that the process of innovation and its diffusion is profoundly social, and driven by ethics and norms which are constantly in flux and to which we all contribute. By being the first revolution where technology is in widespread ways penetrating our bodies, minds and even genomes in obvious ways, the Fourth Industrial Revolution confronts us with the realisation that we change technology and technology changes us. Such changes may be both fundamental and irreversible.

Chapter 6 : Technological and industrial history of the United States - Wikipedia

The water frame, Crompton's mule, and power looms presented new opportunities to entrepreneurs. It was much more efficient to bring workers to the machines and organize their labor collectively in factories next to rivers and streams, the sources of power for many of these early machines.

Objectives[edit] Analyze why England was the first country to industrialize. Examine how scientific and technological changes and new forms of energy brought about massive social, economic, and cultural change e. Describe the growth of population, rural to urban migration, and growth of cities associated with the Industrial Revolution. Trace the evolution of work and labor, including the demise of the slave trade and the effects of immigration, mining and manufacturing, division of labor, and the union movement. Understand the connections among natural resources, entrepreneurship, labor, and capital in an industrial economy. Analyze the emergence of capitalism as a dominant economic pattern and the responses to it, including Utopianism, Social Democracy, Socialism, and Communism. Describe the emergence of Romanticism in art and literature e. The Industrial Revolution[edit] In , most people in Europe lived on small farms and produced most of their needs by hand. By the middle of the 19th century, many people lived in cities and most of their needs were produced by complex machines using steam power. It was a fundamental change in the way goods were produced, and altered the way people lived. The Industrial Revolution is a major turning point in world history. The Agrarian Revolution was a change in farming methods that allowed for a greater production of food. This revolution was fueled by the use of new farming technology such as the seed drill and improved fertilizers. The results of this revolution in farming was a population explosion due to the higher availability of food. Also, the Enclosure Movement, which was the consolidation of many small farms into one large farm, left many people jobless and homeless. These people provided the workforce of the Industrial Revolution. Britain also had access to many navigable rivers and natural harbors which provided for the easy movement of goods both within the country, and overseas. The British overseas empire provided them with a strong economy, this produced the capital money needed to build railroads, factories, and mines. Politically, British entrepreneurs enjoyed a high degree of freedom from state control, compared to their counterparts in France, Russia and other parts of Europe. A relatively fair court system existed to enforce contracts and settle disputes among capital owners. These factors may have allowed new technologies and energy resources to take root and flourish. Britain experienced a revolution in energy use as they switched from animal power, to water power, to steam power in a few short years. The steam engine was the power source of the Industrial Revolution. Philosophy[edit] The philosophy of Communism appeared as a reaction to the condition of the Working Class in industrial society. Karl Marx wrote in The Communist Manifesto that all of human history is based on the conflict between the bourgeoisie those who control the means of production and the proletariat working class. He predicted that the proletariat would rise up in a violent revolution to overthrow the bourgeoisie and create a society with an equal distribution of goods and services. This socialist theory would form the basis for the Bolshevik, Chinese, and Cuban Revolutions in the 20th Century. The United States had a very strong reaction to him. Imperialism[edit] Due to the need for raw materials and new markets, the industrialized nations took control of Africa, India, South East Asia, and others. Imperialism had a negative effect on most of these cultures, and did not completely end until after World War II. Most of the benefits of imperialism accrued to the European nations. The Industrial Revolution was a major turning point in world history as it resulted in a complete change in society on all levels. Effects of the Industrial Revolutions were long reaching, and influenced many other cultures both positively and negatively.

Chapter 7 : Industrial Revolution - Wikipedia

The East industrialized first, based on a prosperous agricultural and industrialization process, as some of its entrepreneurs shifted into the national market manufactures of shoes, cotton textiles, and diverse goods turned out in Connecticut.

Just before the Civil War, Congress passed legislation allowing businesses to form corporations without a charter from the U. After the Civil War, these corporations came to dominate much of American business, and, in the process, to define American life. The era of Big Business began when entrepreneurs in search of profits consolidated their businesses into massive corporations, which were so large that they could force out competition and gain control of a market. Control of a market allowed a corporation to set prices for a product at whatever level it wanted. These corporations, and the businessmen who ran them, became exceedingly wealthy and powerful, often at the expense of many poor workers. Some of the most powerful corporations were John D. These corporations dominated almost all aspects of their respective industries: In , Rockefeller further solidified this control by establishing a monopoly or trust, which centralized control of a number of oil-related companies under one board of trustees. As a result, Rockefeller owned nearly the entire oil business in the United States, and he could set prices at will. Companies in other industries quickly imitated this trust model and used their broad market control to push prices higher. Trusts integrated control of many companies, both horizontally by combining similar companies, and vertically by combining companies involved in all stages of production. Trusts were used to gain control of markets and force out competition. The Government and Big Business In the early years of the Industrial Revolution, the government maintained a hands-off attitude toward business. The government, and much of the nation, believed in the principles of laissez-faire economics, which dictated that the economic market should run freely without government interference. According to the theory, free, unregulated markets led to competition, which in turn led to fair prices of goods for consumers. The government did not want to interfere in the free market. Any concern for the plight of the poor during this time was minimized by the tenets of social Darwinism, which became popular in the late s. The rich, meanwhile, were strong, hard working citizens who contributed to national progress, and, as such, should not be subject to government regulation. The Move Toward Regulation By the s, however, it was beginning to become clear that markets were not free. Corporations had grown so big and powerful that they controlled markets entirely. Consumers grew enraged over the high prices that monopolies had set, while small businesses demanded protection from being squeezed out of the market. Railroad monopolies were overcharging small-time customers, especially farmers, while giving rebates to powerful politicians and favored clients. State legislatures tried to limit the abuses of the railroads by issuing maximum rate laws, which set a ceiling on the prices a railroad could charge. Congress struck these laws down, claiming they were unconstitutional. But as public anger continued to grow over the practices of corporations, the federal government began to change its tune. Congress passed the Interstate Commerce Act in to try to stop railroads from price discrimination. Though this act eventually became extremely important in regulating business, in its early years it was rarely enforced. In fact, the act was so loosely phrased that it sometimes had the opposite of its intended effect: It was not until the early s that government began to enforce the Sherman Antitrust regulatory policies in full. The Growth of Unions Although labor unions began forming in the early s, they did not gain any significant membership base or bargaining power until the s and s. The harsh, even hazardous, working conditions arising from industrialization drove laborers to organize into unions. One of the first major unions was the Knights of Labor, founded in The Knights demanded equal pay for women, an end to child labor, and a progressive income tax, among other reforms. The union claimed a substantial membership, including women, blacks, and immigrants. The Knights successfully supported a number of politicians for election and forced laws favorable to workers through Congress. The riot, intended to protest police cruelty against strikers, got out of hand when one member of the Knights of Labor threw a bomb, killing a police

officer. In the resultant chaos, nine people were killed and close to sixty injured. Prominent leaders of the Knights of Labor were convicted of inciting the riot, and public support for the union plummeted. Whereas the Knights of Labor had boasted an open membership policy and sweeping labor goals, the AFL catered exclusively to skilled laborers and focused on smaller, more practical issues: More radical labor organizations also emerged, most notably the Industrial Workers of the World, nicknamed the Wobblies, founded in More famous for their militant anticapitalism than for being large or influential, the Wobblies never grew to more than 30, members before fading away in about Between and , union activity in the the United States led to well over 35, strikes. As evidenced by the Haymarket riot, these demonstrations at times erupted in violence. This violence alienated much of the American public and the popular support for unions plunged, and employers were free to exact severe retribution on striking workers. As a result, strikes proved largely ineffective at advancing the labor cause. Major strikes and outbreaks of stike-related violence during the later nineteenth century tended to impair the labor cause instead of advance it. Public sympathy for unions plummeted, companies imposed anti-union hiring policies, and the Supreme Court authorized the use of injunctions against strikers. In addition to the Haymarket riot, some of the more notable strikes include: The railroad strike followed the onset of a national economic recession in Railroad workers for nearly every rail line struck, provoking widespread violence and requiring federal troops to subdue the angry mobs. The strike prompted many employers to get tough on labor by imposing an antiunion policy: Some employers even hired private detectives to root out labor agitators and private armies to suppress strikes. Workers staged the Homestead strike against Carnegie Steel Company to protest a pay cut and seventy-hour workweek. Ten workers were killed in the riot. Federal troops were called in to suppress the violence, and non-union workers were hired to break the strike. In the Pullman strike, Eugene Debs led thousands of workers in a strike against the Pullman Palace Car Company after wages were slashed. The courts ruled that the strikers violated the Sherman Antitrust Act and issued an injunction against them. When the strikers refused to obey the injunction, Debs was arrested and federal troops marched in to crush the strike. In the ensuing frenzy, thirteen died and fifty-three were injured. The Supreme Court later upheld the use of injunctions against labor unions, giving businesses a powerful new weapon to suppress strikes. Organized labor began to fade in strength, and did not resurge until the s.

Chapter 8 : Untitled Document

Given that entrepreneurs may be potentially irrelevant and/or impotent, and that entrepreneurship policies can be fraught with potential pitfalls, governments, donors, the UN-system, and development agencies need to tread carefully.

The steam engine was the energy behind the most advanced textile inventions, such as the spinning mule and the power loom. It symbolized the transition from human power in homes to machine power in factories. Moreover, the steam engine revolutionized transportation when it was applied to locomotives and ships. So how did this amazing invention come about? And how did it work? The steam engine was originally invented in England to pull water out of coal mines. For thousands of years, wood from local forests had been the main fuel in England, as well as the main material for shipbuilding and housing construction. By the end of the 17th century, however, few forests remained Weightman So the English sought to find an alternative energy source for heating. They turned to coal, which was in great supply. By the early s, the easy-to-reach open coal pits were gone, and mine shafts as deep as feet were dug to find it In these deep shafts, groundwater would eventually seep in and flood the tunnels. This seepage was dangerous for miners and expensive for mine owners. Miners used pots, hand pumps and, occasionally, windmills to drain the water. Finally, in , Thomas Newcomen invented a simple engine that used steam to pump water out of coalmines. Boiled water created steam, which entered a chamber or cylinder, which pushed a piston up. The piston lifted a pump. Watch this animation to see it in action. But it could only create a pumping motion and not a rotating motion that might be used to grind wheat or move machinery. In fact, it was so inefficient in its use of energy that nobody used it for any other purpose for over sixty years In the old engine, as you can see from the animation, a piston moved up and down as steam was injected: But this resulted in a waste of energy and a waste of time, as the piston cylinder changed temperature and had to be constantly reheated. He suddenly understood that a separate cylinderâ€”called a condenserâ€”could be kept permanently cool while being connected to the piston cylinder, which would remain hot Putting the insight into practice, Watt added a second cylinder or chamber. The steam would be sucked out of the piston chamber and into the new cylinder, cool off, condense, and thus form a vacuum that used atmospheric pressure to move the piston. Meanwhile, the cylinder with the moving piston remained hot as another injection of steam entered. Known for this famous flash of insight, Watt was actually a relentless and careful experimenter, a student of the Scientific Revolution. In all his work, he used rigorous and precise scientific methods to test his ideas. After years of struggling on his own to make the new steam engine work correctly, Watt successfully teamed up with the largest and most famous factory in the world, Soho Manufactory, which made jewelry, silverware, and tools in Birmingham, England. The owner was looking for an energy source that was more powerful than water wheels. At Soho, Watt met and collaborated with the most skilled ironworkers and engineers in the country. Watt continued to tinker and improve it so that steam could be injected into both sides of the piston cylinder, creating a double-acting piston. In , Watt pressed on further to adapt the engine from a reciprocal up-and-down motion to a turning or rotary motion. Now, the steam engine could supply consistent and cheap energy for all the latest textile inventions. The new steam engine could be harnessed to all these new inventions. In , the year after Watt perfected the rotary steam engine, there were only two cotton mill factories in Manchester. Twenty years later there were more than He travelled to Northern Italy to steal designs for secret Italian machines that spun and wove the silk it is worth noting here that the Chinese had been spinning and weaving silk with simple looms for thousands of years before the Italians. In , Lombe patented the ideas as his own in Great Britain and built a large building next to a river to use a water wheel to power the machines. The mill was five stories high and employed men. But this silk factory came into mind years later when industrialists were looking for ways to power new textile inventions at one location. As textile inventions grew in size , they could no longer fit in cottages Rosen ; wikipedia article on factories. Arkwright built his first cotton mill just away from a river and dug out a channel or millrace, so that the water wheel benefitted from the current, as well as the gravity of water coming down

hill and into a narrow chute Rosen Textile factories no longer had to be built right next to a river. However large buildings were required for the new large steam engines, spinning mules, and power looms. In , Arkwright used steam power to run his spinning mule factory. Workers, along with their families, congregated at these new factories. Their need for stores, churches and the like resulted in the formation of small communities, which became towns and cities. Another important result of the factory was specialization of labor. In , Adam Smith, a Scottish economist, wrote the all-time most influential and famous economics book: For Smith, the key to the efficiency, productivity, and quality control of a factory was the division of labor. This was a process by which the key tasks in manufacturing were identified and assigned to individual workers to specialize, perfect and repeat with dispatch. Railroads The steam engine, it turns out, also sparked innovative methods of transportation. Railways were not new in pre-industrial Britain. There were over 1, railways by , most of them connected to an iron pit or a coal mine with a canal or river. But all of these railways were drawn by horses Weightman In fact, horses were the best form of land transportation in Eurasia since the beginning of time; the only other option was to walk. Steam would change all that. The first full-scale steam-powered locomotive took its maiden voyage down the main street of Camborne, England on Christmas Eve in After the first run, the inventor parked it in a shed and went to celebrate his success. Unfortunately, he forgot to turn the boiler off and the entire shed and locomotive were destroyed in a fire. But Trevithick got another chance. An ironworks owner built a nine-mile railway to compete with a canal. Horses pulled cars full of iron and coal along the rails. Sadly, Trevithick could never turn the invention into financial success: A young self-taught engineer, George Stephenson, picked up where Trevithick left off. Stephenson was raised in coalfields, where his family worked. He took jobs there, first working in the mines with a pick and then working on an old Newcomen steam engine that pumped water out of mine shafts. Stephenson grew up illiterate, like the rest of his family, but, as a teenager, taught himself to read and hired a tutor to teach him basic math. To make extra money, he learned to repair watches. At 22 years old, Stephenson was put in charge of running a Watt steam engine at a spinning factory. Over the following years, he taught himself mechanical engineering by taking apart steam engines and other machines,putting them back together. He took out patents on a steam engine locomotive and iron rails in In , Stephenson was commissioned to construct a mile railway line from Liverpool to Manchester. Manchester was the largest industrial town in the world, and merchants needed to transport lots of cotton and finished cloth. Stephenson surveyed the route and built the railway. He set the distance between the two tracks at four feet, eight and a half inches, because it happened to be the width of some coal-mining carsâ€”and this would become the worldwide standard railroad gauge. In , the railway owners sponsored a contest to find out who could make the fastest and most reliable locomotive to run on the newly built Manchester-to-Liverpool railway. Most contestants entered steam-powered vehicles, but one underdog participant actually used a horse trotting on a treadmill attached to a car. A man named George and his son, Robert, called their locomotive the Rocket. They defeated five competitors and reached average speeds of at least 29 miles per hour. On the day the Manchester-to-Liverpool railroad was opened to the public, a member of Parliament and a supporter of the railway was accidently killed by the Rocket. The competition garnered much attention in England and Europe; Stephenson and other top competitors took offers for their new locomotives from as far away as Russia. In , just two years after the race, the Liverpool-to-Manchester railway carried , passengers, 43, tons of cotton, and 11, tons of coal. It gives you a sense of the size and speed of the famous train. But, it also would not have occurred were it not for the rising cotton industry that created the need for the railroad in the industrial town of Manchester. And, of course, the new railroads used coal as the main fuel source. The ultimate triumph of the Industrial Revolution, railroads moved people, raw materials, and finished goods rapidly around England. This interaction brought people to the new industrial cities; gradually increased trade within England, Europe, and the world; and helped turn England into the wealthiest nation on earth.

Chapter 9 : Entrepreneurship and industrialization: tread carefully!

entrepreneurs who sought and accepted the new profitable manufacturing methods. he infrastructure advantages in Britain promoting rapid industrialization included all of the following except internal customs posts.

However, although Engels wrote in the s, his book was not translated into English until the late s, and his expression did not enter everyday language until then. Credit for popularising the term may be given to Arnold Toynbee , whose lectures gave a detailed account of the term. This is still a subject of debate among some historians. Important technological developments The commencement of the Industrial Revolution is closely linked to a small number of innovations, [24] beginning in the second half of the 18th century. By the s the following gains had been made in important technologies: Textiles â€" mechanised cotton spinning powered by steam or water increased the output of a worker by a factor of around The power loom increased the output of a worker by a factor of over The adaptation of stationary steam engines to rotary motion made them suitable for industrial uses. Iron making â€" the substitution of coke for charcoal greatly lowered the fuel cost of pig iron and wrought iron production. The steam engine began being used to pump water to power blast air in the mid s, enabling a large increase in iron production by overcoming the limitation of water power. It was later improved by making it double acting, which allowed higher blast furnace temperatures. The puddling process produced a structural grade iron at a lower cost than the finery forge. Hot blast greatly increased fuel efficiency in iron production in the following decades. Invention of machine tools â€" The first machine tools were invented. These included the screw cutting lathe , cylinder boring machine and the milling machine. Machine tools made the economical manufacture of precision metal parts possible, although it took several decades to develop effective techniques. Textile manufacture during the Industrial Revolution British textile industry statistics In Britain imported 2. In raw cotton consumption was 22 million pounds, most of which was cleaned, carded and spun on machines. Value added by the British woollen industry was Cotton factories in Britain numbered approximately in In approximately one-third of cotton cloth manufactured in Britain was exported, rising to two-thirds by In cotton spun amounted to 5. In less than 0. In there were 50, spindles in Britain, rising to 7 million over the next 30 years. In tropical and subtropical regions where it was grown, most was grown by small farmers alongside their food crops and was spun and woven in households, largely for domestic consumption. In the 15th century China began to require households to pay part of their taxes in cotton cloth. By the 17th century almost all Chinese wore cotton clothing. Almost everywhere cotton cloth could be used as a medium of exchange. In India a significant amount of cotton textiles were manufactured for distant markets, often produced by professional weavers. Some merchants also owned small weaving workshops. India produced a variety of cotton cloth, some of exceptionally fine quality. Sea island cotton grew in tropical areas and on barrier islands of Georgia and South Carolina, but did poorly inland. Sea island cotton began being exported from Barbados in the s. Upland green seeded cotton grew well on inland areas of the southern U. The Age of Discovery was followed by a period of colonialism beginning around the 16th century. Following the discovery of a trade route to India around southern Africa by the Portuguese, the Dutch established the Verenigde Oostindische Compagnie abbr. VOC or Dutch East India Company and the British founded the East India Company , along with smaller companies of different nationalities which established trading posts and employed agents to engage in trade throughout the Indian Ocean region and between the Indian Ocean region and North Atlantic Europe. One of the largest segments of this trade was in cotton textiles, which were purchased in India and sold in Southeast Asia, including the Indonesian archipelago, where spices were purchased for sale to Southeast Asia and Europe. Indian textiles were in demand in North Atlantic region of Europe where previously only wool and linen were available; however, the amount of cotton goods consumed in Western Europe was minor until the early 19th century. Earlier European attempts at cotton spinning and weaving were in 12th century Italy and 15th century southern Germany, but these industries eventually ended when the supply of cotton was cut off. The Moors in Spain grew, spun and wove

cotton beginning around the 10th century. Occasionally the work was done in the workshop of a master weaver. Under the putting-out system, home-based workers produced under contract to merchant sellers, who often supplied the raw materials. Using the spinning wheel , it took anywhere from four to eight spinners to supply one hand loom weaver. The technology was developed with the help of John Wyatt of Birmingham. Paul and Wyatt opened a mill in Birmingham which used their new rolling machine powered by a donkey. This operated until about A similar mill was built by Daniel Bourn in Leominster , but this burnt down. Both Lewis Paul and Daniel Bourn patented carding machines in Based on two sets of rollers that travelled at different speeds, it was later used in the first cotton spinning mill. Model of the spinning jenny in a museum in Wuppertal. Invented by James Hargreaves in , the spinning jenny was one of the innovations that started the revolution. In in the village of Stanhill, Lancashire, James Hargreaves invented the spinning jenny , which he patented in It was the first practical spinning frame with multiple spindles. The jenny produced a lightly twisted yarn only suitable for weft , not warp. The design was partly based on a spinning machine built for Thomas High by clockmaker John Kay, who was hired by Arkwright. The roller spacing was slightly longer than the fibre length. Too close a spacing caused the fibres to break while too distant a spacing caused uneven thread. The top rollers were leather-covered and loading on the rollers was applied by a weight. The weights kept the twist from backing up before the rollers. The bottom rollers were wood and metal, with fluting along the length. A horse powered the first factory to use the spinning frame. Arkwright and his partners used water power at a factory in Cromford, Derbyshire in , giving the invention its name. The only surviving example of a spinning mule built by the inventor Samuel Crompton. The mule produced high-quality thread with minimal labour. Mule implies a hybrid because it was a combination of the spinning jenny and the water frame, in which the spindles were placed on a carriage, which went through an operational sequence during which the rollers stopped while the carriage moved away from the drawing roller to finish drawing out the fibres as the spindles started rotating. Mule spun thread was of suitable strength to be used as warp, and finally allowed Britain to produce highly competitive yarn in large quantities. In he patented a two-man operated loom which was more conventional. Samuel Horrocks patented a fairly successful loom in Eli Whitney responded to the challenge by inventing the inexpensive cotton gin. A man using a cotton gin could remove seed from as much upland cotton in one day as would previously, working at the rate of one pound of cotton per day, have taken a woman two months to process. He is credited with a list of inventions, but these were actually developed by such people as Thomas Highs and John Kay ; Arkwright nurtured the inventors, patented the ideas, financed the initiatives, and protected the machines. He created the cotton mill which brought the production processes together in a factory, and he developed the use of power â€” first horse power and then water power â€”which made cotton manufacture a mechanised industry. Other inventors increased the efficiency of the individual steps of spinning carding, twisting and spinning, and rolling so that the supply of yarn increased greatly. Before long steam power was applied to drive textile machinery. Manchester acquired the nickname Cottonopolis during the early 19th century owing to its sprawl of textile factories. However, the high productivity of British textile manufacturing allowed coarser grades of British cloth to undersell hand-spun and woven fabric in low-wage India, eventually destroying the industry. Productivity improvement in wool spinning during the Industrial Revolution was significant, but was far less than that of cotton. Lombe learned silk thread manufacturing by taking a job in Italy and acting as an industrial spy; however, because the Italian silk industry guarded its secrets closely, the state of the industry at that time is unknown. The burning coal remained separate from the iron and so did not contaminate the iron with impurities like sulphur and silica. This opened the way to increased iron production. Cast iron retaining plates; H. Bridge wall UK iron production statistics Bar iron was the commodity form of iron used as the raw material for making hardware goods such as nails, wire, hinges, horse shoes, wagon tires, chains, etc. A small amount of bar iron was converted into steel. Cast iron was used for pots, stoves and other items where its brittleness was tolerable. Most cast iron was refined and converted to bar iron, with substantial losses. Bar iron was also made by the bloomery process, which was the predominant iron smelting process until the late 18th century. In the UK in

there were 20, tons of cast iron produced with charcoal and tons with coke. In charcoal iron production was 24, and coke iron was 2, tons. In the production of charcoal cast iron was 14, tons while coke iron production was 54, tons. In charcoal cast iron production was 7, tons and coke cast iron was , tons. In the UK was making , tons of bar iron with coke and 6, tons with charcoal; imports were 38, tons and exports were 24, tons. In the UK did not import bar iron but exported 31, tons. For a given amount of heat, coal required much less labour to mine than cutting wood and converting it to charcoal, [46] and coal was much more abundant than wood, supplies of which were becoming scarce before the enormous increase in iron production that took place in the late 18th century. Low sulfur coals were known, but they still contained harmful amounts. Conversion of coal to coke only slightly reduces the sulfur content. Another factor limiting the iron industry before the Industrial Revolution was the scarcity of water power to power blast bellows. This limitation was overcome by the steam engine. These were operated by the flames playing on the ore and charcoal or coke mixture, reducing the oxide to metal.