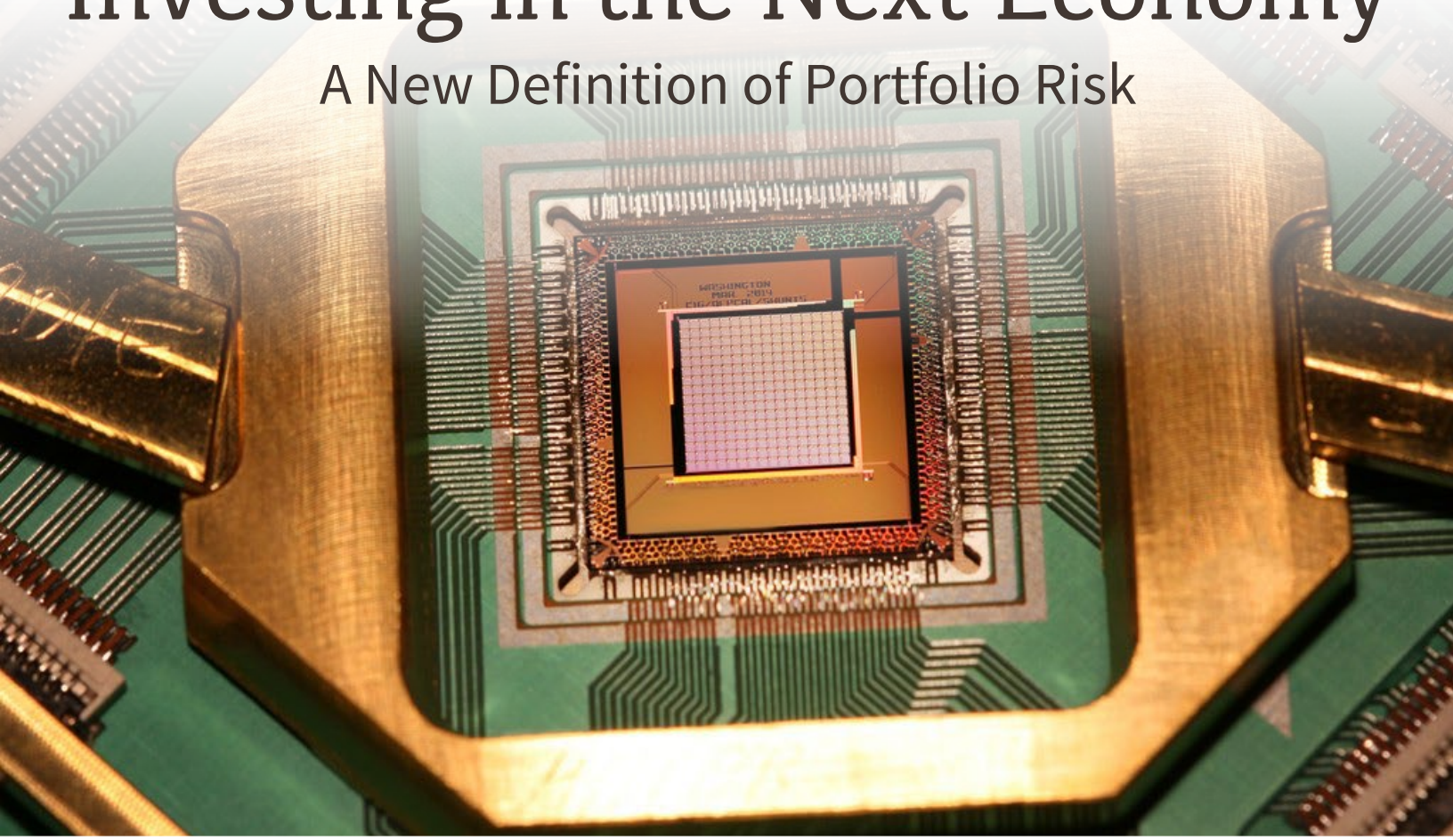
Investing in the Next Economy

A New Definition of Portfolio Risk



The Next Economy™ is the emerging, de-risked, solutions-driven way goods and services are produced and consumed. As systemic risks—the climate crisis, resource degradation, disease burdens, and eroding social cohesion—continue to manifest, demand for solutions is accelerating.

As a result, innovative companies addressing these systemic risks are leading long-term economic growth. Investing in them is our best opportunity to preserve and create wealth.

By directing capital to the most competitive solutions creators, investors can both catalyze and benefit from the highly efficient, sustainable Next Economy.

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About Green Alpha®

Green Alpha Advisors has been redefining asset management since 2007 by ***Investing in the Next Economy***™ *—a low risk, endlessly thriving economy driven by companies creating disruptive solutions to key systemic risks like the climate crisis, resource degradation, disease burdens, and deteriorating social cohesion.*

We consider companies that produce innovative solutions to these risks to be the greatest contributors to economic productivity gains, and therefore the leading growth drivers of the 21st century. Consequently, these companies are our chief opportunity for investments that preserve and grow clients' purchasing power. In terms of impact, directing capital to solutions providers is the most direct way to catalyze change, and stock and bonds—most investors' largest asset classes—offers the largest scale means to create change with investments.

About the Authors

Garvin Jabusch *is Green Alpha's Chief Investment Officer and chair of the Investment Committee. As a former archaeologist, his mix of science and business experience brings a unique understanding of long-term systemic risk and societal collapse to portfolio management.*

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Key Highlights

- **A New Definition of Risk.** Growing systemic risks manifest as current crises—including the climate crisis, resource degradation, eroding social cohesion, and growing disease burdens—have put the business-as-usual economy in peril. Investors must rethink decision-making processes mindful of these material, long-term threats.

- **Solutions Are Economic Drivers.** In a rapidly changing world, long-term economic growth is concentrated among firms that are the most competitive contenders in finding solutions to problems and threats. The primary centers of innovation and efficiency—in renewable energy, connectivity, AI, machine learning, robotics, genomics, advanced agriculture, and many other applications—are individually and synergistically creating the basis of the Next Economy and are the primary growth drivers of the economy overall.

- **Next Economy Portfolio Theory** provides the framework for a solutions-driven investment approach that reduces portfolio risk inherent in the destructive, short-term oriented legacy economy, while simultaneously driving capital toward an authentically sustainable economy.

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Investing in the Next Economy

Today's economy and the market drivers of the future have little to do with those of the past. For some economists and investment managers, this may seem like a bold claim, but the reasons for it are clear.

The expanding list of systemic risks—starting with the **climate crisis, resource degradation, disease burdens, and eroding social cohesion**—has put the business-as-usual economy in peril.

At the same time, **rapidly accelerating innovation**[1] presents myriad opportunities to mitigate these risks while generating economic growth. It is this unfolding, solutions-oriented, innovation-driven, connected, highly efficient economy that Green Alpha calls the **Next Economy**.

> *"A rapidly evolving economy requires an **equally adaptive approach to investment management**."*

This solutions-focused, risk-mitigating economy is materializing across sectors and industries; however, no sound investment approach had been codified to reflect this emerging economy until Green Alpha created Next Economy Portfolio Theory.™

A rapidly evolving economy requires an equally adaptive approach to investment management. Likewise, conventional approaches to investing will prove wanting if they fail to keep pace with shifts in the risk landscape and dramatic increases in innovation.

That is why investors need Next Economics™ and Next Economy Portfolio Theory.

Next Economics is a theoretical framework that incorporates the:

1) likeliest outcomes of burgeoning systemic risks and
2) resulting opportunities to drive economic growth with creative solutions to these systemic risks.

The Next Economics framework then informs the practical investment application, called **Next Economy Portfolio Theory**. Investment managers that employ this framework may capture gains from companies working to drive progress toward the rapidly evolving, highly efficient, low-carbon, innovation-driven economy, while simultaneously minimizing portfolio risk.

Next Economics centers on two key arguments. The first is that *the growing global economy has and will continue to evolve by factoring in systemic risks.* This first concept is not unusual; sustainable development advocates like the UNEP have explored this for several decades.

The second fundamental argument remains untapped: *creative solutions to these systemic risks are becoming the major drivers of long-term economic growth*, *which can then generate investment returns to preserve and create wealth*.

Next Economy Portfolio Theory should follow. A manager can no longer rely on Modern Portfolio Theory ("MPT") to assess risk and opportunity sets fully and accurately; nor can they merely overlay

"green" or ESG specifications onto existing economic or investment theories and expect to realize anything more than a slightly greener version of a legacy economy portfolio.

It's time for a new, indefinitely sustainable system — one that utilizes the best of what traditional models offer, and sheds outdated and outmoded assumptions about performance. Most importantly, one that incorporates known long-term risks to the global economy.

Here's what a truly sustainable system looks like.

Defining the Next Economy: Risks & Economic Drivers

Systemic Risks & Economic Impacts

Traditional approaches to investment management were conceived at a time when:

- natural resources were considered effectively limitless,
- fossil fuels reigned with no viable energy alternatives,
- economic and social disparities, while present, did not yet threaten the social fabric that binds together the economy, and
- the widespread impact of a rapidly warming climate was not well known and had not yet been experienced.

Today, investors have a new set of objective facts that must be considered when prudently building portfolios. Using all objectively verifiable information available is far more likely to result in predicted outcomes (e.g., better risk-adjusted returns) than outdated investment management approaches.

One needs to consider how these new facts affect the economy. Once a framework has been built to understand what the Next Economy looks like and how variables within that economy interact, one can consider how this may play out in a fully-informed investment process.

These facts—or **key factors** of the Next Economy—involve four central systemic risks:

- the climate crisis,
- resource degradation,
- human disease burdens, and
- widening inequality and eroding social cohesion.

Of course, these systemic threats are broad umbrellas that materialize as many downstream hazards. For example, climate change is increasing the severity and likelihood of extreme weather events like flooding, hurricanes, and droughts. Resource degradation will continue to take the form of water, land, and food scarcity. Widening inequality has already led to previously-unimaginable political unrest, violence, and the expansion of terror organizations, all of which undermine global economic stability and growth.

When these global risks intersect, they create new and greater concerns. For example, the increasing frequency of droughts leads to food and water scarcity, which blends with inequality in the form of unequal resource access. It would be a mistake to imagine this as the far-off future, when this exact scenario has played out already in many regions of the world.[2] The ultimate result has been war and

mass migration—a sadly fitting demonstration of the unconfined nature of these systemic risks.[i, 3]

How do these risks pose a threat to the economy? We can use this same example of extreme weather events to illustrate resulting economic damage. In the face of increasing droughts, a once highly productive breadbasket has lost agricultural output, income, and jobs.

For a deeper dive into risks and solutions, see Appendix beginning on page 18. While the list is not exhaustive, it illustrates the pervasive nature of systemic risks, their economic impact at the sector level, and corresponding solutions.

Still other inputs, which may be regarded as positive or negative depending on the outcome, include political and trade policy risks, along with the broad impacts of globalization and deglobalization. Efforts at nationalistic policy, for example, are likely to result in slower economic growth[4] and must be considered when evaluating timing and scalability of Next Economy solutions development.

Solutions as Economic Drivers

While it is clear the historically fossil-fuel driven, inefficient, and wasteful economy has spurred these risks, solutions-creators have also been hard at work. Enterprises from all sectors and of all sizes have begun creating opportunities to avoid the worst outcomes of these systemic risks.

Companies that are economic leaders recognize that it is both economically advantageous and crucial to address looming risks.

An economy built on this principle is one that will be truly "sustainable," meaning it is able to develop and thrive indefinitely, without succumbing to system-disrupting threats. Tackling these risks is necessary, because there are many environmental and social underpinnings required for successful operation of an economy, including: adequate resources (energy, food, fertile land, potable water); a stable climate; diverse ecosystem; and a relatively stable, cohesive, equitable society.

Companies that aim to uphold or enhance these essential underpinnings are finding opportunities to generate long-term revenue, thereby both **contributing to and profiting from** economic growth. By creating innovative solutions to systemic risks, Next Economy companies can drive the development of a genuinely sustainable economy. Conversely, companies that threaten to destabilize the climate, damage fundamental ecosystem services, or foster a dramatically unequal society are undermining core components of a stable economy.

Economic drivers that can be used as tools to combat these systemic risks include:

- **Innovation**, particularly when addressing systemic risks in an economically efficient and competitive manner
- **Efficiency**, constant improvement in economic output per unit of input, be those inputs person-hours, natural resources, or money—resulting in surplus wealth creation

Together, these drivers provide multiple tailwinds for the companies taking advantage of them: better economic competitiveness, opening and defining

[i] For those interested in reading more about systemic threats and their relationship to the economy, Green Alpha recommends beginning with the World Economic Forum's annual Global Risks Reports.

new markets, meeting the demand to de-risk the world, and gaining market share. All to maximize the possibility of growing faster than underlying GDP.

Green Alpha perceives the primary convergence of innovation and efficiency to be in renewable energies, artificial intelligence (AI), robotics, data connectivity, 3D printing, nanotechnology, genomics, advanced materials, energy storage, advanced agriculture, and the applications they individually and synergistically enable.

> *"Companies that aim to uphold or enhance these essential underpinnings are finding opportunities to generate long-term revenue, thereby* ***both contributing to and profiting from*** *economic growth."*

Just as risks materialize across the economic spectrum, so do solutions. Renewables-powered, autonomous, electric vehicles provide a cheaper, cleaner, safer, and more efficient alternative to the fossil fuel-powered vehicles of the past.

As an example of solution creation in action, global investment in renewable power capacity represented $265.8 billion in 2015[5]—more than double the dollars allocated to new coal and gas generation. In 2021, global renewables investment rose to $755 billion[6]. Since there was already so much existing conventional electricity generation online, new, clean technologies accounted for just over 29 percent[7] of world electricity in 2021.

According to BloombergNEF, "Currently, about 90 cents goes to low-carbon energy sources for every $1 put toward fossil fuels. That ratio needs to change dramatically by 2030, with an average $4 invested in renewables for every $1 allocated to high-polluting energy supplies,"[8] meaning decarbonization is proceeding too slowly to stabilize climate risk, but simultaneously, renewables may be poised for even more rapid expansion.

A comprehensive list of advances in and increasing adoption of renewable energies is beyond the scope of this paper. However, one can easily find new reports touting almost-daily progress, such as "by 2026, global renewable-electricity capacity will rise more than 80 percent from 2020 levels."[9]

These are just a few of the very clear signals that solutions creators, rather than risk causers, are making economic headway and leading long-term growth at meaningful scale.


Systemic Risks & Economic Solutions Snapshot
WATER
RISKS
Increasing Demand & Water Stress
Fresh water demand is projected to increase by 55% globally between 2000 and 2050. At the same time, 3.9 billion people will be living in river basins under severe water stress.
Shifts in Water & Agricultural Cycles
Increasing temperatures, variability of precipitation, and occurence of severe weather patterns will strain water resources and agricultural output.
Water Pollution & Contamination
Water quality degradation means contaminated crops, biodiversity loss, unsafe drinking water, and increasing disease, leading to massive economic and human wellbeing impacts.
SOLUTIONS
Slow Degradation of Supply
Stop fracking near aquifers, lakes, and streams and use of chemical-dependent agricultural practices; manage effluent better; electrify and decarbonize the economy; prioritize organic agriculture.
Vertical & Indoor Farming
Indoor farming uses 95% less water than conventional farms; doesn't require soil.
Desalination & Wastewater Recycling
Renewable-powered desal can address water scarcity in arid regions and provide water for far longer than local aquifers.
Infrastructure & Efficiencies
Install advanced and connected measuring, monitoring, treatment, and water transportation infrastructure throughout.
Sources:
"Vertical Farm - 95% Less Water and No soil," Water Network Research, 2016
"Principles on Water Governance," OECD, 2015
"Climate Change and Agriculture in the United States: Effects and Adaptation," USDA, 2013
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Next Economy Portfolio Theory

Next Economics and Next Economy Portfolio Theory align with prudent investment management practices. An investment manager's decisions are based on what they consider material—what they deem likely to have a considerable positive or negative impact on the portfolio. This means materiality is defined by the manager's assessment of forward-looking variables, like economic risks and opportunities. While these variables include risks like climate change, and rapidly evolving solutions like solar power generation, few portfolio managers adequately integrate these material factors into their research and portfolio construction processes. Consequently, many portfolios fail to adequately address systemic risks.

Next Economy Portfolio Theory enables investors to tap into the proliferating, solutions-driven economy, while reducing portfolio risks created by the fossil-fuel driven economy. By applying Next Economy Portfolio Theory, one is deploying their capital to create a genuinely sustainable economy—and standing to benefit as it expands.

However, this requires us to step away from some of the traditional tenets of investment management—most notably the perceived requirement for portfolios to exhibit high correlation with an index.

Why depart from the index benchmark standard? Because most benchmarks are highly focused on past results, rather than today's realities and the future economy already unfolding. Conventional benchmarks are usually riddled with companies directly creating systemic risks. In addition, indexes often don't have the same portfolio construction goals as the portfolio referencing it.

7 Things to Know

Next Economy Portfolio Theory

1. Applies forward-looking criteria to arrive at a list of companies
2. Evaluates the best objective, scientific evidence about risks facing the economy
3. Invests in the most effective and scalable solutions to those risks
4. Seeks to preserve and grow wealth by investing in industries and companies taking market share from less competitive alternatives
5. Doesn't attempt correlation with a risk-filled index benchmark; does not view correlation as safe
6. Updates MPT by including economic risks that were not contemplated in the 1950s
7. Is a go anywhere strategy that seeks the best solutions to our greatest systemic risks wherever they can be found—across geographies, industries, in companies of all sizes, and without regard for misleading labels like *growth* and *value*

Two separate analyses. One comprehensive process.

Next Economy Analysis:
Top-Down Search for Solutions Creators

Because Next Economy portfolios invest in inventive, forward-looking companies, they have a global, go anywhere mandate that seeks quality, rapidly-growing solutions wherever they exist. This provides Next Economy-oriented portfolios the freedom to capture opportunity sets across geographies, sectors, industries, style-box categorizations, and market capitalizations.

High correlation, benchmark tracking portfolios have no such flexibility.

The Next Economy selection process begins by identifying and evaluating economic threats and solutions via the Next Economics framework. Next Economy Portfolio Theory takes the next step by thoroughly analyzing:

1) which solutions work best within specific sectors and industries
2) which solutions are most innovative and scalable
3) which solutions-driven companies are leaders among their peers
4) what percent of each firm's revenue is attributed to solutions
5) which among these leaders are gaining market share from legacy economy firms and peers

While Next Economics provides the foundation for evaluating risks and opportunities, the top-down process allows the investment manager to define their opportunity set by evaluating which solutions might have the highest likelihood of profitable deployment.

Firms passing the top-down analysis with sufficiently high findings are potential Next Economy candidates. Their financial management wherewithal is then evaluated by the second stage of the Next Economy Portfolio Theory process.

Fundamentals-Based Analysis:
Bottom-Up Search for Leaders

Next Economy portfolios utilize fundamental valuation criteria in conjunction with absolute adherence to the top-down Next Economy framework to identify the best investment positions with minimized risk.

Just as the Next Economics framework pairs its novel concept of risk and opportunity analysis with a traditional economic growth structure, Next Economy Portfolio Theory pairs its original risk/solution evaluation process with a variation of the tried-and-true Graham-Dodd valuation methodology. This is critical, because market-based solutions won't be effective if they do not exhibit fundamentals worth investing in.

As such, Next Economy companies generally exhibit high-functioning business models, as demonstrated by:[ii]

- Diversified and predictable revenue streams
  - *Geography, industry, and customer*
  - *Intangible assets (IP, long-term contracts, etc.)*
  - *Market leadership*
- Visible path to growth
  - *Organic growth*
  - *Market share consolidation*

[ii] Representative list only

  - *Smart acquisitions*
- Consistent track record of delivering on earnings, margin, and dividend growth
- Strong and expanding cash flow
- Healthy balance sheet
  - *Cash on hand*
  - *Low debt relative to peers, or no debt; outstanding coverage ratios*
  - *Access to low-cost growth capital, if applicable*
- Management team effectiveness (i.e., consistent track record of hitting business goals, such as product delivery dates and volumes)
- Wise and effective custodianship of capital, with preference for R&D, human resources, and growth capex investments rather than share buybacks.

Finally, Next Economy portfolio constituents are ideally purchased at compelling relative valuations, exhibiting:

- Low price/book
- Low price/sales
- Low forward price/earnings
- Revenue and earnings growth that justify current valuations

The Result: *Next Economy in Motion*

The result of the investment selection process is a highly vetted list of companies or projects that indicate the trajectory and velocity of the Next Economy's progress. These are companies that recognize and respond to the growing set of risks by generating or enabling creative solutions, while contributing to economic growth with proven business models.

Unlike traditional portfolio construction, Next Economy **portfolios are allocated via risk-factor analysis rather than by sector categorizations, yet they nonetheless exhibit broad diversification across industries, geographies, and market capitalizations**, due to the breadth of opportunities that *already exist* to invest in solutions throughout the global economy.

The number of publicly traded Next Economy companies increases every year, a testament to the rapidly unfolding nature of the Next Economy. This also provides expanding investment capacities and potential for increasing levels of portfolio diversification.

*"Next Economy portfolios are **allocated via risk-factor analysis** rather than by sector categorizations, yet they nonetheless exhibit broad diversification across industries, geographies, and market capitalizations, due to the breadth of opportunities that already exist to invest in solutions throughout the global economy."*


Systemic Risks & Economic Solutions Snapshot
HUMAN DISEASE BURDEN
RISKS
Infectious Diseases & Pandemics
Viruses exact terrible suffering and place enormous economic burdens on world populations. It's estimated that in 2017 853 million years of healthy life was lost to disease, and 45% of that from communicable disease.
Drastic Increase in Cancer
According to CDC: "Between 2010 and 2020, we expect the number of new cancer cases in the U.S. to go up 24% in men to 1 million+ cases per year, and by 21% in women to 900,000+ cases per year." While some causes are known, many remain unquantified.
Economic Cost
In 2015, medical costs for cancer in the U.S. were $80 billion+. Global impacts of disability and premature death from cancer was $895 billion in 2008. Estimating costs of infectious disease is more complicated, but they're unquestionably enormous.
SOLUTIONS
Genomic Sequencing & Pathogen Identification
Advances in genome sequencing make understanding viruses, cancer cells, etc. rapid and inexpensive. This enables genomic medicine and the possibility of cheaper, one-and-done treatments for diseases.
mRNA Therapeutics & Vaccines
mRNA science is being used to develop individualized cancer vaccines, in addition to vaccines for infectious diseases. Moreover, mRNA therapies for the already infected are showing promise.
Gene Editing
Advanced trials of CRISPR/Cas9 treatments are underway for diseases from cancer to inherited conditions like sickle cell anemia.
DNA Medicine
DNA medicines deliver DNA plasmids into cells, enabling them to produce antigens targeted at either viruses or tumors.
Sources:
"World health statistics 2020: monitoring health for the SDGs, sustainable development goals." World Health Organization, 2020.
"Burden of Disease" Our World in Data, 2016
"Expected New Cancer Cases and Deaths in 2020," Division of Cancer Prevention and Control, Centers for Disease Control and Prevention, 2018
"Economic Impact of Cancer," American Cancer Society, 2020
"Epidemics and Economics," International Monetary Fund, 2018
"Quest to use CRISPR against disease gains ground," Nature, 2020
"The DNA Drug Revolution," Scientific American, 2020
"RNA Therapies Explained," Nature, 2019
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What's Wrong with Modern Portfolio Theory?

Modern Portfolio Theory ("MPT") is problematic in two critical, interconnected ways — in its definition of risk and in its reliance on historical market data. Next Economy Portfolio Theory aims to resolve these misguided assumptions to provide investors a more relevant and accurate method for evaluating risk and investment opportunities by integrating current near-term and long-term systemic risks, in addition to other forward-looking scenario planning.

In application, MPT's risk analysis relies heavily on historical data, which is problematic when the economy is evolving to look dramatically different from the past. MPT defines risk as any given stock or portfolio's standard deviation from its mean historical return and/or from the mean return of its benchmark index. The measurement of the mean, and consequently the risk of a given investment, is entirely based on prior price movement, not on forward-looking data. It completely ignores critical pieces of information, including current company fundamentals and projections of how specific systemic risks are likely to impact the investment differently in the future than the past.

MPT's five statistical risk measures—alpha, beta, standard deviation, R-squared, and Sharpe ratio—are based entirely on reading the historical relative price performance to determine riskiness.

The *reductio ad absurdum* of MPT is that an absolutely safe portfolio has zero variance from its assigned benchmark.

Almost always, investment management has a preference to correlate with destructive elements of the legacy economy, because the index benchmarks used in such measurements are comprised of companies that grew our economy to what it is today, which are often the same companies enabling the systemic risks so pervasive in today's economy. Things like extractive mining, leaky fossil fuel pipelines, and inefficient manufacturing. So far, investments in these indexes—and portfolios that

When Modern is Ancient

Traditional investing consists of evaluating investments and hoping they conform to their past behavior. Modern Portfolio Theory was developed with no knowledge of the fact that the 21st century's global economy would be riddled with systemic risks that undermine its continued prosperity.

MPT defines risk as any given stock or portfolio's standard deviation from its average historical returns, and/or those of its benchmark index. This definition of risk, which relies solely on backward-looking, comparative price data, is far too narrow to accommodate the realities of the present global economy.

MPT fails to account for our most pressing threats, including the climate crisis, resource degradation, disease burdens, and eroding social cohesion.

Next Economy Portfolio Theory eschews backward-focused mean variance analysis and instead focuses on analyzing current and forward-looking pieces of material information to best determine investment quality.

correlate with them—haven't meaningfully hurt investors' performance, but that shouldn't be expected to be a trend for long.

Put simply, benchmark indexes reflect the legacy economy and perfunctory correlation to their returns no longer makes sense.

Stock selection is a forward-looking endeavor; however, MPT-adherent managers largely rely on backward-looking data. A portfolio is an illustration of the portfolio manager's vision of the future—what they believe has a chance of growth given their views of how the economy is likely to unfold. Portfolios should, therefore, be positioned to take advantage of growth drivers in response to rational, forward-looking inputs.

In Next Economy Portfolio Theory, no attempt is made to mimic traditional indexes, because they include inherently risky companies and most of them reflect the risky legacy economy.

Economies have always had both constraints and innovation, so why change investing analysis factors now? What's different?

The scale of constraints, for one, are now systemic, if not existential. If left unaddressed, these risks threaten to compound and increase exponentially, threatening the global economy as well as its physical, ecological, and social foundations. Sticking to tradition in this case is not a viable option in terms of maintaining a working economy.

The rapid acceleration in the velocity of innovation is also a differentiating factor. The current rate of technological innovation, including those innovations with the potential to address systemic risks, was unimaginable when MPT was introduced.

Backward-looking mean variance calculations do not assimilate realities like the Law of Accelerating Returns.[10] This means that it is no longer safe to assume that the economy will resemble that of the past. If investors continue to assume that risk and opportunities for portfolio performance will maintain the same forms and pace, they will simultaneously expose themselves to more risk posed by systemic threats and capture fewer potential gains from accelerating innovation.

> *"Strong investment in sustainable infrastructure — that's the growth story of the future. This will set off innovation, discovery, much more creative ways of doing things. This is the story of growth, which is the only one available because* ***any attempt at high-carbon growth would self-destruct.****"*
>
> *-Nicholas Stern*

This disconnect between MPT's definition of risk, and the reality of present systemic risks is clear. In applying MPT's backward-looking selection strategy, some investment managers have boxed themselves into two kinds of risk, one old and one new.

The old one is that most investable assets now chase the same relatively small group of index constituent investments, creating a bubble. As Harry Markowitz, who introduced MPT in his landmark 1952 book, has more recently written, "the ability of diversification to reduce risk is surprisingly limited when returns are correlated."[11] With most portfolio managers today

seeking high correlation with the same mean returns, risk is becoming more concentrated among popular benchmark-tracking portfolios, not less.

The other risk is that managers remain committed to MPT's diversification across industries that held sway when MPT was popularized. We now know that some of these industries are causing our largest risks. This means that conventional investment theory fails to adequately map realities of the underlying economy and thus fails to protect investors from risk.

If high-carbon growth in the global economy will inevitably cause that economy to self-destruct, then it is nonsensical to remain committed to high correlation to an index such as the S&P 500, with its dozens of fossil fuel constituents and the multiple other systemic risks embodied within that index.

The Next Economics framework clearly illuminates the major gaps in MPT's backward-looking evaluation of economic risks and opportunities. Next Economy Portfolio Theory responds to these deficiencies by combining:

1) Next Economics' key risk and solution inputs, and
2) fundamentals-based securities analysis to build portfolios that reflect what the economy is.

Opportunity for ESG Managers to Have Greater Impact

Next Economy Portfolio Theory is not only a departure from Modern Portfolio Theory, but it also re-conceptualizes what it means to be a socially and environmentally responsible or impact-oriented portfolio. Rather than asking how sustainability can be molded to fit the current economy, it asks which companies are fundamentally driving progress toward a truly sustainable economy—preserving and creating wealth while doing so.

> *"Achieving a **truly sustainable portfolio with strong long-term returns** must be more than simply screening an established index and adding a green wrapper."*

While organizations like the UNEP and World Economic Forum are incorporating climate change and related risks into their models, many portfolio managers that market themselves as ESG, SRI, or impact-oriented specialists fail to consider these material inputs as they build portfolios. Instead, they remain tethered to traditional MPT-style portfolio construction methodologies, resulting in benchmark-hugging portfolios. The benchmarks they seek to mimic; however, represent the risk-pervasive legacy economy. This is a *major* discrepancy.

Traditional approaches to responsible investing typically fall into one of two buckets. **Negative screening** begins with an index benchmark and uses programmed filters (based on imperfect publicly available lists and historical statistics) to screen out objectionable companies. In the **Best of Breed** approach, shareholders remain invested in all sectors by investing in companies within each that are the least harmful or objectionable.

These approaches to responsible investing, while sincere in intention, are inadequate in determining the best investment opportunities. They also fail to drive capital to an entire portfolio of companies creating meaningful change; therefore, they are not genuine impact vehicles.

Neither approach considers the value available in the increasingly sustainable global economy. The most a screening approach can deliver is a somewhat greener or more socially-just version of an existing index. Achieving a truly sustainable portfolio with strong long-term returns must be more than screening an index and adding a green wrapper.

If practice emerges from theory, then an economic theory that envisions an indefinitely sustainable economy is necessary. From that body of work, portfolio construction processes appropriate to known facts can emerge.

Rather than starting with an index constituent list and screening it down to an ESG-oriented portfolio using imperfect lists, impact-oriented portfolio managers should look at each potential investment and evaluate whether most of a company's revenues are creating high-demand solutions or are contributing to systemic risk.

For example, if a car company has invested in electric vehicles, but most of their revenues are from combustion engine vehicles with a low mile-per-gallon average across their fleet, then that firm is primarily a *contributor to* systemic risk. These are the types of crucial analyses that drive economics, sustainability, and investment management forward. Neither ESG screening, nor best-of-breed techniques contemplate such an analysis.

Overlaying criteria meant to address a social or environmental concern upon legacy economic growth and investment strategies only achieves a slightly greener version of the past.

To reflect the rapidly evolving economy that now exists, asset managers must re-conceptualize risk to incorporate systemic threats and opportunities, and as a result, their investment portfolios.

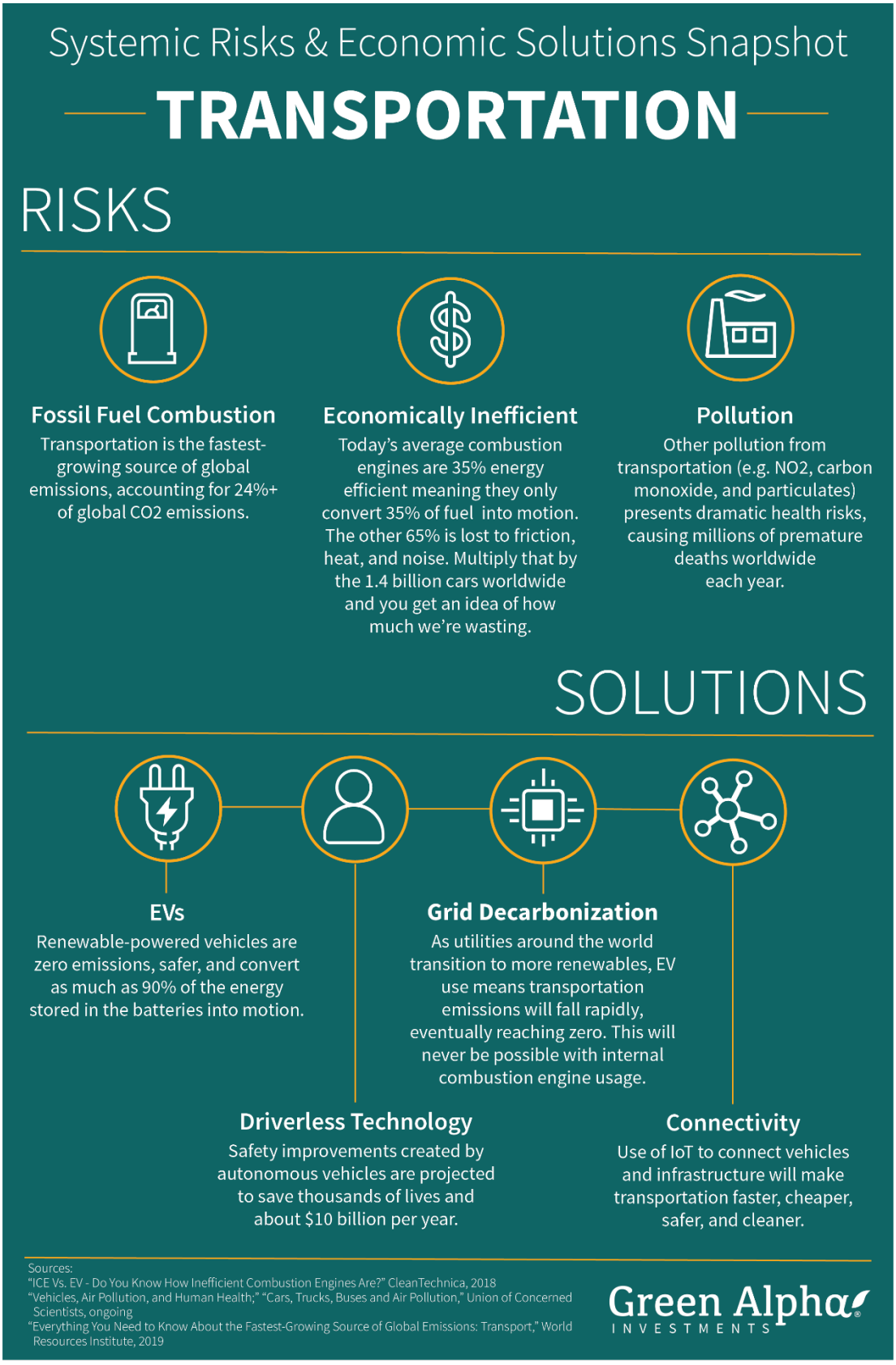
Conclusion

A rapidly evolving economy requires an equally adaptive approach to investing — one that accounts for global economic risks likely to threaten economic growth and investment performance.

Next Economics offers a framework to evaluate this rapidly evolving risk and opportunity landscape.

Next Economy Portfolio Theory allows managers to apply this knowledge to their portfolios, while avoiding outdated economic assumptions underlying MPT. Together, this framework and its practical application enable investors the opportunity to invest in and profit from what the economy is *becoming*, rather than what it *was.*

*"Next Economy Portfolio Theory and it's practical application enable investors the opportunity to **invest in and profit from** what the economy is becoming, rather than what it was."*


Systemic Risks & Economic Solutions Snapshot
TRANSPORTATION
RISKS
Fossil Fuel Combustion
Transportation is the fastest-growing source of global emissions, accounting for 24%+ of global CO2 emissions.
Economically Inefficient
Today's average combustion engines are 35% energy efficient meaning they only convert 35% of fuel into motion. The other 65% is lost to friction, heat, and noise. Multiply that by the 1.4 billion cars worldwide and you get an idea of how much we're wasting.
Pollution
Other pollution from transportation (e.g. NO2, carbon monoxide, and particulates) presents dramatic health risks, causing millions of premature deaths worldwide each year.
SOLUTIONS
EVs
Renewable-powered vehicles are zero emissions, safer, and convert as much as 90% of the energy stored in the batteries into motion.
Grid Decarbonization
As utilities around the world transition to more renewables, EV use means transportation emissions will fall rapidly, eventually reaching zero. This will never be possible with internal combustion engine usage.
Driverless Technology
Safety improvements created by autonomous vehicles are projected to save thousands of lives and about $10 billion per year.
Connectivity
Use of IoT to connect vehicles and infrastructure will make transportation faster, cheaper, safer, and cleaner.
Sources:
"ICE Vs. EV - Do You Know How Inefficient Combustion Engines Are?" CleanTechnica, 2018
"Vehicles, Air Pollution, and Human Health;" "Cars, Trucks, Buses and Air Pollution," Union of Concerned Scientists, ongoing
"Everything You Need to Know About the Fastest-Growing Source of Global Emissions: Transport," World Resources Institute, 2019
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Appendix: Systemic Risks & Solutions

Energy

RISKS

- **Cumulative effect of high emissions** — legacy, inefficient energy systems are among the greatest threats to the long-term well-being of the global economy
  - *Increased global temperatures leading to*
    - Mass suffering and migration from affected regions
    - Melting glaciers, snow cover, and sea ice, resulting in sea level rise
    - Extreme weather events (e.g., heat waves, droughts, extreme rainfalls, flooding)
    - Initiation of warming feedback loops that result in irreversible warming (e.g., permafrost thaw resulting in major release of methane, a greenhouse gas that is 86 times more potent than CO2 in the short term,[12] along with other GHGs which would likely result in a climatic and ecological "tipping point"—the switch from a relatively stable state to an unstoppable cycle)[13]
  - *Air pollution (smog, particulate matter, acid rain)*
    - Public health risk, including up to 10 million annual premature deaths globally[14]
    - Biodiversity loss risk
  - *Ocean acidification, resulting in ecosystem damage*
- **Decreasing economic competitiveness relative to renewables**
- **Oil and gas leaks and spills during extraction, transportation**
- **Inefficiency risks**—only 14% of total generated energy potential becomes economically useful[15]
- **Widening inequality**—stress to social stability
  - *Unequal establishment of pipelines, refineries, and drilling operations in marginalized communities*
  - *Disadvantaged communities and countries will bear disproportionate burden of climate change's negative impacts*

SOLUTIONS

- **Renewable energy**
  - *Far lower greenhouse gas emissions vs. fossil fuels, both direct and in terms of lifecycle*[16]
  - *Lower risk of malfunction, contamination of environment than fossil fuels*
  - *Regenerative—does not require additional inputs (besides maintenance)*
  - *Cost-effective—investment in technology pays for itself over time, unlike commodities like oil and gas that increase in price as demand increases*
- **Price stability**—long-term pricing contracts lower cost volatility for users
- **Energy storage**
  - *Ensures availability during peak demand*
  - *Allows long-term price predictability*[17]
  - *Expands access, combatting energy inequality*
  - *Enables around-the-clock usage of renewables*
  - *Will allow renewables to fully scale*
- **Measurement, monitoring of energy production and use**

Appendix: Systemic Risks & Solutions

Agriculture

RISKS

- **Heavy reliance on synthetic chemical fertilizers, herbicides, and pesticides, leading to:**
  - *Public health risks (for those consuming and growing food)*
  - *Soil depletion (less consistent and fruitful harvests, followed by zero harvests)*
  - *Contaminated groundwater (damages aquatic, riparian, and terrestrial ecosystems; drinking water)*
  - *Oceanic dead zones*
  - *Deterioration of large fisheries*
  - *Nitrous oxide (a powerful greenhouse gas) emission*
- **Dependence on fossil fuel energy**
- **Excessive water uses and waste**
- **Depletion and degradation of arable land**
  - *Inability to grow reliably*

SOLUTIONS

- **Cultivating regeneratively**
  - *Avoids risks presented by chemical and synthetic contaminants*
  - *Is higher in soil organic matter and nitrogen*
  - *Requires lower energy inputs*
  - *Can offer comparable yields to conventional systems*
  - *Conserves soil moisture and water resources*
  - *Sequesters more atmospheric carbon*
- **Increased access to organic and natural foods**
  - *Expands access to healthier food (i.e., less processed, fewer to no chemicals)*
- **Indoor, vertical farming using AI**
  - *Less risk of crop failure due to controlled environment*
  - *Requires much less fresh water*
  - *Reduces impact on soil and oceans*
  - *Decreases distance required for transportation*

Water

- **Geometrically increasing demand due to increasing populations and resulting demand by industry**
- **Changes to water and growing cycles due to climate change**, resulting in more frequent droughts, floods, etc.
- **Contamination of water due to pollution**

- **Improving efficiency of use via monitoring and measurement**
- **Increasing supply of freshwater via desalination and newer technologies**
- **Improvement in water transportation and treatment infrastructure**
- **"Smart" agriculture**
- **Indoor and vertical farming**
- **Indoor and outdoor raising of halophytes** (saltwater-tolerant plants)

Appendix: Systemic Risks & Solutions

RISKS	SOLUTIONS

Transportation

- **Reliance on fossil fuel combustion**
- **Pollution**
  - *Public health risk (reduces labor force, productivity)*
  - *Ecosystem damage*
- **Human error** — nearly 1.3 million people die in road crashes each year globally[18]
- **Inefficient transportation, infrastructure systems** exacerbate existing issues

- **Electric-powered vehicles** (i.e., renewables-powered)
- **Driverless technology**
- **Safety improvements are projected to save thousands of lives and ~$10 million per year**
- **Connected vehicles**
- **Connected infrastructure, transportation systems**
- **Effective, efficient, practical, zero-emissions mass transportation**

Data & Connectivity

- **The more connected the economy, the more it can address legacy, system-wide risks stemming from:**
  - *Legacy energy dependence*
  - *Legacy agricultural practices*
  - *Fresh water contamination and use*
  - *Fossil fuel-based transportation and infrastructure systems*
  - *Excessive creation of waste materials and contaminants*
  - *Health risks of legacy business practices*
  - *Systemic risks from financial services*
  - *Inequality of access to information and education*
- **Specific risks to increased connectivity**
  - *Cybersecurity risks*
  - *Network stability and vulnerability risks*

- **Smart sensors and meters**
  - *Collects and channels data for commercial and individual monitoring, troubleshooting*
  - *Faster transmission of resource consumption data to utility/smart grid*
  - *Remote management of energy usage*
  - *Reduced energy use*
  - *Enables analysis at big data scale, empowering further advances*[19]
- **Smart grids** (detects and reacts to changes in energy usage)
  - *Enables system-wide use of smart meters, appliances*
  - *Reduced energy use*
- **Interconnected infrastructure and devices** (e.g., buildings, roads, cars, phones, sanitation systems, etc.)[20]
- **Cybersecurity enhancement**
  - *Greater safety and privacy in increasingly connected economy, society*

Appendix: Systemic Risks & Solutions

RISKS	SOLUTIONS

Waste-to-Value

- **High extraction and input of raw, over-exploited natural resources that are necessary for climate and ecosystem services** (e.g., trees act as oxygen producers, carbon sinks, soil stabilizers, wildlife, and habitat support, etc.)
- **High output of emissions and waste**
- **Higher resource prices because of resource scarcity** (increasing demand, decreasing supply)
- **High cost of end-of-product-life disposal**

- **Replacing raw, extracted resources with recycled materials** (e.g., wood, steel, wastewater, lithium, animal byproducts, etc.)
  - *Decreases cost in many cases*
  - *Reduces need for extraction and impact on source*
  - *Lessens GHG footprint*
  - *Decreases need for waste disposal*
  - *Creates new value in economic systems by changing a cost center to a profit center*

Biotech & Medicine

- **Heightening risk of epidemics and pandemics** due to habitat encroachment and expanding/changing plant, animal, and microbe territorial ranges
- **Unequal access to quality diagnoses and treatments, including pharmaceuticals**
- **Women's health risks**
- **Accelerating cancer risks**
- **Infectious disease**
  - *Vector habitat expansion*
  - *Encroachment on previously undisturbed habitats*
  - *Biowarfare*

- **Hyper-efficient care models** (integration of AI, connectivity to streamline patient care process)
- **Genomics revolution** – therapeutics, diagnosis, agriculture, biodiversity
- **Cleaner, safer, less invasive care** (e.g., blood tests for cancer, liquid biopsies vs. tissue biopsies, minimally invasive surgeries, customized cancer vaccines and antigens)
- **AI/algorithm-driven disease modeling and prevention**
- **Female-specific health services**
- **Cost-effective healthcare**

Appendix: Systemic Risks & Solutions

RISKS	SOLUTIONS

Financial Services & Real Estate

- **Financial exposure and contribution to systemic risks** (climate, resources, inequality)
  - *Equity investing largely captured by legacy interests*
  - *Financing for systemic-risk-exacerbating projects*
  - *Insuring near-sea-level communities*
  - *Urban and agricultural land price declines associated with droughts or other large-scale changes to original climate*[21]
  - *Consequences of exploitative business practices*[22]

- **Financing risk-mitigating projects** (renewables infrastructure, energy storage, water supply and infrastructure, efficiency projects)
- **Insurance for climate risks**
- **Basic banking and financial literacy for underserved communities**
- **LEED and higher certified building development**
- **Water recapture infrastructure development**

Education

- **Unequal access to education, perpetuating widening inequality**
- **Skewed perceptions of environmental and social phenomena**, resulting in resistance to action in response to systemic risks[23]
- **Low critical evaluation skills and basic scientific literacy**
- **Economic growth is hampered by uneducated, non-competitive workforces**

- **Providers of broadly available formal education**
  - *E-Learning*
    - Fulfills present need for workers to be continually learning and reinventing their careers
    - Rising industry figures show the importance, with E-Learning representing a $165 billion industry in 2017, from near zero in 2005[24]
    - Major cost benefits for universities and students
    - Learn-anywhere model enables greater access to valuable programs[25]
- **Providers of verifiable informational content for informal learning**
- **Access to the world's knowledge**
- **Technologies and platforms to enable access to learning, data, and general information**

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