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The Industrial Revolution 1.0 & 2.0

SCIENCE AND TECHNOLOGY THINKING

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Introduction

In this day and age, we are constantly surrounded by all manner of machinery and technology which we take for granted. If you were to take the time to list every machine in your household, I think you would be surprised by the number you end up with. There was a time when humans did not have the luxury of machines to do work for them.

In fact, as recently as 300 years ago, humans were the main source of energy for most work to be done; literally manpower. Unfortunately, this form of energy was not very efficient. Humans only had limited energy, based on their age, gender, health and the food they ate. The weather also played a big role in whether a person could carry out work or not. Processes, such as, farming, could only be done as fast a person could plant and harvest them.

People later realised that animals were able to do some heavy manual labour faster and for much longer than humans could. While this was a vast improvement on regular manpower, it was not a perfect solution, as there were certain tasks which animals simply could not do. Animals were strong, they were great for preparing soil for planting, but their size and weight meant that they were not at all suitable for tasks such as harvesting what has been planted. A lot of the work, made easier by domesticated animals, still required humans to complete the process.

Around this time, humans also had access to windmills and waterwheels which captured energy from the surroundings to aid in some forms of work. These early, rudimentary, machines were used to grind wheat into flour, saw wood or pump water. Certainly, these machines made some tasks much easier, but alas, this was still an imperfect solution to mankind's energy dilemma. Windmills required a vast open space to be able to catch the wind and work efficiently. Waterwheels, on the other hand, required a body of water such a river with a strong enough current to turn the waterwheel.

Humanity needed a new, more powerful and reliable source of energy which they would be able to utilise and *revolutionise* the way work was done. This new, more powerful source of energy was thought to be just wishful thinking or a fairy tale until the mid-18th century; when the industrial revolution began.

The Industrial Revolution

The Industrial Revolution refers to a period of time where massive economic, technological, social, and cultural change occurred. This change affected humanity to such an extent that historians are now comparing its impact to that of when early humans switched from hunter-gathering to farming, in other words, the start of a new chapter in the story of humanity.

To put it simply, a mainly agriculture-based world economy using manual human and animal labour was transformed into a world economy fuelled by industry and manufacturing by machines. Historians tend to disagree on the exact date of the start of the industrial revolution, but the general consensus is it began around the mid-18th century and lasted all the way to the early 20th century with the developments beginning in Great Britain and then spreading throughout Europe to the rest of the world.

Upon further research by historians, most agree that the industrial revolution should be split into two separate events, the first industrial revolution, which took place between the mid-18th century to the mid-19th century, and the second industrial revolution, which took place from the late-19th century to the early-20th century.

There were a few reasons for historians to make this distinction between the two industrial revolutions. One of the reasons was the slowdown of important inventions which occurred roughly between 1840 and 1870. Another reason for the separate designations is the difference in focus of these revolutions. While the first industrial revolution mainly focused on textile manufacturing, agriculture and the innovation of the steam engine, the second industrial revolution, concentrated instead on the production of steel, the invention of the automobile, and advancements in electricity generation and transfer.

Unbeknownst to many people, the industrial revolution did not end at the start of world war 1. There was a third industrial revolution in the 70's and 80's of the 20th century which focused on partial automation using memory-programmable controls and computers. Following the third industrial revolution, there was another. In fact, we are living in that same industrial revolution at this very moment; the fourth industrial revolution. While both these modern-day industrial revolutions are important, the first two set the foundation for modern society today as we know it.

The Spread of the Industrial Revolution

The first industrial revolution, as mentioned earlier, took place between the mid-18th century and the mid-19th century. It began and was mostly confined to the most powerful and advanced country in the world at that time, Great Britain.

The British were well aware of their head start in this new era of technological advancement and wanted to further strengthen their position as the biggest superpower in the world. To that end, the British forbade the export of their skilled workers, machines and manufacturing techniques to Europe or the rest of the world.

While the crown and the powers that be saw the industrial revolution as a way to bolster their national superiority, many opportunistic Britons saw it as a goldmine of sorts. These money-minded Brits saw the potential profit to be made if these industrial opportunities were made available outside of Great Britain. In fact, many continental European businessmen were more than interested in luring British know-how to their own countries.

Two Englishmen in particular, William and John Cockerill, brought about the start of the spread of the industrial revolution. In 1807, they developed a few machine shops in Liege, Belgium; and with that, Belgium became the first European country outside of Great Britain to be transformed economically. Much like its British progenitor, the industrial revolution in Belgium mainly focused on iron, coal and textiles.

Belgium's big brother and next-door neighbour, France, was industrialised much more slowly and less thoroughly than Britain or Belgium. While Great Britain was busy trailblazing the industrial revolution, France was caught up in their own, more political, revolution. It was the political uncertainty brought on by this revolution that discouraged large investments for industrial innovations in France.

France, however, would not be left behind for long. During the rule of the Second Empire, France experienced great growth in terms of industry. France quickly blew past Belgium, and by 1848, it had become an industrial power; second only to their rivals from across the channel. Great Britain.

For the most part, other European countries were lagging far behind Great Britain, France and Belgium. This was mainly because the bourgeoisie of the other European nations simply did not have the same wealth, power or opportunities that their British, French and Belgian counterparts had. Volatile political conditions in these nations also hindered the oncoming industrial expansion.

One quite notable latecomer to the proverbial industrial party was the Germans. Despite the Fatherland's vast resources of iron and coal, the industrial takeover did not begin until 1870, when German national unity was achieved.

Once started, the German industrial revolution grew with such staggering pace that Germany were outproducing Britain in steel and had already become the leading global experts in the chemical industries by the turn of the century. Germany had essentially had a *blitz*-industry; and they remain one of the leading industrial nations in the world today.

The spread of the first industrial revolution was not limited to just Great Britain and continental western Europe. In the 19th and 20th century, the United States of America rose to prominence as an industrial power and far outstripped the European revolutions. Japan too joined the industrial revolution with astonishing success. They quickly became the most powerful and advanced nation in Asia, surpassing both China and, although not technically Asian, Russia.

The eastern European nations were nowhere to be seen in the industrial landscape in the early-20th century. The Soviet Union did not become a major player in the industry until, then leader, Joseph Stalin, introduced and implemented several five-year plans which would catalyse the industrialisation of the Soviet Union. The vast resources available in the Soviet Union at the time made these five-year plans more realistic and achievable than they otherwise would be.

These five-year plans were so effective and impactful, that the Soviets managed to achieve in a few decades, what took the British over a century and a half to attain. By the mid-10th century, the industrial revolution had already spread far and wide and encompassed most of Europe, America and Australia. It had also spread to hitherto non-industrialised parts of Asia, such as China, India, and the Malay Archipelago.

Significant Technological Developments of Industrial Revolution 1.0

The commencement of the industrial revolution is almost synonymously attributed to a few innovations which took place around the latter half of the 18th century. By the first quarter of the 19th century, significant improvements have been made in a large number of fields. These improvements include, textile manufacturing, iron production, steam power, machine tools, chemicals, cement, gas lighting, glass making, paper making, agriculture, mining and transportation, among others.

Textile Manufacturing

Throughout the 18th century, when the industrial revolution was taking place, several inventors and visionaries such as John Kay, James Hargreaves, Richard Arkwright, Eli Whitney, and Edmund Cartwright developed machines and techniques that would not only improve but revolutionise the productivity of the textile industry.

The “Flying Shuttle” was invented by John Kay in 1733 to improve the process of hand-weaving looms. This invention greatly accelerated the weaving process was able to reduce labour needs by 50 percent as it only required one operator to handle the machinery as opposed to two which were needed previously.

Three decades later, in 1764, a new spinning machine, called the “Spinning Jenny”, which was loosely based on the “Flying Shuttle”, was invented by a poor and illiterate spinning weaver, named James Hargreaves. His invention had one of the greatest impacts on the textile industry and forever changed the how textiles and fabrics would be manufactured. The “Spinning Jenny” had multiple spinning frames which allowed workers to work with eight or more spools of thread at a time. This new spinning machine was vastly more superior and efficient than all of its predecessors, which could only handle a single spool of thread at any given moment. The “Spinning Jenny” greatly increased the yield of cloth production and brought down the price of yarn.

The “Spinning Jenny” was further improved upon less than half a dozen years later in 1769, by a man named Richard Arkwright, the former employer of a certain John Kay. Arkwright’s spinning machine was based on Kay’s “Flying Shuttle”, the main difference being the spinning frame was powered by a water wheel as opposed to a single person. This

meant the water frame was far more powerful than the “Spinning Jenny” and was capable of spinning 128 threads at a time. Not only was the water frame faster and more powerful than the “Spinning Jenny”, it also produced a yarn that was stronger and harder.

Another decade later, in 1779, a man named Samuel Crompton invented what he called the “Spinning Mule”. This oddly named machine combined the ideas of both James Hargreaves and Richard Arkwright who invented the “Spinning Jenny” and water frame respectively. This new contraption gave spinners greater control over the weaving process and it could also hold multiple spindles which significantly increased the production yield of yarn. The machine carried up to 1,320 spindles and could be 46 m long. It could also move forward and back a distance of 1.5 m four times a minute and operated for over 56 hours a week. The sheer capacity of the “Spinning Mule” meant it quickly bested both Arkwright’s and Hargreaves’s machines.

Following the invention of the steam engine by James Watt, a man named Edmund Cartwright invented the first power loom, in 1785. A power loom was a spinning machine which was powered by a steam engine. It replaced all the previous looms which were hand powered and water powered. This machine had one of the biggest impacts not only on textile production, but the entire industrial revolution, as it freed up many labourers from the textile industry which enabled these workers to venture into different budding industries during the revolution. Improvements were later made by Samuel Horrocks and Richard Roberts.

The textile industry was also to benefit from other developments of the period such as the steam engine and iron production. With Cartwright’s loom, the spinning mule, and Watt’s steam engine together with the growing iron industry, the pieces were in place to build a fully-mechanized textile industry. There were no new major inventions, from this point onwards, but there was continuous improvement in technology as mill-owners strove to reduce cost and improve quality. Improvements were made in every conceivable part of the process. The steam engines were improved, wooden turning shafts were replaced with wrought iron ones which greatly reduced the problem of line-shafting. Ever improving, the first loom with a cast-iron frame, a semi-automatic power loom, and, a self-acting mule were introduced which essentially meant that the textile manufacturing process had become industrialised.

Iron Production

Without coal and iron, the industrial revolution simply could not have developed. Coal was essential for steam engines to work, and to produce iron. At the very start of the 18th century iron makers found a new way to extract pure iron out of iron ore using coke, which was purer than coal and burned much hotter, which was able melt the ore more easily.

For the amount of heat given off, coal required much less labour and time to mine. Traditional charcoal required trees to be cut down and then the wood be converted into charcoal. It quickly became the preferred source of fuel as coal was much more abundant than wood which was swiftly being used up and becoming scarce.

England's coal mines were booming during the Industrial Revolution. Miners dug deeper and deeper into the earth's crust to find as much coal as they could and in the 19th century England became the world's largest coal producing country; not something to be particularly proud of today. A majority of the coal was mined in the Midlands, around Sheffield, Birmingham and Coventry. The burning of coal produced a lot of black smoke and darkened the skies which resulted in these areas being given the nickname, Black Country.

As a result of the switch from charcoal to coal, the production of iron increased dramatically and by the early 1800s enough iron was produced to make the goods that were required, like machine frames, water pipes, rails for the industrial necessities and cast-iron cookware for the general public's needs.

Cast iron began being used as structural material for bridges and buildings because its cost had gone down significantly and it had also become more widely available. A bridge, known as the Iron Bridge, built in 1778 using iron produced by Abraham Darby III, is a famous example of early iron structures. Later on, most cast iron was converted to wrought iron.

Until the large-scale production of cast iron, Europe relied on the bloomery for most of its wrought iron. A finery forge was used to convert cast iron into wrought iron. A process known as potting and stamping was developed to improve the refining of cast iron, but this was superseded by Henry Cort's puddling process. Puddling was not the first iron refining

process developed by Henry Cort. In 1783 he developed the rolling process and subsequently the puddling process in 1784. This new method of refining iron produced a structural grade iron at a relatively low cost.

In 1818, Baldwyn Rogers improved on the puddling and two and a half decades later, in 1838, John Hall further improved on the process which greatly reduced losses during iron production. This improved process patented by John Hall was called wet puddling and it resulted in the reduction of losses of iron during production from almost 50% to around 8%.

After 1800, puddling became widely used. Up to that time, considerable amounts of iron had to be imported from Sweden and Russia by British iron manufacturers to meet the growing need of iron domestically. Imports began to decline in 1785, due to the increased British iron production, and by the 1790s Britain eliminated all imports and became a net exporter of bar iron.

The readily available supply of cheaper iron and steel aided in the growth of a number of industries. Those making nails, hinges, wire and other hardware items were able to produce more of these items faster and at a lower cost. The development of machine tools allowed iron to be worked better and more efficiently which, in turn, caused it to be used ever increasingly in the rapidly growing machinery and engine industries throughout Britain and later, the rest of the world.

Steam Power

One of the most important, if not the most important invention of the industrial revolution was the development of the stationary steam engine. At the start of the revolution, most of the industrial power was supplied by water and wind. It was estimated that steam power only contributed to about 10,000 horsepower at the start of the 19th century. However, a little over a decade later, in 1815, steam power had grown over twentyfold and was contributing over 200,000 horsepower to the industry.

While the steam engine is most closely associated to the industrial revolution, in actuality, the first successful piston steam engine was invented more than a century prior to the start of the industrial revolution by Thomas Newcomen around 1712. These early Newcomen steam engines were scattered around Britain to drain flooded, unworkable

mines and to power municipal water pumps. There were a few issues with these almost prehistoric steam engines; they were enormous, required a significant amount of capital to build and were terribly inefficient, by modern standards that is. It was estimated that Newcomen's steam engines produced a whopping 5 horsepower, roughly the same power as a modern-day lawn mower.

However, these machines also had a few positive traits such as reliability and ease of maintenance. These two traits alone were more than enough to ensure that Newcomen engines remained to be used in coalfields and mines for over a century after its conception. These engines were so popular at the time that a few made their way to other European countries such as Hungary, Germany, Austria and Sweden. Some improvements were made to the Newcome engine in the 1770s by engineer John Smeaton, four decades after the death of its inventor and by the 19th century, over 1450 engines had been built.

In 1778, Scotsman James Watt, perfected his version of the steam engine with the financial backing from his business partner, Englishman Matthew Boulton. Watt's steam engine was radically different from his predecessors with many changes made to the fundamental design and operation of the machine. The changes made by Watt translated into huge boosts in efficiency, Boulton and Watt's engines used only a quarter of the coal needed per horsepower-hour and was also significantly smaller than Newcomen's inefficient behemoth.

By 1783 the Watt steam engine had evolved into a double-acting rotative type, meaning it could be directly attached to the rotary machinery of a factory or mill and produced between 5 to 10 horsepower. In 1795, Watt and Boulton opened a foundry to manufacture these engines.

Before the 19th century, most steam engines were built as part of a building or structure, but as time progressed, different patterns of steam engines emerged. Some of these engines could be moved, but were not fully portable yet. This remained true until Cornish engineer Richard Trevithick and the American Oliver Evans came up with a design for a higher-pressure non-condensing steam engine which exhausted against the atmosphere. The high pressure made it possible for the development of an engine and boiler that was compact enough to be used on rail locomotives and steam boats.

The progress of steam engines was further aided and improved by the development of machine tools, such as the lathe, planer, miller and shaping machines which were powered by the very same machines they were advancing. These new machines enabled metal parts for the construction of steam engines to be produced easily and with a level of accuracy which was previously impossible. In turn, the new precision cut parts made it possible for larger and more powerful steam engines to be built.

Agriculture

One of the main causes of the industrial revolution is attributed to the improved agricultural productivity, brought about by the British agricultural revolution. This revolution of the agricultural variety freed up many workers, who would otherwise spend their entire lives working on a farm, to work in other developing sectors of the economy.

In 1701, an English lawyer named Jethro Tull invented and, later, improved upon the seed drill. His invention was a mechanical seeder which was able to distribute seeds evenly across large plots of land and on top of that, planted seeds at the correct depth. Usually this task would have to be carried out by multiple workers over the period of several days, but thanks to Tull's invention, only a fraction of the time and manpower was required. However, the machine's cost and reliability issues prevented it from becoming a commercial success.

Another crucial innovation for the time was the invention of the threshing machine by Scottish engineer, Andrew Meikle in 1784. The threshing machine took the place of traditional hand threshing with a flail. Hand threshing was a laborious and time-consuming task which accounted for a quarter of all agricultural labour.

The Rotherham plough came about half a century prior to the threshing machine. The plough was invented by Joseph Foljambe and was the first commercially successful iron plough. It was based on an earlier Dutch design with a few improvements and was made if mostly iron. The plough was easy for blacksmiths to make and was also cheap. Its popularity spread as it made its way to Scotland, America and France.

Again, the introduction to machine tools and metal working techniques during the industrial revolution eventually resulted in the mass production of agricultural equipment which further progressed the agricultural side of the revolution.

Transportation

In the early days of the industrial revolution, transporting goods was not a very pleasant affair. The inland transportation of goods was made possible through navigable rivers and small roads. Heavier items which could not necessarily be transported on land needed to be ferried by coastal vessels, via the sea. Coal was brought to rivers for further shipment using wagonways, which were in essence, horse-pulled trains on simple tracks.

All of the motive power on land, at the time, was supplied by animals and sails provided the nautical motive power. At the end of the 18th century, the first horse railways were introduced and later, at the start of the 19th century, steam locomotives were brought into the fold. Sailing techniques also improved substantially throughout the time period of the industrial revolution, which resulted in sailing speeds increasing by over 50% on average.

Several British rivers were improved for the transportation of goods before and during the industrial revolution. Obstructions were removed, curves were straightened, navigation locks were built and rivers were also widened and deepened. By the mid-18th century, Britain had over 1,000 miles (1,600 km) of navigable rivers and streams.

For the first time, it was possible to transport bulk materials efficiently and economically thanks to the construction of canals and waterways. Horses were able to pull barges with loads dozens of times larger than that of traditional cart drawn loads. This is because most of the load was supported by the barge and the buoyancy of the water as opposed to the cart and horse itself; the horse only needed to provide the pulling power.

At the time of the industrial revolution, much of the roads which existed in continental Europe and in the United Kingdom were in a terrible state and some were even dangerous to use. France, however, was the exception to this as they were known to have an excellent system of roads throughout the country.

A large portion of the original British roads were poorly maintained by the thousands of local parishes that were in charge of them. Turnpike trusts were set up to maintain roads and to charge toll in the 1720s. by the mid-18th century, almost every main road in England

and Wales was under the responsibility of turnpike trusts which greatly improved the standard of these roads and they were also better maintained.

John Metcalf, Thomas Telford and most notably, John McAdam were responsible for the new engineered roads. The first 'macadamised' road was built in Bristol in 1816 and is considered to be the foundation of modern road building. As time went on, more and more roads radiated out from London which enabled the Royal mail to reach all parts of the country. It also meant that goods could be transported by horse-pulled carts and the rich could travel by stagecoaches. The lower and middle classes were able to travel by paying to ride on carrier carts and other goods transporters.

Railroads became a success because of the reduced friction compared to regular wagons and carts. In 1805, at Croydon, England, this concept was demonstrated to a few businessmen using an iron plate covered in a wooden tramway.

"A good horse on an ordinary turnpike road can draw two thousand pounds, or one ton. A party of gentlemen were invited to witness the experiment, that the superiority of the new road might be established by ocular demonstration. Twelve wagons were loaded with stones, till each wagon weighed three tons, and the wagons were fastened together. A horse was then attached, which drew the wagons with ease, six miles in two hours, having stopped four times, in order to show he had the power of starting, as well as drawing his great load."

At the turn of the 19th century, railways were made practical and inexpensive by the widespread introduction of puddled iron and the rolling mill which was used for making rails. The development of the high-pressure steam engine also made steam locomotives a possibility. Following the Rainhill Trials in 1829, which demonstrated Robert Stephenson's successful locomotive design, more and more railways were rapidly introduced. However, the construction of major railways connecting large cities did not become popular until the very end of the industrial revolution. Many of the workers who built these railway lines decided to remain in the cities which provided additional workers for the new factories.

Significant Technological Developments of Industrial Revolution 2.0

The second industrial revolution is usually referred to as the technological revolution. It was a phase of rapid industrialisation and technological development which took place from the late-19th century to the early-20th century which took place primarily in Britain, Germany, the United States, France, Italy and Japan. The second industrial revolution was brought to a grinding halt when world war 1 started in 1914.

While the First Revolution most notable for the introduction of concepts such as interchangeable parts and mass production, the Second was marked by greater usage of steam power, widespread use of the telegraph and telephone, the dawn of petroleum usage as well as the birth of electrification. During this period, modern organizational methods for operating large scale businesses were conceived and implemented.

Electrification

Michael Faraday was the scientist who was responsible for both the theoretical and practical basis of harnessing electrical power. Thanks to his research on the magnetic field around a current-carrying conductor, Faraday was able to establish the basis of the concept of the electromagnetic field in the field of physics. The foundation of the practical use of electricity in technology can be attributed to the electro magnetic rotary device; one of Faraday's inventions.

The first incandescent light bulb was invented by Sir Joseph Swan in 1881. He supplied over 1200 of these Swan incandescent lamps to the Savoy Theatre in London making it the first public building in the world to be lit entirely by electricity. With the electrification of the Savoy Theatre, the proverbial stage was set for the electrification of the industry as well as homes.

English electrical engineer, Sebastian de Ferranti built the world's first modern power station. It was a never before seen feat of engineering and it pioneered the use of high voltage alternating current. This power station generated 800 kilowatts and was able to supply power to central London. Electrification allowed for some of the final major developments of the revolution especially in manufacturing methods. This lead to the introduction of the assembly line and mass production.

The National Academy of Engineering stated that electrification was “the most important engineering achievement of the 20th century”. As factories began to embrace electric lighting, working conditions and safety improved exponentially as there was no longer a need for gas lighting which not only put off a lot of heat, but was also a pollutant and a huge fire hazard.

The electrification of households did not become a norm until some time after the first world war, and was soon followed by cities during the 1920s. Another major electrical invention, the Fluorescent light bulb, was introduced during the 1939 World’s Fair. Electrification also enabled the relatively cheap production of electrochemicals such as aluminium, chlorine, sodium hydroxide and magnesium; all of which were essential to the second industrial revolution.

Automobile

One of the most impactful innovations of the second industrial revolution was the invention of the automobile in 1886 by a German inventor named, Karl Benz. If that name sounds somewhat familiar, it is because that very first three-wheeled automobile spawned one of the biggest and most successful car vehicle manufacturers in the world today, Mercedes Benz.

Benz’s automobile was unlike anything the world had seen before, it had wire wheels instead of wooden ones, a four-stroke engine of his own design, an advanced coil ignition and evaporative cooling as opposed to a radiator. This automobile was not just a motorised stagecoach or horse carriage, it was designed to generate its own power and be entirely self-contained. He began selling his vehicle in 1888, which made it the first commercially available automobile in history.

Less than a decade later, in 1896, Henry Ford built his own car, making him one of the pioneers of the automobile industry. He later founded Ford Motor Company, in 1903 and the company is still around to this day manufacturing cars. Conventional manufacturing techniques at the time were time consuming and expensive which prevented Ford from realising his vision of building a car that was affordable for the average worker.

The solution that Ford and his company came up with completely changed the way products were manufactured in factories forever. His new factory had machine tools with specialised machines to carry out specific tasks which were all arranged systematically in a sequence. This later came to be known as the assembly line and the whole process was dubbed mass production.

For the first time in the history of mankind, a large complex product which consisted of thousands of parts was produced on an unprecedented scale of hundreds of thousands annually. Mass production brought with it staggering savings which reduced the price of a Ford Model T from \$780 in 1910 to just \$360 in 1916.

Telecommunication

Sir William Fothergill Cooke and Charles Wheatstone invented the first commercial telegraph system in 1837, during the first industrial revolution. This innovation set the foundation for the invention of the telephone by Alexander Graham Bell in 1876; an invention which would change the way the humanity interacted with one another forever.

Bell was asked to help perfect the harmonic telegraph by some investors. They were interested in the device as it was one of the most exciting innovations at the time with the ability to transmit multiple messages simultaneously. While Bell agreed to help, he was more interested in developing a device which would be able to transmit voice instead.

Bell hired electrician, Thomas Watson to assist him with the harmonic telegraph, but he too became fascinated in the idea of a voice transmitting device and the both of them ended up focusing their efforts on the telephone instead of the harmonic telegraph.

The first successful telephone call was made by Bell to his assistant, Thomas Watson on March 10, 1876. During this historic moment, Thomas Watson was able to hear the famous words uttered by Bell:

“Mr Watson, come here. I want to see you”.

Following this invention, he established his own company called “The Bell Telephone Company” in 1877.

Positive Effects of the Industrial Revolution

The industrial revolution brought about many changes to the world we live in today, some of which many of us are not even aware of. Among the many improvements was an increase in wealth as more people were able to join the workforce which in turn raised both the economy and people's personal wealth.

Another positive effect of the industrial revolution was the standard of living. People living during the industrial revolution had access to much healthier food and better housing which contributed to the increased standard of living.

During the industrial revolution, education increased as well mainly due to the invention of the smallpox vaccine and the discovery of bacteria which dramatically improved health care. Both children and adults were healthier and were living longer.

The industrial revolution also marked a dramatic change for women all over the world. For the first time, many women had entered the workforce and were working alongside men. This later gave way to women having the right to vote and becoming more involved in politics.

Countries throughout the world were also better interconnected thanks to advancements in transportation and telecommunication. A greater understanding between people and cultures were able to take place which was a pro to the global community as a whole.

With Great Britain, Europe and America being revolutionised, the impact also spread to the rest of the world. Many of these countries had colonies in places such as South East Asia, Africa and the Caribbean, so by extension, the benefits of the industrial revolution had reached these countries as well.

Finally, the industrial revolution set into motion the chain of events which would lead to modern society as we know it today. Every single comfort and convenience which we take for granted everyday has its roots in the industrial revolution. It has enabled us to progress as a species by improving our lifestyles as well as our communities.

Negative Effects of the Industrial Revolution

The industrial revolution had a huge positive impact on technology, society and humanity as a whole. Unfortunately, like all things, the industrial revolution also had several negative impacts which were present back then and can also be felt today in the present.

During the early days of the industrial revolution, the working conditions in factories were harsh and unsafe. The machines were a threat to the lives of the workers. Those working in mines faced a much more significant health risk as the mines usually contained toxic gases and fumes which were harmful to the workers, who at the time had little to no form of protection from these conditions.

Factory owners realised that they could cut costs by hiring cheap labour to work in their factories. The cheap labour in question was women and children as they were paid much less than men for the same amount of work. It was bad enough that men and women had to work in these harsh conditions, but having children work in the same factories was a danger to their wellbeing.

Another unfortunate side effect of the industrial revolution was cities were becoming overcrowded. While the standard of living was improving, in general, cities were quickly becoming overwhelmed by the number of people who had moved to the cities to be a part of the industrial revolution. As a result, sanitary conditions became poorer and more people fell ill.

The wealth gap between the upper class and the working class also widened significantly. Workers were paid low wages which meant there was high profit to be made in sales. This directly translated to the rich getting richer and the poor, just making enough to survive.

By far the most damning impact of the industrial revolution was the negative effect it had on the environment. With rapid industrialisation came the astronomical need for raw materials which resulted in nature being plundered for every bit of resources it had. The introduction of fossil fuels also significantly polluted the air with toxins which later on contributed to global warming; a phenomenon which we are still plagued with today that has yet to be resolved or stopped.

Conclusion

The industrial revolution is quite simply the greatest revolution which had taken place in the history of mankind. It changed the world in a way that nobody ever thought possible. But like all things, it has had both a positive and negative effect. It is our responsibility as humans to learn from the mistakes made during the industrial revolution so as to never repeat them. At the same time, we must also look to carry on the revolution to progress us further as a species and for the betterment of mankind.

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Appendix

