

# Investor's Outlook •

Quarterly edition of investment ideas  
from the research experts at Francis

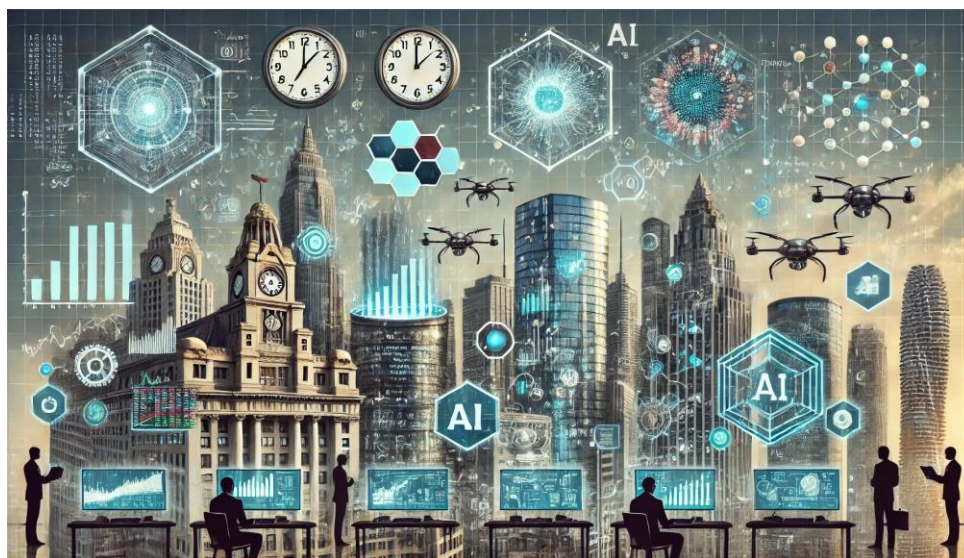
**July 2024**

## Welcome to this quarter's edition of Investor's Outlook

The vision of this quarterly newsletter is to provide a high-level view of investing trends, philosophies, and practices that formulate our investment discipline.

**In this Issue, we're presenting a long-term perspective on a hot topic, Artificial Intelligence.**

- *From History to Innovation: AI's Role in Shaping the Future*



# From History to Innovation: AI's Role in Shaping the Future ●

## Introduction

For investors, the fusion of artificial intelligence (AI) and financial capital is a paradigm-shifting phenomenon that promises to revolutionize industries and redefine economic landscapes. Economic historians have identified five technological revolutions and seem to start over about once every 50 years. Given that the Information Age is credited with starting in the early 1970s, it seems that we are about due for another “Big Bang” moment in technological evolution. Of course, the emergence of AI as the decisive event for a so-called Sixth Technological Revolution can't be agreed upon until more time passes, but we believe historians are likely to mark the start coinciding with the introduction of the earliest models of ChatGPT in 2018.

If this is the case, the path to widespread adoption and economic profits is likely to parallel other revolutions in economic history and their lessons are instructive. Investors should consequently navigate the “AI Super Cycle” by adopting a multi-decade perspective, as history has shown that there are recurrent patterns with each revolution and investors are wise to pay attention to them.

The process of creative destruction produces new industries and businesses all the time which clash with those entrenched in the status quo. Generative AI has sped up the creative destruction a few notches – which is a common attribute of any technological revolution.

This paper aims to arm investors with the knowledge to anchor themselves when making decisions about allocating capital as AI-themed possibilities permeate throughout the global economy. AI exists in the quantitative realm, but a qualitative analysis is more helpful to determine investors' opportunities versus diving into higher level math and understanding just how those billions of nodes in AI communicate with each other. Like the way experts utilize Michael Porter's methods to determine a company's competitive strategy, applying a qualitative technique to assess the implications of a technological revolution on a broader scale brings into view valuable lessons of economic history. Although stocks like NVIDIA and Microsoft have recently driven the returns of the overall stock market, let us take a step back to see what the implications are for a broader investment theme.



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## Technological Revolutions, Brief History

The Industrial Revolution started in the 1770s with Arkwright's mill opening in Britain and not too long after that, the advent of steam power and mechanized manufacturing processes emerged in the 1820s. Carnegie's Bessemer steel plant opened in 1875, and the electrification of industries and households marked another critical moment in history. The Age of Oil, Automobiles, and Mass Production was marked by Ford building the first assembly line plant in 1908 that rolled off the Model Ts. By the early 1970s, the advent of computers and subsequently the Internet brought the Information Age. Technological revolutions have followed a cyclical pattern of boom and bust, much like the sine wave that illustrates a business cycle, with the former spanning decades while the latter is usually 5-8 years.<sup>1</sup>

## What We Learn from The Past

Technological revolutions of the past all followed a similar pattern: kicked-off with initial skepticism, moved to rapid adoption, entered a phase of speculative investment followed by a financial crash, and the battle-tested establishments generated periods of sustained economic growth. What these events teach us is that the transmission of new technology into a complex economy is a lengthy process, during which new industries emerge, and existing ones either become obsolete or undergo significant change.

Technological advancements don't always render industries obsolete, and they can breathe new life into existing ones. By integrating cutting-edge innovations, capital-intensive industries can extend their longevity and boost efficiency. The commercial aviation sector is a good example, with the adoption of high-bypass turbofan engines leading to remarkable fuel efficiency gains. Over the past five decades, new jet aircraft have achieved a 40% reduction in fuel consumption. Similarly, you can anticipate artificial intelligence to revolutionize various industries by streamlining operations, minimizing expenses, and unlocking novel revenue streams. Consultant firm PwC estimates that by 2030, AI could contribute up to \$15.7 trillion to the global economy, which is more than the current combined output of China and India. This potential contribution is broken down as \$6.6 trillion likely to come from increased productivity and \$9.1 trillion likely to come from consumption-side effects.<sup>2</sup> Much like its technological predecessors of other revolutions past, AI stands to generate wealth by expanding output while minimizing inputs, thereby enhancing productivity.

## AI and the Hype

When a groundbreaking technology captures enough attention, the mania over its possible applications and profit potential goes parabolic. Like a gold rush of the past, a new generation of speculators emerges with the willingness to risk it all in search of life-changing money. No doubt, some hit it big early on, but the dissemination phase for technology is intricate and takes much longer to see sustainable returns on investment than what could be implied in the early goings. The systems built upon the technology of the past and present cannot be replaced on a dime, of course, but hysteria can challenge rational thinking leading some to believe nearly everything of today will be obsolete tomorrow. In most cases, that's the exception, not the rule.

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## Exhibit 1 – Technological Revolutions

Technological Revolution	Technologies Introduced	Infrastructure Developments
First: 1771 Industrial Revolution	Mechanized Cotton Industry and Iron Machinery	Canals and waterways Roads, Waterpower
Second: 1829 Age of Steam and Rail	Steam engines, mining, railway construction	Trains, Telegraph, Ports and Ships
Third: 1875 Age of Steel, Electricity, and Engineering	Bessemer Steel, steam engines for ships, copper cable, paper and packaging, canned food	Global transport connectivity via ship and rail, development of electrical grids
Fourth: 1908 Age of Oil, Automobile and Mass Production	Assembly-line, petrochemicals, home appliances, refrigeration and frozen food.	Worldwide telecommunications, cable, roads, and airplanes
Fifth: 1971 Age of Information and Telecommunications	Microelectronics, computers, decentralized networks	Worldwide digital communications, cable and fiber optics, satellite communications

## Exhibit 2 – Historical Phases in Technological Revolutions

GREAT SURGE	Technological revolution Core Country	INSTALLATION			Turning Point ↓	DEPLOYMENT	
			Irruption	Frenzy		Synergy	Maturity
1 <sup>st</sup>	<b>The Industrial Revolution</b> Britain	1771	1770s and early 1980s	Late 1780s and early 1790s	1793-97	1798-1812	1813-1829
2 <sup>nd</sup>	<b>Age of Steam and Railways</b> Britain (spreading to continent and USA)	1829	1830s	1840s	1848-50	1850-1857	1857-1873
3 <sup>rd</sup>	<b>Age of Steel, Electricity and Heavy Engineering</b> USA and Germany overtaking Britain	1875	1875-1884	1884-1893	1893-95	1895-1907	1908-1918*
4 <sup>th</sup>	<b>Age of Oil, Automobiles and Mass Production</b> USA (spreading to Europe)	1908	1908-1920*	1920-1929	Europe 1929-33 USA 1929-43	1943-1959	1960-1974*
5 <sup>th</sup>	<b>Age of Information and Telecommunications</b> USA (spreading to Europe and Asia)	1971	1971-1987*	1987-2001	2001-2003	2003-2013	2014-2018
6 <sup>th</sup>	<b>Age of Artificial Intelligence, LLMs, and NLPs</b>	2018	2019-2022	2023 - ??	??	??	??

↑ big-bang
↓ Crash
↑ Institutional Recomposition

Source and Chart Credit: Carlota Perez, Technological Revolutions and Financial Capital, (Cheltenham UK: Edward Elgar Publishing, Inc), p. 14. Important notes: the 6th Great Surge added to this chart by Francis LLC for illustrative purposes only and is not part of the original works by Perez. Dates for Synergy and Maturity in the 5<sup>th</sup> Great Surge added by Francis LLC and is not included in works by Perez.



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## **New Tech Takes Time to Adopt**

In contrast to expectations and fears of how rapidly technology can change an economy, the time frame for real changes to go mainstream spans decades and generations. Take, for example, the search for ways to efficiently illuminate homes, factories, and cities. The candle had been the main source of light for thousands of years. As the discovery of more uses for hydrocarbons prevailed in the 1800s, camphene emerged as a replacement for animal fats like whale oil to provide the fuel for lighting, but "...Its unfortunate habit of exploding undermined its claim to be the lighting fuel of choice for the family home."<sup>3</sup> Various other fuels were turned to before kerosene took significant market share for decades, and then later, electricity was able to be delivered more cheaply than kerosene but not after going through some feedback loops (i.e., avoiding things that destroy your property) to attain that efficient, safe alternative for lighting on a grand scale.

The successful integration of new technology into an existing economic system depends on society's ability to build upon improved institutional knowledge as well as overcoming regulatory hurdles, social resistance, or the inability of the supply chain to obtain enough commodity resources to sustain implementation.

*When a groundbreaking technology captures enough attention, the mania over its possible applications and profit potential goes parabolic.*

To this end, never underestimate the resistance to change from the institutions which have grown accustomed to controlling the rules of the game. Politicians and government regulators have been persuaded time and again with incentives to pass laws protecting the status quo even if the existence of a faster, cheaper, and better-for-society alternative is in plain view. New technology generally makes society fret at what will happen to existing jobs, and AI brings other questions with it including numerous security, privacy and intellectual property concerns. Commodity and infrastructure strains to get AI integrated into the system are already apparent as AI has even forced tech juggernauts like Google to reset their climate goals due to the power needs to keep AI moving ahead. Nevertheless, the resources can be aligned, and infrastructure built resulting in an entire generation growing up with the technology which by then will be mainstream. Although there may be delays in AI's induction into the economic arena, transformative technology ultimately claims its role as an influential member seen as a compliment to life's challenges versus its adversary.

## **From History to Today - What Should I Do with My Money in the AI age?**

From fears of missing out on lucrative opportunities to worries about an impending market crash, the gamut of emotions is flowing through investors' minds as they try to answer the question: What should I do with my money in the AI age? Given historical patterns, the hype around AI should naturally lead you to be skeptical, and yet, there could be an opportunity cost if you decide to sit on the sidelines in anticipation of an imminent crash. Drawing comparisons to previous technological booms, such as the dot-com bubble in the late 1990s, it's understandable why some would be apprehensive about the current market environment.

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As we have examined, technological revolutions and their impacts on the economy follow familiar patterns so we can apply some analysis to draw parallels from previous instances as to what has happened, is happening, and what might happen. Exhibits 1 and 2 are interpretations to which credit must be given to Carlota Perez for providing the basis of in her superb work *Technological Revolutions and Financial Capital*. With history as our guide, it can be argued that we are perhaps wrapping-up what she terms an “Irruption” phase and maybe we are early into the “Frenzy” phase of this revolution. This is a subjective assessment, but some major factors are in play to keep the “Frenzy” phase going longer than what most are likely anticipating. Per Exhibit 2, the average time frame for the previous “Frenzy” cycles is over a decade so if this is a tech revolution, the current cycle seems to be early on at least relative to economic history.

## **A Market Crash is in the Future, But When?**

In short, historical patterns indicate that the present cycle is likely to experience rapid growth and heightened enthusiasm for several years before possibly facing a downturn like witnessed in 2000 and 1929. A high P/E ratio for the S&P 500 relative to its long-term history could rightly be interpreted as overvalued (i.e. irrational exuberance) but a high P/E could also just be justified as an economy moves into an extended growth phase following a slowdown. Context is key. When appraising the metrics today, the stock market’s valuation isn’t excessive, unless of course you have a permanently bearish view, and evidence of enthusiasm at any point causes concern.

## **Strategic Risk Management**

There is a familiar pattern where the hype and the resulting expectation regarding economic profits creates a widening divergence between the deployment of financial capital and the economic profits generated. It is possible the “Magnificent 7” exhibit this, but do not associate the potential overvaluation in a group of stocks to suggest that there will not be a continuation of the revolution and that other companies could take over. Some make it through and adjust like Amazon did while others do not, such as etoys.com. The tipping point for a crash is never known in advance, but professional investors have historically turned to assessments of company valuation as one way to determine when excesses are emerging. This can also be done at a broad level by comparing market statistics to long-term averages as well as estimating the present value of future cash flows.

In valuation theory, the present value of a company’s future cash flows determines its intrinsic value, discounted at an interest rate that incorporates expected risk for a business. As we have seen, the dissemination phase of new technologies can be constrained by resources, laws, and skepticism resulting in years of changes needed to make full use of the new technology throughout society. However, stock prices are held back by no such forces and are free to run as quickly as anyone’s imagination. Professional investors can discern when the valuation of financial capital implies that it is unlikely to keep up with the productive capital at hand. Suppose the stock price of the Best Widget Maker, Inc implies they can produce 100 widgets per year for the next 5 years but the production in place can only do 50 per year at best. Quite simply, an analyst can assess the productive capabilities of the resources employed at the company and decide that there is no way a company can produce enough to justify the current stock price.

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A valuation exercise is straightforward to perform for companies in well-developed industries with long histories of financial data to assess but the task becomes extraordinarily difficult when considering emerging technologies.

There are new markets that will open, businesses crushed overnight, or perhaps some smart people created an incredible product, but no one buys it until another company brings their invention to market. Unlike evaluating a group of established companies, the presence of a technological revolution introduces uncertainty which is hard to model. In other words, conventional methods for assessing investment value are challenged by the unknowable output from new technology. So, what should we do as investors?

## **Important Signposts to Consider**

A technological revolution takes time to unfold in its various phases. Both at the macroeconomic and microeconomic level, the sustainability of an AI revolution seems to be firmly in place. We must acknowledge that the elements of progress can always be derailed temporarily due to unforeseen events, but the secular trends eventually prevail.

*AI exists in the quantitative realm, but a qualitative analysis is more helpful to determine investors' opportunities...*

## **The Macroeconomic Framework**

**Time** - The illustrations provided in Exhibit 2 are helpful for investors to set some general expectations relative to time intervals associated with past technological revolutions. These are subjective but arguably reasonable time frames given the recurrent patterns over several hundred years. You may be tempted to think “this time is different” with AI, meaning the time frame will all be condensed, but it is likely all the previous revolutions brought forth such prognostications from those alive at those times. Like business cycles, they can be shorter or longer than average, but their duration has characteristically been meaningful and is like a rising tide that lifts the boats.

**Financial conditions** – What has been labeled as a “Turning Point” (see Exhibit 2) by Carlota Perez is also coincident with a market crash and the initial stages of recovery. Technological innovation thrives when financial conditions are favorable. In other words, it requires significant capital to fan the flames of innovation and without access to it, even the best ideas will die awaiting funding. It is no coincidence, in our view, that AI has burst onto the scene after an unprecedented amount of monetary stimulus pumped into the system first in 2008/2009 to counter the “Great Recession” and again in 2020 to deal with COVID. Should the Fed reverse course and go into rate hiking mode again or take other measures to drain substantial liquidity from the system, then the “Frenzy” phase could be at risk.

**Stock Market Concentration** – Much has been made about the concentration in the stock market related to AI and the “Magnificent 7.” According to Bloomberg, the market cap of these stocks is nearly \$15T (25% of the total US stock market) which has fueled concerns about a bubble. Interestingly, the stock market concentration was much higher in other time periods when similar technological revolutions were in vogue.

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If market concentration is a barometer, then previous examples suggest that the market can get even more concentrated before reaching the tipping point. Quite simply, financial returns expectations from the new technology can easily outpace its actual productive capabilities, and investors are increasingly willing to make those bets so long as the capital can be deployed, and the economic environment is accommodative which in our firm's view, should remain the case in the near term.

These signposts are important for perspective, but the reality is that many other factors related to overall global monetary conditions, governmental attitudes towards big business, and geopolitical factors are included in the dynamic of what drives and sustains a technological revolution. As we introduced earlier in the paper, the investor needs to draw upon a qualitative analysis to appraise cycles and accept that the exact time frames for cycle changes are unknowable, but it is nevertheless worthwhile to embrace a long-time frame and estimate where we may be.

## **The Microeconomic Framework: Network Effects**

To keep this simple, think back to the Internet coming into its own in the mid-1990s. During those years, numerous experiments were tried, and capital was deployed into an array of places in a shotgun manner. Eventually, astute business owners and investors required tangible returns (some say economic profits) on their investments and refused to allocate capital until the math justified doing more. To this end, once the infrastructure was built and able to process at ever faster rates of speed, then the business models which could readily move their inventories from off-line to on-line and create network effects saw the most benefit.

Network effects are very important as they signal that consumers have indicated their acceptance of the transition from offline to online. One of the most successful examples of this was Booking.com (a.k.a. Priceline) linking thousands of independent hotels in Europe in the 2000s onto one platform readily searchable by anyone in the world. This led to the evolution of renting single-family homes (Airbnb) and bringing cars that sat unused into greater value through ride-hailing services like Uber and Lyft.

Linking Europe's niche hotels together and creating a marketplace would naturally be accepted as consumer travel online habits were conditioned with large-scale hotels already doing just that. This was simply another extension of providing consumers with a new way to book a hotel stay away from traditional mass-market options. However, renting someone's house in a faraway land or jumping into a stranger's car for a ride took a little more convincing. To overcome consumer hesitancy, the Internet also provided a valuable feedback loop via customer reviews and eventually generated the prized network effects for bringing areas of the economy online that were previously viewed strictly in offline terms by consumers.

## **Synergies: Old Economy is Better with New Economy**

Hotels, houses, and cars are long-lived assets that gained more value in the global economy because of the Internet. Expect AI to do something similar. The progression of how on-line business models grew in acceptance amongst consumers should also be instructive in how we can think about where AI can take the economy next.

*Given that the Information Age is credited with starting in the early 1970's, it seems that we are about due for another "Big Bang" moment in technological evolution.*





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From minimizing how much of a bet you make individually to deciding how to draw from other resources as needed for your next speculative endeavor, a few simple planning steps will serve you well. In professional money management, this is known as risk management which, if it is executed properly, will minimize the impact of a single misstep and help you sleep better at night.

## The Road Ahead or Perhaps the Approaching Neural Pathway?

As AI continues to integrate into the financial landscape, its impact will become increasingly profound. Its potential to automate mundane tasks, analyze vast amounts of data, and drive innovation across sectors is akin to the impact of railroads replacing the need for water canals and horse carriages. Investors who approach this new frontier with a blend of historical perspective, strategic foresight, and emotional awareness as an investor will be well-positioned to navigate the complexities of the AI revolution. The lessons of past technological revolutions serve as a guide, reminding us that while the path to widespread adoption is often varied and turbulent, the long-term rewards can be substantial and accrue over many, many years.



## Summary – From History to Innovation: AI's Role in Shaping the Future

### Technological Revolution: AI

- For investors, the fusion of artificial intelligence (AI) and financial capital is a paradigm-shifting phenomenon that promises to revolutionize industries and redefine economic landscapes.
- Technological revolutions and their impacts on the economy follow familiar patterns so we can apply some analysis to draw parallels from previous instances as to what has happened, is happening, and what might happen.

### What's Important for Investors to Consider?

- A technological revolution takes time to unfold in its various phases. Both at the macroeconomic and microeconomic level, the sustainability of an AI revolution seems to be firmly place.
- Where we are today is squarely in the infrastructure building stage. From here, the investable opportunities with highest economic returns will likely come more from the real economy being retrofitted with AI though the new players which can build infrastructure that is “bigger, faster, and stronger” (think, iron ore to steel in construction) are going to capture attention.
- While a market crash has accompanied technological revolutions of the past, and the exact time frame is unknowable for the next one, history and macroeconomic factors in place today likely portend a longer time frame of speculation and “Frenzy” ahead.

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## Endnotes

- <sup>1</sup> Carlota Perez, *Technological Revolutions and Financial Capital*, (Cheltenham UK: Edward Elgar Publishing, Inc), p. 14.
- <sup>2</sup> <https://www.pwc.com/gx/en/issues/data-and-analytics/publications/artificial-intelligence-study.html>
- <sup>3</sup> Alasdair Nairn, *Engines that Move Markets*, (New York, NY: John Wiley & Sons), p. 102.

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