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How the Special Century Shaped the World Political Landscape

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Abstract: How much of an impact will technology and innovations have on human society? In order to access the influence Gordon proposed a concept of "Special Century". The century more than 150 years ago, a number of unsurpassed Great Inventions emerged, and it was these inventions that made the production and life of human beings change drastically, leading mankind from a backward age to a bright future, and also laying the academic foundation for the future development of science and technology. What followed was the rapid progress of the economy and the initial formation of the world's political landscape. This paper summarizes the impact of science, technology, and innovations on human society during the period 1870-1970, analyzes how the economy was reshaped using the C-D production function, and then interprets the establishment of the capitalist world system, the development of hegemony and the formation of colonialism from the perspective of economics.

Keywords: Technology and innovations, 1870-1970, Political landscape, Cobb-Douglas production function

1. Introduction

Robert Gordon, in his book The Rise and Fall of American Growth, refers to the term "Special Century" and defines the years from 1870 to 1970 as a special century. He argues that the revolution of 1870-1970 is unique and unrepeatable in human history because so many of its accomplishments could only happen once. Some inventions are more important than others, and the post-Civil War revolutionary century consisted of a unique cluster of late 19th century inventions, which he called "Great Inventions" [1]. In terms of its current influence on society, the science, technology, and innovations during a hundred years between 1870 and 1970 have had an impact unsurpassed by any other masterpieces to date, not only as milestones in the history of human civilization, but also in reshaping the political landscape of the world by leading the way in economic development.

The year 1870 marked the beginning of the Second Industrial Revolution, and there is no doubt that it was the Second Industrial Revolution that fundamentally changed the way of life of human beings. Prior to that, the only sources of light for people were candles, whale oil, and town gas, and the majority of production was carried out using steam engines, waterwheels, and horses. An ever-expanding network of passenger and freight railroads provided intercity transportation, but train

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speeds were only a third of what they had been after the Second Industrial Revolution. Transportation within and between cities and towns still relied on horses, and most people commuted by foot. Therefore, the invention of electricity and the internal combustion engine, the advent of chemicals, radio, and indoor plumbing all dramatically altered the way humans lived. Looking back at the technology and innovations after 1970, there has never been a completely new research system, theory, or methodology for today's research, but it is all based on the continuation of the research of previous scholars, such as the fields of electricity, energy, computers, integrated circuits, and so on. This is the "Second Order" proposed by Gordon [2]. These second-order inventions are a combination of first-order inventions and do not have a fundamental influence on the way of life of human beings. In contrast, the technology and innovations of the "Special Century" have had an immeasurable impact on the economy, politics, academics, and human civilization around the world.

This paper examines how science, technology, and innovations affected the world between 1870 and 1970, analyzes how these inventions have changed humankind's way of life, studies the significance of technological innovations for economic growth using the Solow Growth Model, and explores how this "Special Century" has reshaped the world's political landscape through economic development.

2. Changes to Human Existence

According to relevant materials and documentaries, the streets of the 1870s were filled with livestock, and even in the cities, the roads were lined with countless animal droppings that emitted a foul odor. The pungent industrial fumes, dumped rubbish, and enormous amounts of food waste brought about by the First Industrial Revolution made the living environment unbearable. Before the invention of electricity and running water, life in the countryside could be described as isolated, relying on purely human labor to accomplish everything. Even basic lighting and heating supplies, such as lamp oil and coal, were scarce in isolated places. The terrible climate aggravates the risk of human diseases and reduces immunity, and all kinds of common epidemics can lead to a huge number of casualties.

However, such an era really came to an end when a series of great inventions began to appear. Multi-factor productivity peaked in 1913 and remained faster than ever before or since for the next roughly 60 years [3]. For that period, Cowan's work clearly states that "four technological systems" dominated the history of the twentieth century: the automobile and its essential sources of roads and fuel; airplanes, spacecraft, and rockets; electronic communication devices, from wireless telegraphy to personal computers; and finally, biotechnology, new foods, drugs, and contraceptives [4]. These four technological systems are in use today and no such inventions have been created in the 21st century. Almost all of the technology we see in modern society is "on the shoulders of giants", such as the VCR, which combined television and movies; and the Internet, which replaced one form of entertainment with another. The most modern of all, the computer, has not created a civilization without paper. Thus, these inventions and creations laid the foundation stone for the future development of science and technology, and to this day, scientific innovations are still based on the theoretical foundations of that "Special Century".

In assessing the importance of the Internet as an invention, Gordon conducted a test comparing the New Economy to the Great Inventions that made up the Second Industrial Revolution. As a result, he found that the Internet may be fun and provide access to a great deal of information, but it represents a far smaller improvement in living standards than the change in existence that was brought about from 1870 to 1970. Electric lights allowed people to be active at night, electric motors allowed factories to grow in efficiency by leaps and bounds, automobiles allowed flexibility and freedom of transportation, airplanes turned the earth into a global village, chemical experiments discovered new elements and materials, telephones gave humans a way to communicate without meeting face-to-face, the advent of radio and television brought entertainment and news into people's homes, and urban

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sanitation and indoor plumbing lengthened human life expectancy, all of which have led to dramatic improvements in human health and comfort, and have taken human civilization to new heights. All of this has fundamentally changed in ways that past and later technologies have failed to do. Even the most advanced technology of modern times has done little more than make human life more colorful or more convenient.

In summary, the inventions that emerged in the "Special Century" contributed greatly to the subsequent development of human society, and the economic and political landscape began to change quietly from this time onward.

3. Transformation of the economic landscape

The acceleration of labor productivity due to technology and innovation is not merely a cyclical phenomenon or a statistical bias; rather, it reflects, at least in part, a more deeply rooted and still evolving shift in our economic landscape [5]. The six decades from World War I to the early 1970s saw a remarkable increase in both labor productivity and multi-factor productivity in the United States and the majority of other industrialized nations. Productivity growth during these 60 years was significantly faster than it was before and after. In the 25 years since then, the rate of growth of both labor productivity and MFP has declined substantially, and Gordon argues that both the acceleration and slowdown are normal, and what needs to be explained is not the economic slowdown in 1972, but the acceleration after 1913.

According to accepted wisdom in the technology sector, innovation is happening at an exponential rate [6]. However, the data on the economy once again shows a different reality. From the 21st century perspective, productivity growth in the United States increased by an average of 3% per year in the prosperous old days, but only by 0.6% from 2015 to 2017. And even while recent years have been a time when automation has skyrocketed, investment in software development and IT has grown at a much slower rate in the past decade than they did in the previous one. As Lawrence Mishel and Josh Bivens point out, automation in the broadest sense has slowed during the past eight to ten years, and capital investment has grown more slowly since 2002 than at any other time since the end of World War II [7]. Clearly, the influence of efficient automation and the information revolution has not outpaced the transformations that were made to the world between 1870 and 1970.

Data from various sources indicate that the global transformation experienced during the period 1870-1970 was epochal, dividing the pre-industrial and post-industrial worlds into two very different worlds. Of these, the changes caused by technology and innovation were the most important and seminal, leading to the subsequent reshape and transformation of the entire world economic landscape. Even if we look at the economic development of each period, so far, the growth rate has not been able to exceed that of this period. This proves the importance of this particular period.

4. Research on the economic growth based on the C-D production function

Economists have always found economic growth to be a fascinating subject of research, and two key components of this subject are exploring the internal dynamics of growth and identifying the factors that influence it. At present, most empirical studies at home and abroad mainly focus on three aspects: capital accumulation, labor input and technological progress. Scholars through the study of national economic growth factors found that: technological progress is the main driving force of economic growth. For instance, the Exogenous Growth Model established by Solow using the C-D function decomposes economic growth factors into capital accumulation, labor input, and technological progress. The result shows that the contribution of capital and labor to the total growth rate is about 12.5%, and the contribution of technological progress to the total growth rate is 87.5%, thus he

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believes that technological progress determines economic growth. Denison's 1983 study also confirmed Solow's view.

The Solow-Swan Model is a derivation of the Cobb-Douglas Production Function as a setting. The Cobb-Douglas Production Function was initially a production function created by the American mathematician C.W. Cobb and the economist Paul H. Douglas when they jointly explored the relationship between inputs and outputs, and it was an improvement on the general form of the production function by introducing the factor of technological resources. Its basic form is:

$$Y=AX_1^{\alpha 1} \cdot X_2^{\alpha 2} \cdot X_3^{\alpha 3} \ldots X_n^{\alpha n} \quad (1)$$

Among them, $0<a_i<1$, i=1,2, ...n. Y is a constant, Xi is the input of the i^{th} factor of production, and ai is the output elasticity of the i^{th} factor.

The traditional Cobb-Douglas production function mainly selects 2 variables of K (capital) and L (labor) in the form of:

$$Y=F(A, K, L) = AK^{\alpha}L^{\beta} \quad (2)$$

Where, A represents the rate of technological progress (labor-augmenting technology or "knowledge"), K represents the capital stock, L represents the number of labor force, α, β are constants greater than 0, representing the output elasticity of capital and labor inputs, respectively.

This function sets technological progress as a constant, that is, the factor of technological progress is classified as an exogenous factor of economic growth, and the reason why economic growth is able to break through the law of diminishing marginal returns brought about by factor inputs is due to the endogeneity of some of the factors in technological progress to economic growth. So technological progress is an important factor influencing long-term economic growth.

In the short run, the rate of technical progress of the C-D production function is constant and unchanged. So it is also destined to be limited in its usefulness in studying economic growth over a slightly longer period of time. The world before and after 1870 was so "fragmented" by technological "miracles" that it was difficult to express the increase in the constant A even in terms of a simple multiplier. The rate of technological progress A in this period grew at an exaggerated exponential rate until the new information revolution, with the invention and application of atomic energy, electronic computers, space technology and bioengineering, brought mankind into a completely different era. However, after the end of the Third Scientific and Technological Revolution, breakthrough technological advances have been hard to come by. In the absence of breakthroughs in technological progress, the diminishing marginal effects of the act of continuously investing capital and labor to promote economic growth can be easily observed in the GDP growth rate. Therefore, this is the reason why countries are increasingly investing in R&D in the expectation of gaining new comparative advantages through technological innovation.

5. Evolution of the world political landscape

The revolutions of 1870-1970 clearly brought about more than just an economic impact; when human existence changed dramatically and the economy skyrocketed, the political landscape inevitably changed along with it. According to Maslow, once human beings have addressed their physiological and safety needs, they will begin to actively change the society in which they live as they become more responsible for their personal lives [8]. So they began to pursue freedom and equality, and then the capitalist world system was established. The economies of the first countries to industrialize, mainly in Europe, grew by leaps and bounds, and began to look outward for markets in order to dump commodities and plunder cheap raw materials and labor, which led to the opening of the New

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Voyages, the discovery of the New World, and the unveiling of the European expansion. At this time, the world political pattern began to take shape. In contrast, the countries in the East were obviously backward: the ruling class at that time rejected the development of industrialization in order to secure their political position, thus creating a huge gap between them and the industrialized countries in the West in terms of science and technology, economy and other aspects. The ever-expanding ambition coupled with the world pattern of advanced West and backward East, and the imperialist struggle for market economy and world hegemony intensified. In addition, the changes in the forms of transportation brought about by the Industrial Revolution made the links between countries gradually closer, which promoted the formation of transnational organizations and the emergence of international monopoly groups that demanded to divide the world economically, prompting these capitalist countries to step up the pace of foreign expansion and aggression. Until the end of the 19th century and the beginning of the 20th century, the major capitalist countries around the world, such as the United States, Britain, France, Germany and Japan, entered the imperialist stage one after another. To a certain extent, this is a stage that the development of capitalist countries is bound to go through.

But in any case, the revolutions of 1870-1970 did achieve the finalization of the capitalist world system and pushed the world to slowly become one. Although the hegemonic development of the world was accompanied by unavoidable wars and looting, the emergence of colonialism, and the suffering of war-torn populations, these were all part of the inevitable development of human civilization. In every sense, therefore, this "Special Century" has had an impact on the world's political landscape that previous and subsequent revolutions have failed to achieve.

6. Conclusion

From the perspective of technological, economic and political developments in the 21st century, it is clear that Gordon's view of the technologies and innovations of the "Special Century" is very far-sighted and objective, and that the influence of these inventions on human society is unsurpassed, and is even greater than what we can see now and what we may expect in the future. This paper focuses on the significant effects that technology and creativity had on human civilization during the period bewteen 1870 and 1970 and analyzes how these technologies and innovations reshaped the world's economic landscape, and thus the world's political landscape, from an economic perspective.

These great inventions have fundamentally enabled mankind to survive, improved the basic problems of food and disease, increased the average life expectancy of mankind, and changed the way of production and life of human beings. They brought humanity into a brighter world, increased productivity and the rate of economic growth, promoted the emergence and development of capitalism, facilitated the formation of the World's Colonial System, and laid down the basic world political pattern. In addition, scientists and researchers at the time created a new system of scientific research that is still in use today and has had an immeasurable impact on the academic world. All of these have fundamentally advanced human civilization and put basic natural resources at the disposal of human society.

According to the C-D production function, economic growth can break the law of diminishing marginal returns due to technological advancement. The "fragmentation" of the world through technology and innovations has allowed the economy to soar in this century. However, despite the fundamental impetus given to the development of some countries, capitalism has been characterized by imbalances in various spheres, by the expansion of Europe in search of markets, by the emergence of a world hegemony, and by an intense struggle for political status. However, it cannot be denied that these technologies and innovations did intervene in politics through their enormous impact on the economy, contributing to the establishment of the capitalist world system and the formation of a world colonial system in which the world gradually became one.

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