

The First Industrial Revolution: Creation of a New Global Human Era

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Abstract

The First Industrial Revolution began in England in about 1750–1760 that lasted to sometime between 1820 and 1840. It is one of the most distinguished turning points in human history. During this period human and animal labour technology transformed into machinery, such as the steam engine, the spinning jenny, coke smelting, puddling and rolling processes for making iron, etc. Industrial Revolution is renewed for global economic growth, increase in production and consumption of common people. The system of transportation communication through canals, road and rails had improved. Also banking and other financial systems improved to run the industries and business firms smoothly. Child and infant mortality rate decreased and fertility rate increased. As a result, population growth had dramatically changed. On the other hand, women and child labour has increased in dangerous and unhygienic condition. Factory workers have to work sixteen hours in a day merely to save the family from starvation. Industrial Revolution created a wide gap between the rich and the poor. An attempt has taken here to describe the various effects of Industrial Revolution.

Keywords

Industrial Revolution, Technological Change, Human Capital, Economic Development

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1. Introduction

England is the first country where industrial related productions have commenced. In the late of the 18th and in the beginning of the 19th century (1760–1840) there were enormous socio-economic changes in England which collectively known as the Industrial Revolution (IR). It is called First Industrial Revolution or simply Industrial Revolution. The IR was a more relentless and universal success, than the Florentine Renaissance, or the French Revolution (say) [51]. The IR was the transition from human and animal labour technology into machinery, new chemical manufacturing and iron production processes, improved efficiency of water power, the increasing use of steam power, and the development of machine tools. The iron and textile industries played central roles in the IR [4].

The invention and improvement of the steam engine brings fruits in the IR. The engine was made of iron and fuelled primarily by coal. Coal played a vital role in the IR [18]. The IR transferred the rural industries into towns and craftsmen became the wage labourers. The British colonial countries were primary source of raw materials, such as cotton, sugar and tobacco, etc. England supplied slaves to Latin and North America through English ships to collect raw materials from those countries. But in 1793 slave trade was abolished [39, 40].

One of the great technological advances came in 1712, with the invention of a steam engine by an English blacksmith, Thomas Newcomen (1664–1729). In history his invention is consider as the “atmospheric engine” [68]. This engine burned coal to create motive force that could be used to pump water out of the shafts of coal mines. Scottish mechanical engineer James Watt (1736–1819), working in a Glaswegian university

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lab of England, improved the Newcomen's steam engine in 1776, which harnessed massive amounts of coal-powered energy efficiently and economically [43, 74]. This invention created the early modern industrial era in the worldwide, which brings revolutions in textiles, mines, steam-powered railroads, steam-powered ocean freighters, steel production, and other areas of economic activities. This made massive expansion of cities, industries, and infrastructure of all kinds [66, 78].

Before the IR in Britain most people lived in small villages. They travelled on foot or by horses through small paths. Illness was common because of inadequate food, poor hygiene, use of polluted water, and non-existence of sewage system. As a result, life expectancy was very short. About 80% people worked in small agricultural farms in rural areas and rest 20% people lived in small towns. The villagers worked from sunrise to sunset. Very few people worked in manufacturing, mining and trade units. Manufacturing was small and localized. People used handmade tools powered by people or animals. About 1% citizens were aristocratic who did not work. They only invested much of their wealth in land [20, 43].

Before the IR, people wove textiles only by hand but after the IR greatly increased output of machine-made goods. The IR was based on a surplus of cheap labour and the creation of good quality items for the rich people who owned the land. Metal was worked manually minimum using the basic hand tools, such as hammers, files, scrapers, saws and chisels [11, 35].

Scottish social philosopher Adam Smith (1723–1790) was the first economist to explain the workings of a modern economy in terms of specialization and the division of labour, efficiently market transactions, and an increase of productivity. He advocated an economic system based on free enterprise, the private ownership of means of production, and lack of government interference. The economy is based on the doctrine of *laissez-faire* which is free trade without interference from the government. By this doctrine factory owners had independence to arrange working conditions in whatever way they pleased. As a result mercantilism took place in the society [4].

During the IR the average income and standard of living of common citizens have not increased. More workers gathered in cities where the factories grew and cities developed rapidly. As more people joined in factories, the percentage of farmers in the total population declined [8].

2. Literature Review

Jaume Ventura and Hans-Joachim Voth had shown that during the IR Britain's borrowing boom was beneficial for agricultural improvements, enhancement of textiles and iron

industries that accelerated structural change of business and massive social change [76]. Vijjika Singh has enlightened on technological advances through machines during the IR [69].

Robert C. Allen has stated that the IR has started in Britain and the new inventions and technologies have changed the world. He stated that wages were remarkably high and energy was cheap in Britain than the other continents. Living standards of Britain rose generally due to economic developments [2].

Harshit Agarwal and Rashi Agarwal have discussed the technological change and development of banking and financial firms during the 1st and 2nd IR. They have stressed that the invention of power loom and steam engine and improvement in the technology of iron making became the major reason behind the 1st IR. During the IR increased the number of country banks, the increased network of the joint and country banks and the coming of Bill-workers changed the banking and financing of firms [1].

Joyce Burnette indicated that during the IR the wage gap between female and male were very high. Men received two to three fold wages than women [14]. Patrick O'Brien believes that England's productive and responsive agriculture, combined with its abundant and accessible endowments of coal and other minerals, foreign trade, and significance technological discovery and innovation are the causes or origins of the IR in England [60].

3. Methodology of the Study

Industrial Revolution had begun in England which is considered as the turning point in human history. Before the IR common people of England were poor. During the IR social, cultural, and political situation has changed. The IR has created the new era. Many kinds of industries, such as Cort's puddling and rolling process for making iron that was reinvented by Henry Cort (1740–1800), Crompton's mule for spinning cotton that invented by Samuel Crompton (1753–1827), and the Watt steam engine had developed during the IR.

The article is prepared on the basis of historical context. To prepare this article we have used the secondary data. The data are collected from websites, books, previous published articles, theses, conference papers, case studies, and various research reports. In this study we have tried to discuss aspects of the first IR in some detail.

4. Objective of the Study

Main objective of this study is to represent the consequence of the IR. The other objectives are;

a) to show the benefits of the IR,

- b) to show the negative effects of the IR, and
- c) to show the developments in various areas.

5. The British Industrial Revolution

The IR began in England in about 1750–1760, which was the transition to new manufacturing processes in the period from about 1760 to sometime between 1820 and 1840 [4]. According to the R. M. Hartwell, the IR is [37], “*The sustained increase in the rate of growth of total and per capita output as a rate which was revolutionary compared with what went before.*” The IR is considered as the sustained but very slow economic growth in Britain based on constantly growing useful knowledge. England had expanded its import and export markets through capitalism to finance in factories and machinery. The IR made England the wealthiest country in the world in the 18th century and beginning of the 19th century [26].

The IR is an important historical process in local, regional, national, continental and global contexts. Due to the IR social, cultural, political and geopolitical progress happened, which drive economic transformation from an agrarian to an industrial economy, in Europe and in the North America. Economic historians called it structural change to an industrial economy [59].

The year 1776 is renowned for four incidents. This year Adam Smith, rightly known as the father of modern economics, published *The Wealth of Nations*, the American colonies declared their independence, James Watt improved the modern steam engine and Edward Gibbon published *The Decline and Fall of the Roman Empire* [66]. In 1776, a James Watt steam engine cost £500–800 [53]. Operating a steam engine consumed £3,000 of coal per annum [46]. The steam engine used for steam-powered railroads and steam-powered ocean freighters, which Karl Marx (1818–1883), and his co-author Friedrich Engels (1820–1895) wrote *The Communist Manifesto* in 1848. This book made bold steps to create the new industrial economy and the breakthroughs in industrial technology [24, 50, 66].

The inventors, skilled craftsmen, financiers, merchants, and the owners of the new mills and mines had formed the IR. Investment in local improvement of roads, bridges, canals, dock works, and later railroads had developed England [61].

Newtonian science was necessary for the IR and this science only penetrated in the British society. This science was missing in the USA and other parts of the world to commence the IR. Also Britain had strong security of real and financial property, and better intellectual property protection [6].

During 1700s England had extensive natural resources, such as water power and coal to fuel the new machines, iron ore to construct machines, tools, and buildings, rivers for inland transportation and harbours from which merchant ships set sail. England was a politically stable society and it was the world’s leading colonial power [21]. Its colonies could serve as a source for raw materials, as well as, a marketplace for manufactured goods. Besides, England had an emerging economy to support industrialization. Businessmen invested a large amount for new inventions in the manufacturing. There was the growing interest in scientific investigation and invention in England [57].

England had highly developed banking system to invest in industry. People were encouraged by the availability of bank loans to invest in new machinery and expand their activities. Political stability of England had an advantage to continuous increase of industrial production [26].

The invention of locomotive and build of railways were revolutionizing of transport in Britain. Railroads spurred industrial growth by providing cheap way to transport materials and finished products, created hundreds of thousands of new jobs for railroad workers and miners, enhanced agricultural and fishing industries. Rail journey became popular for easier and comfortable travel [68].

6. Various Developments During the IR

Many kinds of industries had developed during the IR. There were many technological changes at that time. For example, Cort’s puddling and rolling process for making iron, Crompton’s mule for spinning cotton, and the Watt steam engine were invented. Those inventions improved the total factor of productivity [44].

The worker at a machine with 100 spindles on it could spin 100 threads of cotton more rapidly than 100 workers could on the old spinning wheels. During the IR Britain became the “workshop of the world” [4].

6.1. Development of Textile Industry

Development of textiles was at the heart of the IR. Textiles contribute an economic development in Britain [72]. Cotton textiles had grown in England from 1770 to 1870. By 1900, 40% of the entire world output of cotton goods was produced within 30 miles of Manchester [19]. Textile industry of Britain clothed the world; especially the colonized countries in wool, linen, and cotton. The IR is a self-generated boom in the output of manufacturers that radically changed British society [41].

John Kay (1704–1779), a Lancashire mechanic, invented and

developed the flying shuttle in 1747. His weaving machine had flying shuttle which speedily carried threads of yarn back and forth when the weaver pulled a handle on the loom. It had four spinners to keep up with one cotton loom, and ten people to prepare yarn for one weaver [38, 67].

James Hargreaves (1720–1778), a weaver, carpenter and inventor, patented spinning jenny in 1770. It could run eight spindles instead of one by a single worker, which was later increased to eighty. Sir Richard Arkwright (1732–1792), an English inventor and a leading entrepreneur, invented the water frame in 1769 which used the waterpower from rapid streams to drive spinning wheels. Rollers produced yarn of the correct thickness and a set of spindles twisted fibers together. The machine was able to produce a thread far stronger than any other available at the time. In 1779, Samuel Crompton (1753–1827), an English inventor and pioneer of the spinning industry, combined both features of the spinning jenny and the water frame to produce the spinning mule that made thread that was stronger, finer, and more consistent [32, 73].

There were 12,150 power looms in England by 1820, which rapidly grew up to 45,500 by 1829 and 85,000 by 1833 [5]. In the mid-18th century about 800,000 to 1,500,000 people were employed in wool textiles [12]. England's cotton came from America. American cotton production increased from 1.5 million pounds in 1790 to 85 million pounds in 1810. Within just a 35-year period, more than 100,000 power looms with 9,330,000 spindles were put into service in England and Scotland. During the 1800s, Leeds and Manchester dominated textile manufacturing in the world. The port of Liverpool, Manchester formed the centre of Britain's busy cotton industry [11].

6.2. Development of Iron and Steel Industries

The iron and steel industry had grown dramatically during the IR. In 1750, iron production in Britain was only 28,000 tons, but it had increased to 250,000 tons by 1805. During this period much of the iron used in Britain was imported from Sweden and Russia [19].

In 1709, Abraham Darby (1678–1717), an English ironmaster, used coke to fire his blast furnaces at Coalbrookdale. The pig iron he made converted to cast iron that was used to make several bridges and structures [46]. Henry Cort (1740–1800), an English ironmaster, developed two significant iron manufacturing processes: wrought iron rolling in 1783 and puddling in 1784. The rolling replaced hammering for combining wrought iron and expelling some of the dross. It was 15 times faster than hammering with a trip hammer. The puddling produced a structural grade iron at a relatively low cost [46, 70].

In 1828, James Beaumont Neilson (1792–1865), a Scottish inventor, patented the *hot blast* process, which saved energy for the manufacturing of pig iron. In 1855, Henry Bessemer (1813–1898), an English inventor, patented the Bessemer process for making steel from iron that supplied cheaper and better iron and steel [34].

6.3. Development of Chemical Production

During the IR there was a large scale production of chemicals, such as sulphuric acid, hydrochloric acid, alkali, sodium carbonate, sodium sulphate, potash, bleaching powder, concrete, etc. These chemicals were being used in making glass, textile, soap, bleaching cloth, etc. [1]. In 1746, John Roebuck (1718–1794), an English inventor and industrialist, invented the production of sulphuric acid by the lead chamber process. In 1791, Nicolas Leblanc (1742–1806), a French chemist and surgeon, developed the production of sodium carbonate. Sulphuric acid was used to pickle iron and steel, and for bleaching clothes. Sodium carbonate was used many purposes in the glass, textile, soap, and paper industries [49]. In 1800, Scottish chemist and industrialist, Charles Tennant (1768–1838) developed the production of bleaching powder which was extensively used in the textile industry. In 1824, British bricklayer, Joseph Aspdin (1778–1855) made Portland cement that was used for the construction of building and tunnel [62].

William Murdoch (1754–1839), a Scottish engineer and inventor, established gas lighting process in London between 1812 and 1820 which was used in factories, stores, houses, and streets. In 1798, Nicholas Louis Robert (1761–1828), a French soldier and mechanical engineer, patented a machine for making a continuous sheet of paper [36].

6.4. Population Growth

From 10,000 BC to 1800, the rate of growth of global population was 0.01% advance or less per year. In the 17th century about 1.5% of pregnancies ended with the death of the mother, which is equivalent to a women marrying at 25, who would give birth to the average of 5.6 children for such marriages. But in the early 19th century these chances had dropped to about one-third [18].

During the IR child and infant mortality rate decreased and fertility rate increased due to the development of medical science, improvement of sanitary system and economic development. When standard of living changed, population growth had dramatically changed. In England population growth was 1.36% per year during 1791 to 1831; between 1680 and 1820 the population increased 133% and between 1820 and 1900 it rose another 166%. The population of Britain had more than doubled from 8.3 million in 1801 to 16.8 million in 1850 and, by 1901, had nearly doubled again to 32.5

million. Population tripled between 1761 and 1861. Europe's population increased from about 100 million in 1700 to 400 million by 1900 [58].

6.5. Economic Development

Between 1250 and 1800 there was little sustained improvement in the British economy. During the IR a small part of the economy had improved. Between 1780 and 1889, the real wage became 22-fold [18, 44].

In the USA, between 1865 and 1920 real gross domestic product (GDP) became more than seven times and real per capita product became more than double (1.7% per year), which was higher than ever before in the US history [15]. During the IR systems of transportation communication and banking improved. The IR also improved standard of living of the rich but the bulk of the population was at the bottom of the social ladder [20, 54]. In the 18th century Britain had a successful economy. A grand coalition of merchants and landowners emerged to protect commerce and property. Between 1806 and 1906 income per person grew at an average of 0.9% per year in Britain. From 1906 to 1990 it grew 1.5% per year [64].

Growth during the IR was slow by modern standards. Business area has increased between countries. New types of economic systems developed. For example, capitalism expanded in the USA; socialism in Great Britain and France; and communism in the Soviet Union [11].

6.6. Agricultural Revolution

Wealthy landowners had bought their lands from the village farmers and enclosed their land with fences, and cultivated in the larger fields. Wealthy landowners forced small farmers to become tenant farmers or to give up farming and move to the cities to work industries. Farmers used new technologies, such as seed drill and Dutch plough which contained iron parts, and the threshing machine. The seed drill invented in 1701 by Jethro Tull (1674–1741), an English agricultural pioneer who helped to bring the British Agricultural Revolution. It had a mechanical seeder which distributed seeds evenly across a plot of land and planted them at the correct depth [10]. Rotherham plough, the first commercially successful iron plough, was invented by Joseph Foljambe in 1730 [42].

English farmers used more productive seeds and harvesting methods to obtain boost production. They cultivated rotating crops, such as cultivation of wheat, turnips, barley and clover in turn. Moreover, English agriculture was distinguished by high levels of output per worker [12]. It had control over land, capital and labour exercised for the increase of agricultural production. Livestock breeders improved their methods allowing best cattle to breed [60]. As a result, meat production had increased. Between 1700 and 1786, the average weight for

lambs became from 18 to 50 pounds. They improved farming methods that create agricultural revolution [3, 25].

6.7. Improvements of Transportation

During the IR all sectors had improved, so that improvement of transportation became essential to transport human, animal and goods in different locations. Transportation is the backbone of any economic, culture, social and industrial development [17].

James Watt's steam engine worked faster and more efficiently while burning less fuel. It is used in water transportation to propel boats. In England, canals and other human-made waterways were used to transport raw materials and finished goods. From 1700 to 1850 road transportation in Britain improved greatly. In 1830, there were 2,000 miles of canal in Britain and by 1850 these developed to 4,250 miles [18]. British roads improved by the equipment of road beds with a layer of large stones for drainage. Private investors formed companies that built roads for transportation. In the early 1800s, John McAdam (1756–1836), a Scottish engineer and road-builder, equipped road beds with a layer of large stones for drainage [73].

In 1804, Richard Trevithick (1771–1833), an English engineer, transported ten tons of iron and 70 men over nearly ten miles of track in a steam-driven locomotive. It is the first locomotive built to run on rails [68]. In 1821, George Stephenson (1781–1848), an English civil engineer and mechanical engineer, built some 20 engines for mine operators in northern England. In 1829, the railroad opened under the supervision of Stephenson whose engines can move 29 miles per hour which was called "Rocket". It was the first steam locomotive to carry 1,200 passengers between Stockton and Darlington [19]. In 1829, Rail network of England had reached 430,000 km. The railroad boom created hundreds of thousands of new jobs for both railroad workers and miners. The public intercity railway line between Liverpool and Manchester started in 1830 [6, 17]. Railroads were introduced in the USA in 1829 [16]. In 1835, Belgium opened a railway line which carried more passengers than all the lines operating in Britain [18].

6.8. Collection of Capital

At the start of the IR capital were raised by peer-to-peer lending from friends, family, and local owners [55]. In the 1770s, it is observed that in London a stock exchange was established. In the early 1790s, the New York Stock Exchange was started its journey. The Bank of England financed the Government debt to run the industries and business firms. On the other hand, merchant banks financed foreign trade. Consequently, private credit markets did not work very smoothly. Very few financial institutions financed for entrepreneurs. New firms could not easily raise equity on the

stock market [13].

The factory owners who were successful made huge profits. They bought more machines in the factory, and purchased supplies in greater quantities at enormous savings. They had invested in building canals, railroads, and steamships and in developing foreign trade. They became a powerful new class in England, the industrial capitalists [57].

7. Living Standards During the IR

During the IR living standards was controversial. The cities of England grew rapidly without no development plans, sanitary codes, and building codes. Police protection in the cities was very weak. As the income of the workers was very low, they lived in dark, dirty shelters, with whole families crowding into one bedroom. They found little improvement in their living and working conditions [29]. During the period 1780–1850 real wages and real national income per head grew at the same rate. Majority of workers had found no real earnings before the 1830s [23].

In the start of the IR, landowners and aristocrats had occupied the top position in British society. But later factory owners, merchants, and bankers grew wealthier than the landowners and aristocrats. A larger middle class, such as government employees, doctors, lawyers, and managers of factories, mines, and shops had grown. They enjoyed a comfortable standard of living [64].

As more children went to factories as workers, school enrolment ratios were low in Britain. The period 1750–1850 was one of surprisingly slow growth in per capita [77]. The standard of living in the industrial countries grew very rapidly. Increases in real wages allowed labourers to purchase more goods and services, including better food and shelter [44].

Between 1800 and 1850, the number of European cities increased from 22 to 47. London became the largest and most important city of Europe. In the start of the IR terms growth was slow and improvements in the standard of living were very limited. Growth and rates of productivity change only accelerated after 1850, when the classic period of the IR ends [26].

The population of England doubled between 1750 and 1830. Household budget surveys and alternative indexes of living standards, such as the human development index (HDI) strongly suggest that gains in living standards were very small [28, 79]. Living standard of well-to-do merchants and factory owners were very high. They often built luxurious homes in the suburbs [64].

8. Movement of Industry During the IR

The British strongly prohibited on transferring their technology and skilled workers to other nations. By the mid-19th century, industrialization spread from Britain to other European countries, such as Belgium, France, Sweden and Germany, and to the USA. Samuel Slater (1768–1835) had smuggled the design of a spinning machine to the USA. By the early 20th century, the USA had become leading industrial nation in the world [24].

British skilled workers played a key role for industrialization in Belgium. In 1799, William Cockerill (1759–1832) was a British inventor and entrepreneur, illegally made his way to Belgium. He made secret plans for building spinning machinery in Belgium. His son John built massive industrial enterprise in eastern Belgium. More British workers migrated to Belgium. As a result, Belgium became an industrialized country in Europe [30].

Around 1835, Germany imported British equipment and engineers to establish industries. Germany built railroads that linked its growing manufacturing cities [75].

9. Consequence of the IR

During the IR there were enormous economic, social and political changes, such as advances in agriculture and transportation, huge production of goods, expansion of global trade, increase of employment, creation of earning source for women and children, change in standard of living, increase accumulation of information, motivation of nationalism and imperialism, development of democracy, capitalism and socialism, and depletion of environment. Per capita GDP of European and North American countries had increased substantially [52].

9.1. Revolution of Workers

After the IR some problems, such as working hours, wages, unemployment, accidents, employment of women and children, etc. arose. Children and women were hired for less pay. About two-third workers in some factories were children. Workers were worked from 12 to 14 hours a day under terrible conditions. To keep the children awake, mill supervisors beat them. They found half an hour for lunch and an hour for dinner [31].

Trade Union practice is a part of the British heritage. For years, the British government denied workers the right to form unions. After the IR trade union is formed to help advance the interests of working people to grow aspiration and improve their condition of life. Early trade unions were just to defence

in their aims and sought to protect existing standards of living and security of wage advances. Workers formed labour union, an association of workers that pushed for benefits and reform. Unions would ask for better working conditions, fewer hours, and higher pay. Workers demanded improved conditions, fewer hours, and higher pay, and wages through labour unions. They also demanded to improve the lives of workers, including women and children [65]. Workers refused to work (strike) until the owners met their demands. Many riots took place between striking union workers and the police. Strikes often turned into bloody battles. Labourers eventually won higher wages, shorter hours, and better working conditions after they joined together to form labour unions. Trade unions were illegal until 1825 and even after that year strikes were banned. As a result, the workers had lost the ways of fight against their rights [40].

9.2. Development of Global Inequality

The IR extended the gap wealth of between industrialized and non-industrialized countries. Raw materials for factories of the industrialized countries were imported from non-industrialized and least-developed countries. On the other hand the industrialized countries exported their manufactured products there. The Great Britain forced its colonial countries for raw materials and to create markets. The IR had shown a huge gap between the rich and the poor. During that period the gap of wages between men and women was remarkable. It is matter of regret that women and children were neglected in the factories and they found one-third to half wages than men [14].

9.3. Change of Social Structures

During the IR capitalism and socialism were established in the society. Capitalism is considered as an economic system where production system is completely depends on the factory owners. It strongly supported that wages would be forcibly decreased as population increased. Laissez-faire economics support capitalism. Laissez-faire mainly supported by the three political economists: Adam Smith (1723–1790), Thomas Malthus (1766–1834) and David Ricardo (1772–1823). These three economists were against the government efforts to help the poor workers. According to Smith, economic liberty guaranteed economic progress, and government should not interfere. Malthus argued that population increase more rapidly than the food supply. He suggested that except wars and epidemics to kill off the extra people, most were destined to be poor and miserable. Ricardo supported that a permanent underclass would always be poor and wages would be forced down as population increased [71].

Philosophers and socialist thinkers Charles Fourier (1772–1837), Saint-Simon (1760–1825), and others sought to offset

the ill effects of industrialization with a new economic system called socialism [47]. According to socialism wealthy people or the government must take action to improve lives of all people which restrict the abuse of workers. The factors of production are owned by the public and operate for the welfare of all. Socialism supported that government control of factories, mines, railroads, and other key industries would end poverty and promote equality [9, 80].

Karl Marx (1818–1883), German journalist, and Friedrich Engels (1820–1895), a German political thinker, son of a textile mill owner suggested a radical type of socialism. According to them, the IR had enriched the rich but made insolvent the poor. They believed that capitalism would eventually destroy [50]. They called complete socialism as communism, which supports that all land, mines, factories, railroads, and businesses, would be owned by the people [27]. In the 1900s, Marxism inspired revolutionaries, such as Russia's Lenin, China's Mao Zedong, and Cuba's Fidel Castro. At the peak of Communist expansion in the 1980s, about 20 nations were Communist-controlled, including two largest nations; China and the Soviet Union [7, 48].

9.4. Benefits from the IR

Despite some problems a number of positive effects happened during the IR. The IR provided better quality of life for most people. It shifted to powered, special-purpose machinery, factories and mass production. Wealth of the nation had increased. It gave plentiful jobs and people could earn higher wages in factories than on farms and wore better clothing. It also improved systems of transportation, communication and banking. Before the IR families were rural, large, and self-sustaining. Women passed their time for household tasks and were less important for family. Sometimes they were burden for the family. During the IR they earned in factories and became important members of the families [22].

During the IR greatly increased the production of goods. It raised the standard of living for many people, particularly for the middle and upper classes. It provided healthier diets, better housing, and cheaper, mass-produced clothing. It expanded educational opportunities for rich families. The IR was blessing for women. They found higher wages than work done at home [22].

In the 19th century tax revenues had increased that were used by local, state, and federal governments to invest in urban improvements and raise the standard of living of most city dwellers. Communication became easier during the IR with inventions of telegraph. Due to the IR the following developments are happened among the nations [4, 24]:

- a) agricultural productivity started to rise,
- b) urbanization increased,

- c) business increased,
- d) more sophisticated market economy began,
- e) the rule of law expanded,
- f) invention of scientific models and instruments,
- g) invention of new machineries,
- h) discoveries of various items, and
- i) invention of new technologies.

9.5. Negative Effects of the IR

Before the IR skilled artisans produced the entire product with the help of apprentices and family members. Some scholars revealed that the IR is linked with the increase of factories and the decline of skilled artisans and increase of unskilled workers (unskilled farmers, labourers and servants) in manufacturing. In the USA, in the early industrial period (1820–1840), factories in New England employed the unskilled labours of women and children [33, 45, 56]. Factory owners could hire and fire workers for any reason. They were overworked but underpaid. Children were employed more because of their small size to pass them through the narrow spaces. Employers could pay women and children less than men even though they were expected to work just as hard. At that time, primary school attendance was not mandatory and many children were forced to go to work for the financial support to their families. Due to unhealthy and risky works many children suffered from long term illnesses, amputation, and even death [31].

After the IR life for the poor and working classes continued to be filled with challenges. Cities became over-crowding, workers faced lack of housing, poor sanitary conditions, disease, and poverty. The coal that powered factories and warmed houses polluted the air dangerously. Textile dyes and other wastes poisoned river water. Jobs in industries became bore to workers, as they did the same thing every day and never developed a sense of pride in their works [74].

In 143 water-powered cotton mills in England and Scotland more workers were children in 1788 [19]. Many children developed lung cancer, tuberculosis, cholera, and other diseases and died before the age of 25. Many died from gas explosions or crushed under the machines or burned. Some lost limbs or blinded [63].

To attend workplace in time workers compelled to live a crowded slum district near the factory. They lost the independence. Small farmers sold their lands to the larger landlords and joined the factories as workers. The workers had to work 14 hours a day at the job, 6 days a week under terrible conditions. They started work before dawn every day and worked until after sundown. Wages of labours in factories

were low. Factories were dirty and unhealthy, machines injured workers, a boiler might explode, a drive belt might catch an arm, etc. In coal mines frequent accidents, damp conditions, and the constant breathing of coal dust made the average miner's life span ten years shorter than that of other workers. The IR caused unhealthy working conditions, air and water pollution, increased child labour. It created tensions between the working class and the middle class [31].

Lack of coal, limited capital accumulation, slow construction of railways, slow mass production, slow population growth, etc. were some factors to slowed down of the IR [40].

10. Conclusion and Recommendations

During 1760–1840, Great Britain experienced the IR, which began a period of economic growth and prosperity which we call the modern era. Development of textile industry, iron and steel industry, various chemicals production, agricultural revolution, improvement of transportation, etc. had happened during IR. In that period standards of living of some people had improved but most of the populations were poor. Child and infant mortality rate, and also adult mortality rate had decreased and fertility rate increased. As a result global population had increased rapidly. The IR was the transition from human and animal labour technology into machinery world. At the end of the IR a middle class had created.

Although IR had unlimited successes, it had some negative effects, such as increase of unskilled workers, rise of women and child labour in unhygienic and risky situation, rise of slave trade, and rapid increase of environment pollution. There was no compulsory primary education in the schools, the child labourers increased in the factories. The large gap between the rich and the poor had created.

In this study we have tried to discuss the various changes that created the new era in the human history. At the end of the First Industrial Revolution, technology and skilled workers from Britain has transferred some other countries of Europe, such as Belgium, France, Sweden and Germany and to the USA. As a result, global economic development has commenced.

During the IR trade union had formed against the various tortures on the workers. In the study we have revealed that at first capitalism had formed for the wealthy people and later socialism had created to support the poor labourers.

It is recommended that IR has both benefit and negative effects but no doubt we have found the beginning of new age of invention and innovation. The first IR has opened the door of second, third, fourth, etc. industrial revolutions.

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