

THE INFLUENCE OF THE INDUSTRIAL REVOLUTION (1776) ON ECONOMIC GROWTH IN THE MAIN COUNTRIES OF THE WORLD

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Abstract:

The evolution of human society is one of many thousands of years, about which we have more information, or less, as are the years with the greatest antiquity, about which there is some information but not so credible or detailed, because even today some information is preserved (most), but there are also some considered irrelevant that disappear.

Perhaps we would like to have more information about some areas from the past or present, but we do not have it at our disposal and we cannot make some reflections on some problems that man has faced before compared to those of the present.

Regarding the economy, many data are accessible from the present days and even older but not from the more distant past, because we could draw other conclusions when we have more information.

In this case, we are studying the industrial revolutions, a history of technologies that have positively marked the way of life on the planet, the developments that were more relevant through those human inventions or discoveries that determined changes in the way of life, advances that have also made human behavior a new and different one, having superior possibilities to provide food and other necessary things.

In this case, we are referring to the steam engine, considered the main landmark of the first Industrial Revolution, or for the second revolution marked by the advent of electricity, but also of many types of engines from the period from the mid-19th century to the mid-20th century.

The third revolution is marked as starting from the mid-20th century until the year 2000, during this period there were many inventions and innovations that made an essential but also efficient progress for humanity, so that after the year 2000 a fourth revolution for the humanity of the planet could be considered, with considerable changes for the economic fields and human way of life.

Key words: revolution, industry, innovations, inventions, economies

JEL classification: M10

1. INTRODUCTION

The evolution of human society has known certain stages of development, through the emergence of new technological discoveries, which have generated changes in the way of life of the human being, of course for the better, but also in an easier life, which means an increase in the standard of living for millions of people. Specialized literature refers to the steam engine which would be the main landmark product of the Industrial Revolution, an object that was able to replace the physical labor of man or that of beasts of burden.

The basic idea of the present study is to analyze descriptively, based on international literature, what were the implications of the Industrial Revolution (1776) on economic growth and improvement of living standards in the main countries of the world. In essence, we aim to provide theoretical clarifications regarding the controversy existing in the literature whether there is a single industrial revolution over two and a half centuries with four distinct waves or whether there are four separate industrial revolutions. Associated with this objective of our study, we aim to locate as best as possible the moment and the context in which industrialization began in Romania.

2. LITERARY REVIEW

The analysis of the Industrial Revolution, as a historical moment and as the technical/economic implications it had, involves making a synthesis of the technical and social

inventions/innovations that took place over a period of about two and a half centuries. According to the arguments brought by Drucker, the social innovations made by the Western world, starting with 1600 and up to the present, were as important for economic growth as the technical innovations (Drucker, 1993, p. 121). In the present study, we are going to synthesize as clearly as possible both the importance/role of some technical inventions and the implications brought by some innovations/social reforms on the economic progress that occurred in the Western world, then in some countries or regions of Asia and the Middle East, starting with 1800 and up to the present. It is worth mentioning that the impact of some social innovations (for example: the Modern University textbook, the pension system, credit sales, etc.) on economic growth is more difficult to quantify precisely enough. Therefore, we will emphasize in the study the influence generated by technical inventions, which can be patented, on productivity and performance at the company/country level.

History gives us many examples of inventions that changed the world, some larger and others smaller in effect, but the machine revolution marked the disappearance of manual labor and opened up the importance of technology and engineering professions.

The landmark of 1776 is not unique for the great discoveries of the world, or inventions that helped man escape manual labor and we can give previous examples and long before, especially in the 11th, 12th, 13th centuries, when gears were set in motion by water or wind, or even from the end of the 2nd century BC, according to some authors, in the case of water mills (Gimpel, 1983, p. 13).

Prior to the steam engine, also in England, in 1733 John Kay had invented the "flying bobbin", with a superior positive effect in the production of weaving mills, and in 1764, James Hargreaves invented the spinning machine which, even if it was manually operated, allowed the production of several types of yarn at the same time, but later in 1767, Thomas Highs developed a hydraulic spinning machine (Murgescu, 1962, p. 39).

The aspects regarding the emergence of the Industrial Revolution in England, around 1776, are also supported by other authors, by placing it in the last decades of the 18th century and the first decades of the 19th century, being a prelude to the industrial revolution in other countries, such as the USA, France, Germany, Japan and others (Roman, 1965, p. 24). It is known that industrialization began to be present in Japan relatively later, compared to the USA or Europe, namely starting with 1910; in the same sense, South Korea, other Asian countries and more recently China took over the industrial development model only after 1950. The same author invokes the fact that for the first time the term industrial revolution was used by Engels in 1845 in the work *The Situation of the Working Class in England*, and accepted by the specialized literature in other countries, adding that the moment was marked by the invention of the steam engine and some cotton processing machines, (Roman, 1965, p. 24).

The industrial evolution after 1800, both in Europe and in the USA, also determined the introduction of new strategies/practices, new organizational models, in business, as invoked by Peter Drucker in his work *Innovation and Entrepreneurship* or Alfred Chandler in *Strategy and Structure*, regarding the management and evolution of large companies in business.

Some authors discuss a single industrial revolution starting in 1776 and up to the present, which had four or five different "waves", which cannot be precisely delimited in the sequence of time.

Other authors discuss the existence of four or five different industrial revolutions, in which case it is even more difficult to identify a clear chronology regarding the technological evolution in the main countries/regions of the world and the way in which various emerging technologies began to condition professional realities at the individual, company and country level. From the perspective of our study, we recall as a distinct topic the fact that industrialization in Romania occurred somewhat later, approximately 1880-1900.

On the territory of Romania, in the 19th century, the development of industry was weak compared to Western Europe, the Ottoman rule in the Principalities and the Habsburg rule in Transylvania were nothing more than barriers, which stopped many things. In 1831, there were 74

professions registered in Wallachia with a number of 11,200 craftsmen and journeymen, and in Moldova in 1845 there were 8,530 craftsmen and journeymen practicing 101 trades (Groza, 2022).

In the mid-19th century, companies were established in the alcohol and beer industry, cloth factories, matches, candles, glass or bricks, these and others experiencing greater development in the period 1848-1916, especially after gaining independence in 1877, (Groza, 2022).

During the interwar period, economic development saw some establishment of industrial companies, especially in the field of metallurgical products, and there were 356 such companies that almost completely ensured domestic consumption. Galvanized and leaded sheet metal was sought after, necessary for covering new buildings, but also for the construction of locomotives, through the factories in Reșița but also Malaxa in Bucharest, which had reached the point of producing 100 locomotives annually and repairing about 200. Pipe production was also developed, especially necessary in the exploitation and refining of oil, through modest-sized factories. Cities such as Reșița, Hunedoara, Brăila, Cernăuți, Galați or Brăila and others, already experienced industrial development, especially in the metallurgical field, but also other industrial branches in the area of military or food production, glass and construction materials, (Dumitrescu, 2024).

A distinct aspect that needs to be highlighted in our study is given by the fact that around 1900-1910 there was a transfer of technological power, innovations and patents from Europe to the USA; after 1920, the USA as a country and American corporations managed to maintain a clear dominance at a global level with regard to everything that means the development of new technologies, continuous innovation and permanent growth of GDP per capita.

The transfer of the industrial revolution from Europe to the United States did not take many years, as goods that were previously handmade began to be produced in large quantities by machines in factories and new techniques, especially in the textile industry, but also in iron manufacturing and other industries.

The production opportunities in the United States were exploited by British industrialists, such as Samuel Slater who in 1793 established a textile factory in Pawtucket, Rhode Island, bringing here the technology developed in England (Yuko, 2021).

Technological progress in the United States was quite rapid, influencing almost all fields and continuing for decades, but first in cities, where people preferred urban areas for employment opportunities, in this sense the population of cities continued to grow, and their decision-makers were faced with overcrowding, the need for housing or the emergence of infectious diseases. (Yuko, 2021). A major step in the development of the US was the rapid development of the railway system around 1870, an important means of sending and receiving supplies and goods for some places. According to Chandler, the railways became, after unification, around 1880, the most modern and largest corporate conglomerate at that time (Alfred D. Chandler, 1977, p. 130). According to information from Professor Daniel Hammel of the University of Toledo, even though the population of cities was growing, by 1920 most Americans lived in rural areas, and after the census of that year it was found that over 50% lived in larger but also smaller cities (Yuko, 2021). Although the United States had previously experienced the Civil War and was dominated by an agrarian society, factories gradually appeared that attracted millions of immigrants in search of jobs and a better life.

3. RESEARCH METHODOLOGY

The study carried out by us was essentially based on three research stages:

a. In the first stage of the research, the author documented himself as extensively as possible based on the specialized literature in order to establish which are the main factors and/or historical contexts that explain the progress of the Western world, starting with 1700 and up to the present, compared to other countries/regions of the contemporary world. In a broader sense, I formulated the following research question: "To what extent do technologies explain the different power positions held by some countries of the world vs. others?".

b. In a second stage of the research, I brought clarifications based on the literature regarding the approximate delimitation of the four or five "waves" of the Industrial Revolution over the span of two and a half centuries.

c. In a separate stage of the research, we synthesized and located Romania's position on the overall sequence of the four waves of the Industrial Revolution. Within this stage, we included a necessary delimitation for the history of the Romanian economy during the period of the centralized political system (approximately 1950-1990), a period in which rapid industrialization was resorted to in various sectors/domains, but the technologies used and the performance obtained lagged far behind the Western world.

4. MAIN RESULTS. DISCUSSIONS

In addition to the shift from manufactured to industrial products, the industrial revolutions also caused many national economies to gain momentum, so that national production made sales abroad possible, and in the 20th century, trade between countries grew faster than production (Strange, 1997, p. 211).

There are several inventors with significant contributions to the discovery of electric current, whether it is Alessandro Volta with the voltaic pile, Michael Faraday's electric dynamo, Thomas Edison and Joseph Swan's filament light bulb, but the most advanced for the times of discovery were those of Nikola Tesla, with inventions for a future modern world, (Constantin, 2022).

We can say that the evolution in the field of electricity was more extensive after 1884, when Tesla arrived in the USA and then collaborated with Edison, but more so after the separation of the two and the competition between them, Edison being strong on direct current and Tesla on alternating current, both types subsequently evolving in many fields (Shinohara, 2021).

The evolution of cybernetics led to the development of the internet, 5G networks, the Internet of Things (IoT), quantum and cognitive information processing, Artificial Intelligence and others appeared. Cybernetics is a globally integrated entity of networks and communications and at the same time a discipline that studies the management of relationships between different subsystems, of many types, and their control, leading to changes in the functioning of the world at the political, economic, cultural, military or social level, (Sîrghi, 2020,).

It is important to note that the great advantages of cybernetics are increasingly threatened by entities or individuals pursuing different interests, through more and more attacks, causing transformations in the field to counter these attacks. A major attack occurred in 1988, when Robert Morris, a graduate of Cornell University in the USA, created a worm that infected approximately 6000 systems, which constituted about 10% of computers connected to the internet, (Anton Rog, 2019).

In short, an industrial revolution, according to Claude Fohlen, would represent a fairly rapid and sustained increase in per capita production with implicit technological transformations, with demographic and economic changes in a society (Fohlen, 1971, p. 51).

We consider that it is a fairly correct nuance to exemplify a revolution, because the finality of such a moment must be a positive change in any society, which makes a difference with the previous society, but also through a more advanced type of life.

The four waves of Western industrialization are (in Annex no. 1 we present a synthetic assessment of the four industrial revolutions):

The first wave of industrialization, the industrial revolution in Great Britain starting with 1776, was marked by the mechanization of textile production, the development of steam power and the expansion of the factory system with its use. Even though the steam engine is the benchmark of evolution and given as an example by the specialized literature, there are also authors who contradict this fact and give as an example the clock, motivating the importance of measuring time, which had many stages in its development, but which is the most omnipresent of any machine (Gimpel, 1983, p. 137).

There are opinions that can contradict, as Gimpel does, that measuring time is also important, but this time involves many human activities, even the functioning of the steam engine must be measured, but the origins of the clock are much older and its evolution has gone through many periods, so that nowadays it reaches very high levels and timings of all human activities but also of animals that also feel the passage of time, because orientation in time follows us permanently, regardless of whether it is by days or hours, so that after reflecting on all this we could also support the Clock Revolution.

The notion of "industrial revolution" according to some authors was first formulated in 1845 and then taken up by others, considering the effects produced by the invention of the steam engine and cotton processing machines, and until then there were prolonged controversies on the notion (Georgescu, 1972, p. 37).

Of course, it is one of the opposing opinions and there are probably more, but the Industrial Revolution dated 1776 is a starting point, because the steam engine was followed by other inventions and innovations that were not yet visible, and the energy of the steam engine was multiplied by the appearance of other types of machines that greatly changed manual work with mechanical work, and the textile field from which it began continued with other economic fields.

The literature insists on the steam engine, but other sources also indicate the contribution of Matthew Boulton who also transformed the tanning industry in Birmingham into a large-scale production at that time, revolutionized the minting of coins and many other improvements in the work, management and sales systems and much more (Dobb, 1963, p. 29)

There were some limits to the technologies in the years following the landmark year 1776, because they were traditional enterprises in the vast majority with a volume of activity not too large that the owners had no problems with the administration of the companies, and most were family businesses, these legal forms being maintained until 1840, after which partnerships and other forms appeared (Chandler, 1977, p. 50).

Mechanization made industry enter the structure of the economy, gradually diminishing the economic percentage brought by agriculture, then developing transport through the construction of railways which increasingly helped economic exchanges, but also developing mining through the extraction of coal and other resources, which boosted metallurgy and the creation of factories and industrial cities.

There were major changes for that period, even if there were opponents to some new things, such as some English parliamentarians who doubted the usefulness of the steam locomotive, because there was a risk that it would give sparks that would set some crops on fire.

There are still such opponents to certain important works for the country's economy today, because most inventions or innovations can also have some negative sides, even if very small, but the plus obtained is so great that it cannot be refused.

Such works of general interest are analyzed and all types of preventive measures are established, so that human life and the ecosystem are not put at risk, but accidental cases also happen, but most often due to failure to comply with regulations or sufficient awareness of the respective risks.

Another stage of the Industrial Revolution is that of the second half of the 19th century and until the middle of the 20th century, after the discovery of electricity, the appearance of internal combustion engines, the appearance of the first automobiles and then airplanes, the development of the chemical industry, communications with the appearance of the telegraph and then telephones, and according to some authors the specificity of this stage/revolution is the electricity used to operate production equipment and the introduction of production lines, the first of which was in 1870 at the Cincinnati slaughterhouse, but the most famous and economically relevant was Ford's in 1913, for the Ford T car model with an increase in production from 40,000 units to 260,000 (Banabic, 2018).

We cannot omit that also during this period, after major arrivals of emigrants, the USA experienced strong economic development, so that around 1900 it became the first industrial country.

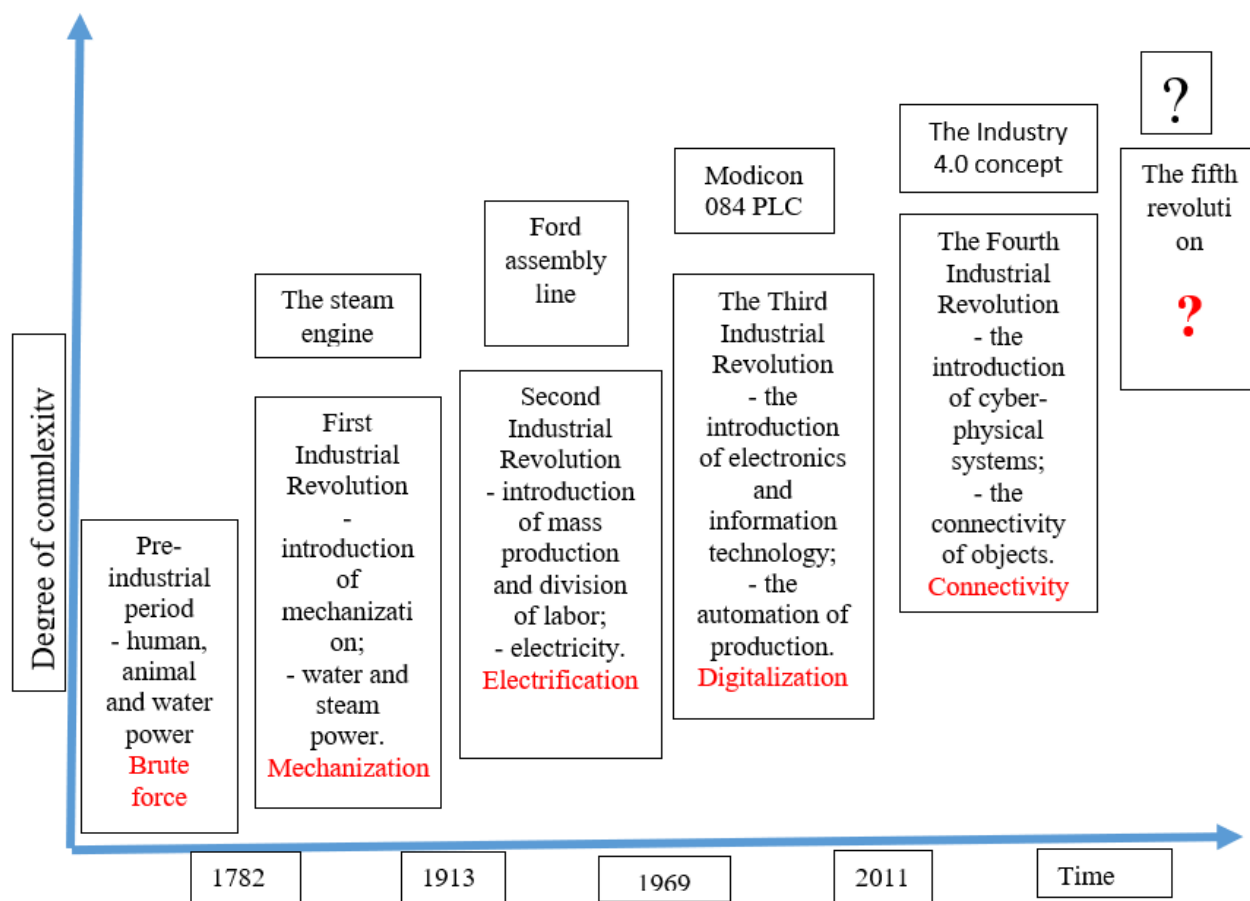


Figure 1. The increasingly complex evolution

Source: <https://scholar.google.com/scholar>

An important element of the first 30 years of the 20th century was the development of research and physics in general, so that the structure of the atom was deepened through quantum mechanics, then the construction of lasers, but also the development of electronic sciences and industries (Ivaşcu, 1981, p. 109).

Another stage of industrial development, but also a landmark for the third Industrial Revolution, is given by the second half of the 20th century, with many other differences compared to the previous ones, with more and more replacements of human labor by technologies, with new inventions and innovations that produced performances for most economic fields (Popkova, 2020).

It is an important period to which the author refers, it is one in which the Cold War also began, with an arms race, in which new technologies were applied but also with quite a lot of information for the people living at that time, the fact that various nuclear explosions were being experienced in some atolls around the world.

Another characteristic is given by the use of electronic systems and information technology and the increase in the use of nuclear energy, but also the introduction of programmable devices in the control of machines and industrial processes (Banabic, 2018).

The development of electronics is an enormous step for humanity and could be studied as a separate revolution, because electronics has penetrated all fields of activity with very great effects and which coordinates many of human activities or helps them in shortening many of them, being very precise in the operations performed, compared to manual ones, where humans could still make mistakes.

Other opinions claim that this revolution is a consequence of the Marshall Plan, after the Second World War, the main beneficiaries being the countries in Western Europe that accepted the plan, but not the states in the East under Soviet influence, and after the acceptance of American

funds and the redevelopment of European industry, production increased in Western European countries by 6% in the period 1953-1975, with a transition of the population from agriculture to the industrial sector (Tudorache, 2024, p. 89). The fourth wave of the industrial revolution at a global level occurred from the 2000s to the present and, if applicable, is still taking place at the time of 2023/2024 (some authors claim that a fifth wave of the industrial revolution has occurred). Within this fourth wave of the industrial revolution, called in some works 4.0 (industry), the internet, satellites, wireless telecommunications and especially AI-based technologies have become essential for economic growth, which has also had some opposition due to job losses, being great progress through the use of robots, but also setbacks such as income increases and improved quality of life (Tudorache, 2024, p. 72).

The author argues that this fourth revolution, compared to the previous ones, is evolving at an exponential pace, and the introduction of new technologies creates more possibilities to satisfy newer needs compatible with a more advanced society, but also accumulations of wealth through more money which is essential for obtaining many essential things and according to some authors they are a storehouse of values (Korten, 2009, p. 13).

The aspects briefly mentioned above can be found presented by us in more detail in Appendix no. 1. Based on the synthesis in Annex no. 1, we present in Table no. 2 only selectively, some aspects that, when evaluated cumulatively, give us an acceptable picture of the factors and events that explain the dominance of the West over the rest of the world in the succession of the four industrial revolutions, respectively over the course of about two and a half centuries.

If we go back for a moment to the history of civilizations, we can encounter some civilizations such as the Chinese, Egyptian or even Persian ones, which had a minor technological advance in their times, or perhaps even more, but the reality shows us that after these, those technological landmarks came from the West, starting with England, which became superior to those before and which triggered those industrial revolutions, which today place them on higher levels of development and on important climbs for human life.

Of course, these technologies, starting from England and then the USA, but also from Western Europe, have made greater strides in global economic progress, "stealing" from here also those in Asia through Japan and South Korea and then China, proving will and obedience from those in the West, but also major seriousness, so that they came very close to the "teacher" and even reached him.

In this way, those in the East today are in leading positions in some economic rankings, without having the natural resources, as is the case with Japan, but with important objectives established and with superior professionalism to achieve superior qualities even above those in the West.

Table 1. Western dominance vs. the rest of the world, in the sequence of the four Industrial Revolutions

N o. cr t	Characteristics /factors and events	First Industrial Revolution (RI1)	Second Industrial Revolution (RI2)	Third Industrial Revolution (RI3)	Fourth Industrial Revolution (RI4)	Deductible implications and perspectives on elements/factor s of Western dominance
		1776-1870	1870-1945	1945-2010	2010- present	
1.	The emergence of the joint-stock company (U.K.- around 1600)	European countries and the USA take over the U.K	Model The US improves the corporation model	New corporation remains basic in the US and Europe	The new corporation position is maintained	Corporation and limited remain essential for the West
2.	Patent (UK): 1600	Starting with 1650 establishes competition	Thousands of technical innovations	Countries adopt IPO conventions	Companies obtain thousands of patents annually	Patent: essential tool for competition

N o. cr t	Characteristics /factors and events	First Industrial Revolution (RI1)	Second Industrial Revolution (RI2)	Third Industrial Revolution (RI3)	Fourth Industrial Revolution (RI4)	Deductible implications and perspectives on
3.	The adding machine (mechanical calculator) appears around 1642;	The differential machine using punched cards appears	1940 - the first computer, called CNC for short,	Appears in 1946 the ENIAC	2010 Apple creates the first iPad,	Continues the more complex evolution of computers
4.	Evolution of firm size	Category SMEs	Corporations such as Standard Oil	MNCs become essential for innovation	MNCs become essential for innovation	Firm size is maintained for innovation
5.	“Invention of the Invention” (Landes)	The revolution of 1776 was essential for all subsequent technological progress	The second revolution was mainly aimed at electricity and telecommunications	The computer and digital technology appear	Progress in satellites, AI, robots, etc.	Technologies remain essential for economic growth for countries/firms

Source: developed by the author; the full version of the proposed analysis can be found in Annex no. 1

It is worth noting that since 1776, even if we are talking about a number of 4 revolutions, more can be taken into account, because there have been important technological milestones that have marked human society, which have essentially changed both work and life, so much so that they have made a difference with the past, but in order to be able to better measure these differences we must take into account several economic indicators, with their evolution before and after the implementation of new technologies.

Of course, at this point, the specialized literature invokes four revolutions and we go with references to them, but still there are many other milestones that should not be neglected because they have produced positive effects for human society and as an example you cannot fail to take into account the arrival of man on the moon, or the transformation of war from a classic one to a hybrid or rocket-based one, without hand-to-hand combat as it was centuries ago.

Fiber optics, which we talk about less than other human inventions, from our perspective, is a giant step in telecommunications, replacing metal, no matter what it is, but which can transmit information via cable simultaneously, without limit in number, but also with clarity that is much superior to those previously transmitted through classic cables.

Of course, there are also *satellites* that cannot be neglected from the greatest inventions of humanity, but the fact that through suboceanic optical cables all continents are connected to each other and information is prompt, even if the distances are very great is an achievement of man that makes him not alone, or a stranger to those in distant places of the globe.

5. COMPETITION

It is not a bizarre thing, but new information tells us about many other discoveries of rare natural resources in many locations around the world, which can help existing technologies to perform more remarkably and large corporations will not remain inactive to take advantage of such opportunities.

A great revolution of humanity was the appearance of computers, at first more incipient and simpler, then increasingly complex, so that they replaced more and more work that required manual calculations or writing with classic typewriters.

The microcomputer revolutionized bureaucracies, then they stored information forming databases, with their processing increasingly faster, (Toffler, 1995, p. 178).

For about twenty years, IBM (International Business Machines), had little competition, and the USA probably owned more computers than the rest of the world, only to spread rapidly throughout the globe, and then to face competition from companies such as NEC (Nippon Electric Company), Hitachi and Fujitsu from Japan, or from France with Groupe Bull, or ICL (International Computers Limited) from Great Britain, (Toffler, 1995, p. 13).

In the new world, certain standards of technologies are also established, which do not last long because, as Toffler claims, new equipment appears, because it is a struggle for power based on knowledge, which is continuously manifested with the aim of having control, channeling and regulating information (Toffler, 1995, p. 141).

One of the battles for computers took place in 1983, when several European computer manufacturers allied themselves against IBM, which dominated the market, by association opting for a counter-standard called O.S.I. (Open System Interconnection), regarding free conversation between computers, the Europeans being helped by their governments, because on the opposing side IBM was also helped by the American government, which claimed that what the Europeans were doing was discrimination, but in the end they chose to ally themselves with the European group (Toffler, 1995, p. 140).

This case involving the large company IBM is an example, but there are many like this in the corporate world, with emphasis on the types of products, the resources used, the markets or even the competition for the cheapest and most prepared human resource.

A strategy applied by some companies due to the destructive competition between them is the option of merging through mergers and acquisitions, and another is to share technologies, production facilities, markets, but do scientific research together.

There are also restructurings, which cause some activities to be given to subordinate units or external suppliers dependent on the company's activity, but both with lower-paid employees, compared to those in the corporate headquarters, which is why there are few large companies and very many small ones, as Korten claims, because in America there are only 1000 companies that represent 60% of the gross national product, and the rest comes from about 11 million small companies, which gravitate around the large ones (Korten, 1995, pp. 251-252).

As shown in Figure 2, each of these waves of industrialization was characterized by innovations specific to each period, and we present a graphical synthesis of the succession of the four revolutions.

As shown in Figure 2, based on the principle of division of labor and narrower specialization, the "invention of invention" and dozens of social reforms regarding education and the business world, companies in the Western world have succeeded in successively achieving inventions/innovations with an unsuspected impact on technological progress and implicitly on social progress. What prospects can be foreseen on this subject?

The big world of corporations will not stand still, because they have considerable resources for research and are constantly competing for the new, for winning new markets and increasingly secure profits, and we can see with our own eyes new things that appear from year to year, so that they will never stop.

If today we see a big "battle" on electric cars, as an example, but there are other technological competitions, in the coming years there will be other areas as well, from here comes technological progress, which of itself attracts social progress.

The vast world of information circulating everywhere, with the exception of secret ones, makes humanity informed and encourages the opening of as many innovative capacities as possible, which produce real effects for the world economy and for higher living standards.

Technology cannot be neglected by anyone, this term must be understood as the "root" of humanity's progress, which must be "permanently watered" to grow new and new technologies that will never be exhausted because there are still many things that need to be discovered to help man in life, without going through many trials or unsuccessful confrontations with natural accidents.

As Korten claims, technology can put an end to environmental overstrain and poverty through not too large investments in technology to reduce carbon dioxide, or the use of new energy sources, but also to reduce demographic growth for a more rational use of water and natural resources (Korten, 2009, p. 48).

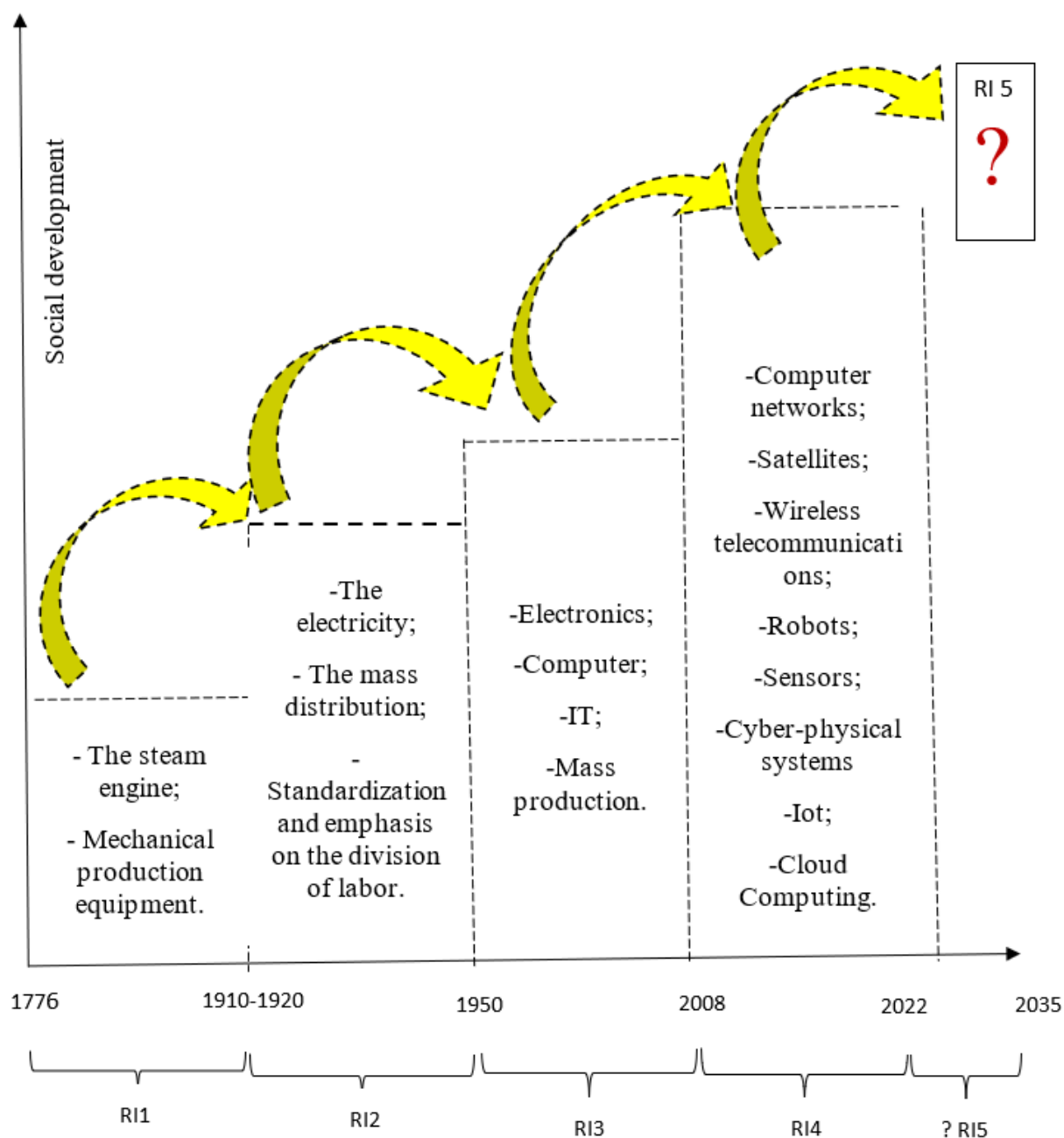


Figure 2. Waves of world industrialization after 1776

The author Korten has correct views when it comes to water and natural resources, but we cannot agree with the idea of population growth, for reasons of resources, when in fact in many areas of the planet there is a waste of water and food, plus which should reach the poorer areas. On the other hand, there are many uncultivated areas, which can produce the necessary food for many more inhabitants of the planet, and some of these areas lack the human resources for the necessary activities.

With current technologies and others to come, deserts could be used in some proportions to produce as well, but we are looking for deserts on other planets, even if we have them at hand on our planet.

The competition continues and we will be able to experience other revolutions, even if some past ones have not been talked about, such as that of transportation and communications which Alfred Chandler says is what helps the large volume of production and distribution (Chandler, 1977, p. 79).

The author gives priority to the railway compared to river routes and supports the commercial success due to this transport system, compatible with mass production and mass distribution.

Based on the synthesis in Annex no. 1, we have in table no. 1 only selectively, some aspects that, when evaluated cumulatively, give us an acceptable picture of the factors and events that explain the dominance of the West over the rest of the world in the succession of the four industrial revolutions, respectively over the course of about two and a half centuries.

Regardless of whether we are discussing a single industrial revolution (the one from 1776 and which subsequently had three successive waves) or four distinct industrial revolutions, the conclusion is that for more than two and a half centuries, technologies themselves have become a force that cannot be stopped/blocked; they have decisively influenced not only the organization and administration of successful companies, but also the way in which societies in the main countries of the world have evolved. Simply put, technologies still influence our lives today, sometimes perhaps imperceptibly, as individuals and microgroups, including at the family level. As we have shown previously, technologies, the organization of firms and the increasing size of a market explain the almost continuous progress of American MNCs compared to European and/or Asian MNCs.

As can be seen from Table no. 1, on the principle of division of labor and narrower specialization, the "invention of invention" and dozens of social reforms regarding education and the business world, companies in the Western world have succeeded in successively achieving inventions/innovations with an unsuspected impact on technological progress and implicitly on social progress. What perspectives can be foreseen on this subject?

It is difficult to predict with precision what could come next, but the Western advance still exists, but the globalization we are experiencing can carry certain performances from one space to another as history has shown us with the translation from Great Britain and Western Europe to the USA around the 1900s, it can also happen in other places, especially since part of the Asian population is looking for jobs in Europe, some of them can take certain information with them when they return.

The decline in the birth rate in Europe will probably continue to attract labor from the Asian surplus, but we must also take into account the copying made by the Chinese in Europe so far, which has made this country, adding what they had, come close to the USA, of course also having the largest sales and consumption market.

The post-war Japanese experiment of listening to American instructors on quality and then competing with their products against American and European ones can also be repeated, but South Korea cannot be left on the sidelines, as well as other countries in the area increasingly channeled into electronics industries, with products much cheaper than European or American ones, even if the qualities are inferior, because there is a larger target group for the cheaper products.

However, if China and other Asian countries reach some economic indicators of the West, but not soon, they will not be able to reach the higher technological level, with the exception of Japan, the USA and Western Europe.

6. CONCLUSIONS

In this paper, we have accumulated more information regarding the evolution of technologies that started mostly in Western Europe, with translations to the USA, but then together, accelerating for as many inventions and innovations that climbed the great scale of technological performances, with the enormous economic development impact, which made the state entities there to be very economically developed, compared to many other areas of the world, including those in Asia that are lagging behind.

Of course, the analysis started from the study of the four Industrial Revolutions, invoked by the specialized literature and especially by famous authors with economic skills, who emphasized a single industrial revolution, all four or even more, but the certainty is that all of them brought more or less great performances for human society, even if some have some risks attached to them, but the positive part is in very high percentages, so that the risks are neglected and the evolution of humanity is very high.

The benefits brought to humanity are very relevant, powers are increased and wealth is accumulated, which is why certain technologies are not abandoned until more efficient ones appear, because they are part of human activity, regardless of where it is carried out, there being no jobs or even places to spend free time without certain products.

We cannot neglect the contribution of Asians, because they have also developed some technologies, but not at the level of those in the West, but their help must also be recognized through some special resources that other areas of the world do not have, so that for the smooth running of the world economy, there is a need for complementarity between all economic entities, for a better life for all.

Annex no. 1 Significant inventions / innovations in the succession of the four Industrial Revolutions

Nr. crt	Features /factors and events	First Industrial Revolution (RI1) 1776-1870	Second Industrial Revolution (RI2) 1870-1945	The Third Industrial Revolution (RI3) 1945-2000	The Fourth Industrial Revolution (IR4) 2000-present	Deductable implications and insights on elements/factors in Western dominance
Prior mentions: Progress in the Western world has been based on a few major technical inventions (writing paper and printing) along with some social innovations (the textbook). The joint-stock company originated in England around 1600, when the East India Company was set up; it was the first company to have a share capital, a number of private owners and paid dividends; similar ways of setting up corporations have developed from this model in various European countries, the USA, etc. The patent idea also originated in England 1600-1660.						
1.	The emergence of the joint stock company (U.K.- around 1600)	The same legal form of company/firm was quickly taken up by Germany, France, Italy and other countries The American model of the <i>corporation</i> to American investors.	The Anglo-Saxon business model has been introduced in other parts of the world.	The joint-stock company or <i>new corporation</i> was and remains the most important player in the US economy.	The joint-stock company or <i>new corporation</i> is becoming more familiar.	The legal form of "joint-stock company", next to the limited company (equivalent to SRL, under Romanian law.
2.	Patent (UK): 1600	The patent also appeared around 1600 in the U.K.; from 1650 onwards it was the main instrument of competition and innovation in England	Tens of thousands of technical innovations in the US and Europe have benefited from legal patent protection Romanian Patent Office, (O.S.I.M.)	The patent remained protected by the state alongside some international conventions (notably under the WTO after 1950).	Major companies such as IBM, GM, Intel, Intel, Sony and Samsung each obtain several thousand patents each year.	New products are appearing on not too great terms, outperforming the existing ones and attracting new customers.

Nr. crt	Features /factors and events	First Industrial Revolution (RI1) 1776-1870	Second Industrial Revolution (RI2) 1870-1945	The Third Industrial Revolution (RI3) 1945-2000	The Fourth Industrial Revolution (IR4) 2000-present	Deductable implications and insights on elements/factors in Western dominance
3.	The pragmatic perspective (applying firms, FORD, GM, etc.)	Key technical and organizational elements in the period considered: - steam engine mechanical production equipment	Table distribution (Chandler) Standardization and increasing division of labour	Technical aspects and main achievements: Electronics; Computer; IT; Mass production.	Wireless telecommunications; Robots; Sensors.	Rapid urbanization; The formation of the working class; Heavy pollution in some industrial areas
4.	State vs. education (organizing education and training for employment)	Around 1810, legal reforms took place in Germany Humboldt University model and other relevant establishments.	R&D, systematic innovation, etc. is being taken to a new system of organization (see Edison's pre-1910 research labs and Bell laboratories within AT&T).	In 1945, at the end of the Second World War, the US was literally the greatest political, military power, thanks to the industrial drive for war and the absence of wartime confrontations on American soil.	The end of the Cold War in the 1990s has strengthened the US global position. By 2010, China becomes the world's second largest economy by absolute GDP.	Increasing automation in manufacturing and services; Growing demand for digital skills; Advances in medicine, the environment and discussions on social inequalities.
5.	State vs. Innovation "The Visible Hand" - A. Chandler	The state has directly or indirectly supported business R&D and continuous innovation	The state has directly or indirectly supported business R&D and continuous innovation	"The 'visible hand' of the state is becoming increasingly involved in supporting innovation.	The "Visible Hand" of the state has come to complement the "Visible Hand" of professional managers in MNCs	Chandler emphasizes the need for corporate hierarchies.
6.	State vs. company size	The American state passed the first anti-trust laws; in industrial, etc.	The US state enacted the first anti-trust laws; in firms based on private capital.	US government adopts tougher regulations to prevent monopolies and unfair competition	In the main European countries, governments have generally been a supportive element public-private .	The Industrial Revolution was marked by superior performance.
7.	Owners vs. managers	RI1 marked the transition from an owner-dominated management to a managerial organization.	There have been new developments in the relationship between owners and	The owners, as shareholders or board members, have strengthened their positions.	The role of managers in the fourth industrial revolution extends beyond functional areas.	Greater emphasis on private property; Multiple business start-up

Nr. crt	Features /factors and events	First Industrial Revolution (RI1) 1776-1870	Second Industrial Revolution (RI2) 1870-1945	The Third Industrial Revolution (RI3) 1945-2000	The Fourth Industrial Revolution (IR4) 2000-present	Deductable implications and insights on elements/factors in Western dominance opportunities.
8.	Evolution in firm size -Europe -S.A -The rest of the world	SME firms were predominant.	The first big corporations like Standard Oil appear in the US, some are divided by supreme court rulings, in Europe the process is just beginning	MNCs are becoming essential for innovation, research.	MNC firms become essential for innovation, patents, experiments, prototyping, etc. which together ensure technological dominance.	During IR1, Europe saw significant changes in the organization of companies.
9.	Evolution of human resources	Migration from agricultural to industrial work	Employees with minimum qualifications; Hard working conditions	Long working hours: Employer-employee contradictions.	Higher qualifications by occupation; Developing skills in newer areas.	Superior ethical relationship between employer and employee; Better organizational policies.
10.	"Inventing Invention" (Landes)-Chapter 5 of ...	Landes' study shows how the first industrial revolution led to a major shift in economic growth.	RI2 has revolutionized industries and has had profound effects on economies and societies, driving productivity and efficiency, productivity increases, and efficiency gains.	This revolution has been defined by advances in digital technology, computers, telecommunications and the internet.	RI4 is an ongoing process and new inventions and innovations continue to emerge as technology advances. These advancements (AI, IoT, 3d Printing etc) have superior potential.	The industrial revolutions were marked by a series of new technologies.
11.	Major inventions -Europe -S.A -end of the world	Major inventions - the steam engine, textile machinery, manufacturing processes,	This period saw a wave of major innovations that further transformed	A number of major innovations have transformed industries and societies: transistors and	The fourth industrial revolution is characterized by the fusion of digital	These innovations are interlinked and mutually reinforcing.

Nr. crt	Features /factors and events	First Industrial Revolution (RI1) 1776-1870	Second Industrial Revolution (RI2) 1870-1945	The Third Industrial Revolution (RI3) 1945-2000	The Fourth Industrial Revolution (IR4) 2000-present	Deductable implications and insights on elements/factors in Western dominance
		railroads, the telegraph - spurred expansion.	industries and societies. These included the development of electric power systems, the internal combustion engine	integrated circuits, computers, microprocessors The internet, mobile technologies, the digital environment and biotechnology.	technologies, automation and data-driven systems. It is characterized by major inventions: the Internet of Things (IoT), artificial intelligence (AI) and machine learning.	.
12.	Foundations of management theory -H. Fayol -F.W. Taylor	Fayol and Taylor were not active players in the first industrial revolution, as their work came later.	Fayol and Taylor both made their contributions during this time period.	Management theories have changed significantly over this time period to generate technological progress.	Management theory has faced new challenges and opportunities following the Fourth Industrial Revolution.	These revolutions in management have extended their work to adapt theory.
13.	The managerial revolution 1	The focus has been on process automation.	As industrialization progressed, the need for higher qualifications became apparent	RI3, often known as the digital revolution or the information age, is taking more and more places in IT.	The ongoing RI4 is distinguished by the incorporation of digital technology and increasing automation.	The notion of managerial revolution is closely linked to the latter.
14.	Practical foundations - H. Ford ("Fordism", the Fordist production system)	Mechanization and the shift from agricultural to industrial economy dominated the first shift towards industry.	Fordism was essential to the second industrial revolution by implementing the production line.	RI3 began with advances in computer technology and automation.	In the context of IR4, Fordism's emphasis on efficiency, standardization and mass production had a major effect.	Although Fordism emerged during the Second Industrial Revolution, it was first for efficiency.
15.	Large size (MNCs) and organizational forms: *Europe -Conglomerat -Holding -Trust *USA -conglomerate	The industrial environment was characterized by smaller-scale enterprises	The rise of larger firms and the expansion of industrial production marked the second industrial revolution	MNCs, as organizations that have operations in many countries and frequently engage in trade and investment	Organizational structures, such as MNCs and conglomerates, continue to play an important role in this period, but new forms of the	The emergence of multinational corporations, conglomerates, holding companies and keiretsu varies depending on

Nr. crt	Features /factors and events	First Industrial Revolution (RI1) 1776-1870	Second Industrial Revolution (RI2) 1870-1945	The Third Industrial Revolution (RI3) 1945-2000	The Fourth Industrial Revolution (IR4) 2000-present	Deductable implications and insights on elements/factors in Western dominance
	(precursor keiretsu)				type are developing: Holding, as entities	the mid-century.

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