

(No Model.)

T. A. EDISON.
ELECTRIC LAMP.

No. 263,878.

Patented Sept. 5, 1882.



PAGES ABOUT...

Investing In Innovation



Attest
J. D. Cott
C. W. Howard

Inventor
Thos. A. Edison
per Dyer & Miller

ABOUT OUR '8 PAGES' SERIES:

The Librarium Associates monthly '8 Pages About..' series is a publication created by our team focused on topical current issues that we feel warrants a deep dive where we can distill the key developments and provide an alternative view on such topics.

We are constantly engaged in active horizon scanning while adhering to our belief that students of the lessons of history and permanent features such as geographic realities can provide superior insights.

From these broad scenarios we work to identify investable trends and specific opportunities. We find that such a broad approach provides an 'early alarm' system for risk management and an indicator of attractive price/value situations across asset classes.

The intention of our research and the basic premise of this publication is to present rational perspectives based upon a diligent analysis of historical data. Through organizing the data logically, information is created. Through understanding and developing perspectives on the information, knowledge is generated. With knowledge, one can then start to make informed decisions.

The most practical way to imagine the future is to question the expected, this is best done making use of what we call 'critical thinking' – Critical thinking is the careful, deliberate determination of whether one should accept, reject or suspend judgment about a claim and the degree of confidence with which one accepts or rejects it. Critical thinking employs not only logic but a broad intellectual criteria such as the one outlined above. Critical thinking requires extensive experience in identifying the extent of one's own ignorance in a wide variety of subjects which is often captured in the following sentence: I thought I knew, but I merely believed.

As J.F. Kennedy put it: **"Belief in myths allows the comfort of opinion without the discomfort of thought."** Our aim is always to avoid this trap of the mind, when one attempts to look into the future one is better off exhibiting a more intellectually humble approach and challenge one's beliefs and opinions by asking the question: What if we took the opposite view? This leads to a more balanced set of insights in our view.

The insights and opinions offered in this document are meant as a summary of events and our views – not a conclusive or exhaustive overview or for that matter a specific investment recommendation.

We hope it will offer some food for thought and that it can form the basis of conversations between our clients, interested parties and ourselves.

Sincerely yours,

Mr. S.H. Sorensen
Senior Associate

LIBRARIUM ASSOCIATES LTD. – WWW.LIBRARIUMINSIGHTS.COM – NOVEMBER 2017.

THE POWER OF INNOVATION AS A WEALTH CREATOR

As an investor and a student of economic history one can't fail to see the fact that innovation, applied in core economic sectors supported by favorable long-term trends, are the most consistent and lucrative returns generator in history. This is undoubtedly true from the invention of the wheel to the microchip.

THE CHALLENGES TO ACCESSING THIS PROFIT ENGINE

Aligning your money with the forces of human ingenuity has long been a winning investment. However finding the right idea and people to execute it at the right period in time has historically been a formidable challenge. There is a reason why the recent darlings of the VC private market space are named after a mythical beast – The Unicorn. Sightings are rare – for every 'Amazon' there is 1000s of 'Pets.com' and 10,000s that never even make it out of the garage/dorm room. Innovation and implementation of new concepts is more art than science, a messy mix of unpredictable forces best captured by Mr. Rette's brilliant observation: **"We are living in a storm where a hundred contradictory elements collide; debris from the past, scraps of the present, seeds of the future, swirling, combining, separating under the imperious wind of destiny."** Change can be tantalizing, it can fuel massive opportunities. However change by itself is difficult. As an investor you have to identify it before it occurs. Consumers have to change their behaviors to create a viable market to underpin it. These two events are often contradictory and illusive. As investors we seek enduring dynamics, things you can allocate time and capital into today with probabilities in your favor so that you have a reasonable chance of it being a solid long term play, ideally with some catalysts for significant upside driven by innovation.

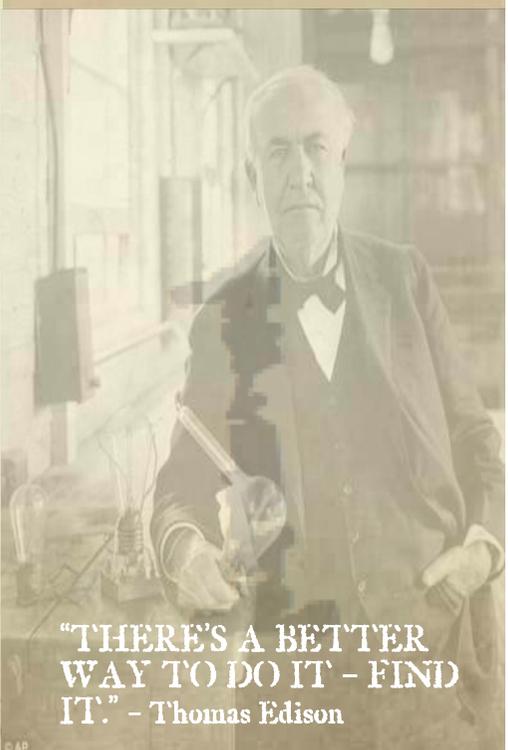
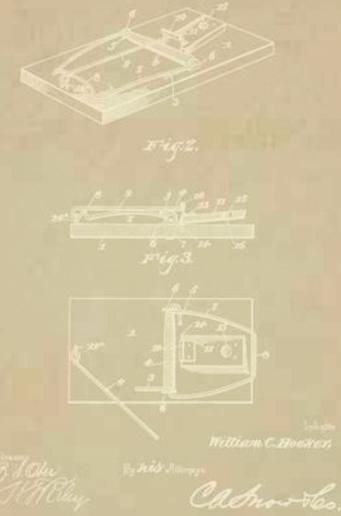
In the excellent book 'Engines that move markets – Technology investing from railroads to the internet and beyond.' By Mr. Nairn he comes to the following conclusions after a comprehensive review of the history of market-shaping industries and their impact on how we invest.: **"The best technology does not always win. Winning the technology battle is no guarantee of financial success. Insiders usually make the best returns from new technologies. The only surefire way to make money from new technologies over any extended period of time is through monopoly protection."**

When the next 'new new' messianic thing is ushered in, profits have proven elusive for public and private market investors. Messrs. Edwin Drake and Nikola Tesla are just two examples of how even the inventors, entrepreneurs & insiders can also find success short lived and fast profits slithering away beyond ones grasp, as elusive as handful of sand.

With the benefit of an even longer look back in time from Fernand Braudel's seminal work; 'Civilization & Capitalism 15th-18th Century; The structures of everyday life' we get the following brilliant set of insights:

"In the realm of technology, co-extensive with the whole of history, there is no single onward movement, but many actions and reactions, many changes of gear. It is not a linear process. (...) The history of inventions, taken by itself, is therefore a misleading hall of mirrors. (...) In other words, there are times when technology represents the possible, which for various reasons - economic, social or psychological - men are not yet capable of achieving or fully utilizing; and other times when it is the ceiling which materially and technically blocks their efforts. In the latter case, when one day the ceiling can resist the pressure no longer, the technical breakthrough becomes the point of departure for a rapid acceleration."

"Build a better mousetrap & the world will beat a path to your door." - R.W. Emerson



"THERE'S A BETTER WAY TO DO IT - FIND IT." - Thomas Edison

WHERE IS THE VALUE AT?

Our current crop of high profile innovators seems to be adherents to Mr. Zuckerberg, perhaps ill advised, motto; **"Move fast and break things"** in their breakneck speed pursuit of the next disruptive idea. Away from the headlines innovation, as an expression of humans inherent ingenuity, continues its long slog of evolution and innovative concepts just as disruptive and perhaps more lasting in nature takes place every day. Actors in less flamboyant and more industrial sectors such energy, transportation (Mighty Mr. Musk is an outlier), chemicals & agriculture are channeling the 'Bell Labs' way of **"move deliberately and build things."**

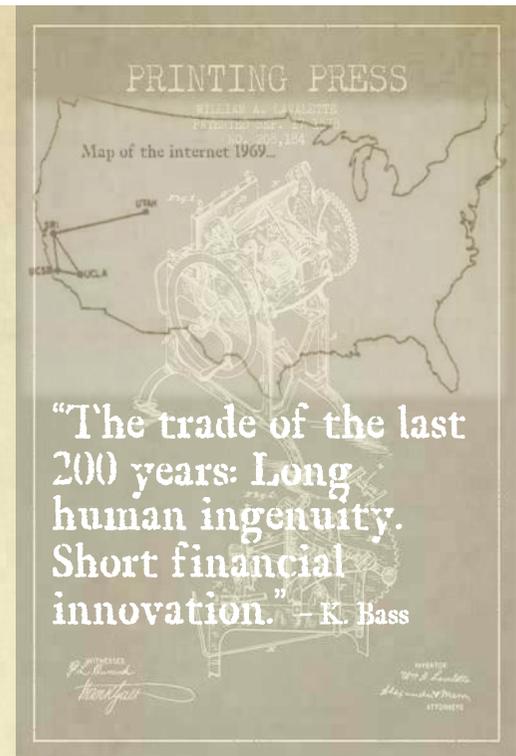
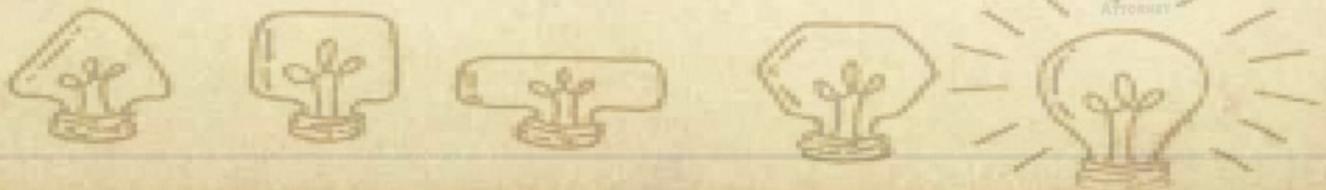
Revolutions happen fast but dawn slowly. Bell Labs and subsequent imitators have achieved real disruptive improvements but at a more incremental pace – achievements that we are still harvesting today. Bell Labs invented the transistor in 1947, which is now the building block of all digital products. Billions of transistors now reside on the chips that power our phones and computers. They invented the silicon solar cell, the precursor of all solar-powered devices. Two of its researchers were awarded the first patent for a laser. They created and developed the first communications satellites, the theory and development of digital communications and the first cellular phone systems. They built the first fiber optic cable system and subsequently created inventions to enable gigabytes of data to zip around the globe. These are just a few of the practical technologies Bell Labs were responsible for. It literally gave Silicon Valley its name.

"I'm often asked what will change in the next 10 years. I almost never get the question: What's NOT going to change in the next 10 years? And I submit to you that that second question is actually the more important of the two. You can build a business strategy around the things that are stable in time." - Jeff Bezos

Taking all this into consideration how does one go about allocating funds to innovation focused strategies?

A starting point should be to identify sectors of the economy supported by long term trends but where a 'bottleneck' or even better a 'finite supply meets infinite demand' type situation is forming. Challenges faced by crucial economic sectors are where human ingenuity can best be expressed and long term value created. Historically agriculture and related fresh water – energy and transportation – Healthcare and pharmaceuticals and unfortunately military hardware are examples of such economic sectors. Throw in automation, supported by our constant pursuit of increased productivity and which has a strong wind in its sail as we seek to overcome the demographic challenges faced by most of the world's major economies, and you have a comprehensive investment universe to consider. On the following pages we will take a cursory look at a few of them.

"I have not failed. I have just found 10,000 ways that won't work." - Thomas Edison



THE BIG PICTURE:

Faced with an increasing global population, fresh water and productive agricultural land are both faced with an intensifying scarcity challenge and the companies that can provide the solutions are set to benefit over the long-term.

Advances from the mechanization in the 1920s and the Green Revolution from 1940-1960 have largely been exhausted. Rates of yield increases for major crops have been trending negatively on a 10-year curve at the very time that global forces of population growth, prosperity, and globalization are putting basic supply-and-demand pressure on our agriculture system. Agriculture and freshwater has been influenced by global demographical trends and it is only set to continue. Within the past century, the world population has tripled from 1.8 billion in 1900 to over 6 billion in 2000, and in slightly more than 10 years, we have added another billion, reaching the 7 billion mark in 2011. Although growth rates have begun to level off, the world's population is expected to reach 9 billion by 2050.

We have also seen changing consumption patterns, historically there has been a positive correlation between disposable income and meat consumption. The global middle class is expected to grow from about 1.8 billion people today to 4.8 billion people by 2030. A larger middle class – most of which will be located in the emerging markets – will consume more meat. Producing one calorie equivalent of meat requires 10 times more water than producing one calorie equivalent of corn or wheat.

More freshwater specific the increasing industrial production will require higher volumes of high quality water and much of the recent industrial expansion – mining, fracking and manufacturing – are located in water-stressed areas.

Climate change is also due to have a significant impact on the distribution of precipitation and the availability of water. For instance, in India, Pakistan, China and other Asian countries, about 1 billion people rely on run-off from the Himalayas as their main water source. As a result of global warming, glaciers that supply most of the freshwater to the region during the dry season are expected to deliver up to 50% less water within the next few decades. In addition, rising sea levels and floods will have a dramatic impact on coastal fresh water sources, causing them to become brackish or salty.

The global water infrastructure is in desperate need of investment it has been neglected in both emerging and developing markets. In developed countries, water pipes built during the 19th or 20th centuries form the backbone and are susceptible to main breaks and leaks. Many large cities lose 30% or more of their tap water to leaks according to a study by the World Bank. The same study indicates that the cost of maintaining and expanding the water mains stands at \$65 billion annually with operating costs amounting to more than \$100 billion. It is forecast that investment in this area alone will almost double in 2017. If you look at sewage treatment, drinking water purification and desalination you are looking at markets that was valued at over \$250 billion in 2007.

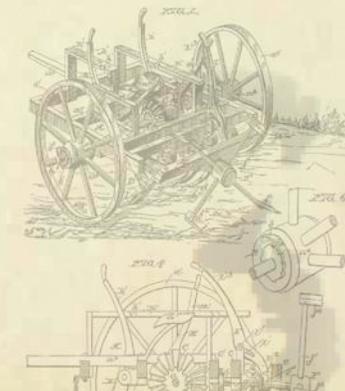
Agriculture and freshwater are closely linked, agriculture is a major consumer of water accounting for 70% of the water used worldwide. Eighteen percent of cropland is now under irrigation and the percentage is growing.

Where infinite demand meets finite supply opportunity for real game changing solutions through innovation are the greatest and potentially most rewarding for those who fund this crucial progress.

Agriculture & Fresh Water.

The total investment in Ag-Tech in 2017 topped a record \$1.5 billion. With Investment Corp of Dubai's \$203 million round into Indigo AG representing an increasing interest from SWFs.

C. D. BAILEY & J. J. WESTER.
OCEAN CRUZZER.
No. 364,746. Patented June 14, 1887.



**THE FUNDAMENTALS
DEMAND
INNOVATION...**

C. D. Bailey
J. J. Wester

SCANNING THE HORIZON...

As discussed population growth and changing dietary habits drives the need to ramp up food production at a time in history where high quality farm land is getting scarcer and climate related factors are making farming more unpredictable. Innovation is the only variable that can navigate these unbalanced dynamics and provide the solutions we need. Governments, large Agri-businesses, entrepreneurial farmers and the technology startup sector are working to develop new solutions in a variety of spaces such as: **Life Sciences:** Geonomics, pharmacology, crop protection, animal health & biologicals – **Food & Nutrition:** Health & performance, nutraceuticals, organics, food safety & aquaculture. – **Information Technology:** Sequencing & analytics, monitoring & diagnostics, agronomics & Farm data management. – **Precision Farming:** Sensors & data, robotics & automation, water management, fertilizers & indoor farming. – **Supply Chain:** Harvesting & processing, distribution & storage, food traceability, waste & biomass. New ideas and improvements across these diverse areas should lead to higher productivity and more sustainable farming techniques.

Globally, Goldman Sachs, estimates that advances in Ag-Tech – including such things as autonomous Ag vehicles/machinery, farm robots, drones as well as precision in planting, fertilizing and irrigation – could result in farm yields potentially rising by more than 70% by 2050. Even limited automation according to the same GS study could lift farmer revenues by more than 10%. It also suggests that precision Ag-Tech used today is already saving growers money and increasing yields. The study predicts Ag-Tech could become a \$240 billion market opportunity for suppliers. The big Agri-business players have made significant improvements in seeds, nutrients & pesticides during the last decade and are leading this new innovation drive both internally and by investing in or outright acquiring startups with innovative concepts. In the past over 95% of Ag-Tech exits have occurred via M&A as technologies were incorporated into the established distribution channels and farmer networks. To harness the value being created in this sphere institutional investors have been increasing their allocations, more money went into funding Ag-Tech startups last year than the previous two combined as 'Big Ag' jostled for position with some of the Silicon Valley VC's and SWF's such as Temasek and China's SOE's who has a mandate to aggressively pursue deals in the space. It pays to be the disrupter in this billion dollar industry as the world seeks solutions in this crucial sector.

As an investor this is a powerful opportunity to finance the next revolution in agriculture and set the world onto a more sustainable path and harvesting the rewards.

BIG BLUE...

Nearly 3/4s of planet earth's surface is covered in water, but with more than 96% of it in the oceans and much of our fresh water trapped in the polar ice caps, less than 1% is available for drinking and irrigation (70% of our global usage). Human use of water will only increase with population growth, rising living standards, and widespread commercial use of water in everything from hydraulic fracturing to manufacturing. Such escalating demand, combined with a fixed and limited supply, is why water is one of the most appealing long-term investments. The demand is not affected by inflation, recession, interest rates or changing tastes making it a truly durable investment thesis. How does an investor tap this opportunity? A diversified approach across the whole segment is advisable, utilities that distribute it, environmental companies that treat and purify it, to makers of pumps and filters and technology companies with new concepts for how to monitor and manage its use as well as areas such as desalination.

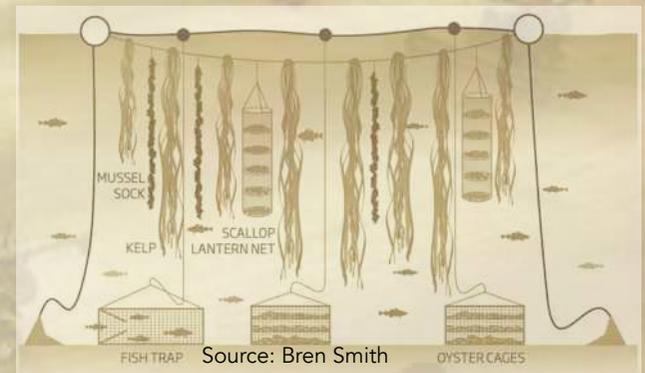
A Growing interest in Ag-Tech.

Private investment (PE & VC) in Ag-Tech.

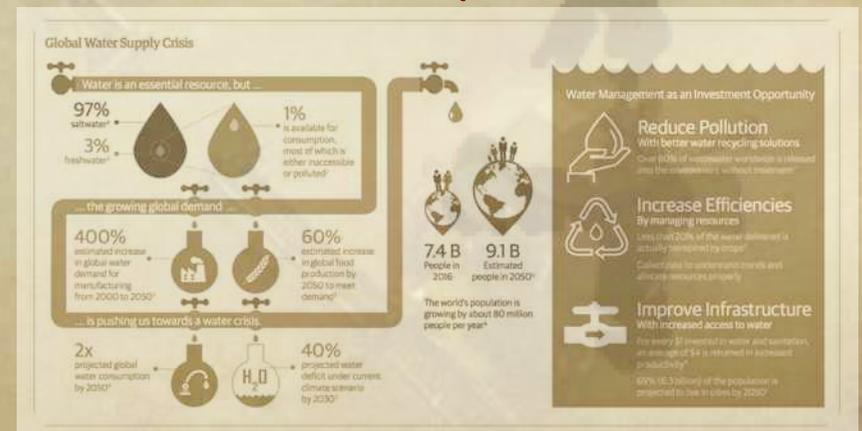


Vertical Thinking...

By utilizing the entire water column, 3D ocean farms can produce a lot in a small area.



Finite Supply meets Infinite Demand...



Source: Guggenheim Investments.

Newcomen, 1712 ENERGY & TRANSPORTATION

We live in an energy hungry world. Global GDP is set to treble by 2060, with two thirds of that growth coming from emerging markets which display significantly greater energy and carbon intensity per unit of GDP than developed markets. Feeding that energy demand and facilitating growth while minimizing emissions will take brave and coordinated decisions on the part of policymakers and innovative solutions from the private sector.

Innovative companies are set to reap the rewards of harnessing the winds of change in an industry that a recent Citi Bank report forecasts will be the beneficiary of around \$200 trillion (both capital expenditure and fuel) over the next quarter century. History shows that innovations in technology can cause dramatic increases in productivity, transforming industries and setting whole societies on new paths to growth. The world is approaching a tipping point in the development of energy technologies that could generate increases in energy productivity on a scale not seen since the industrial revolution. It is difficult if not impossible to talk about energy without mentioning innovation. From the light bulb to unconventional production or clean energy, examples abound.

Just to cite a few figures, unconventional gas now accounts for 40% of US natural gas production and renewable technologies accounted for 42% of total power capacity added worldwide in 2012. Take the solar industry during the last 15 years annual installations of photovoltaic systems in the US has grown from 4 megawatts (MW) in 2000, to over 6,000 MW in 2015. This is a compounded annual growth rate of nearly 70% and a total growth rate of 155,000%. Even during the last year with low oil and gas prices the renewable industry finished another record-breaking year, with more money invested, \$329 billion, and more capacity added, 121 Giga watts, than ever before according to Bloomberg New Energy Finance data.

Over the last 5 years the US shale revolution has upended oil and gas markets in the US and the world at large. At first it was dismissed as unworkable, then it was minimized as unsustainable. Now, having helped drive a massive drop in the global price of oil, it is hailed as an economic and geopolitical game changer. The electricity sector is quietly undergoing its own transformation, and it is set to yield dramatic economic and social benefits.

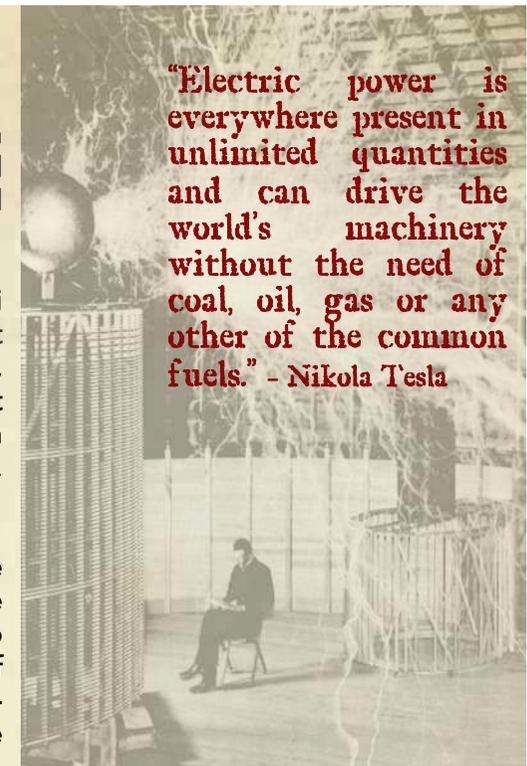
Thanks to technological innovation, smart government regulation, Chinese industrialization and creative financial engineering, solar panels are becoming cheaper and more accessible than ever before and the consequences are likely to be profound.

Batteries too, have the potential to change the world just as much as shale has, should the technology continue to improve. That's because large-scale batteries could unlock the full potential of renewable power, which has been held back by its intermittent nature.

Electric vehicles are already evolving into a significant reality that is only set to expand and again the development of viable low-cost, large-scale batteries could be the game changer. As mentioned solar panel prices have already plummeted with wide ranging positive side effects, and batteries look set to follow in the future again with significant knock-on effects across industries.

The energy sector offers many opportunities - now and in the future - and as an investor you can't afford not to be on the right side of these changes.

"Electric power is everywhere present in unlimited quantities and can drive the world's machinery without the need of coal, oil, gas or any other of the common fuels." - Nikola Tesla

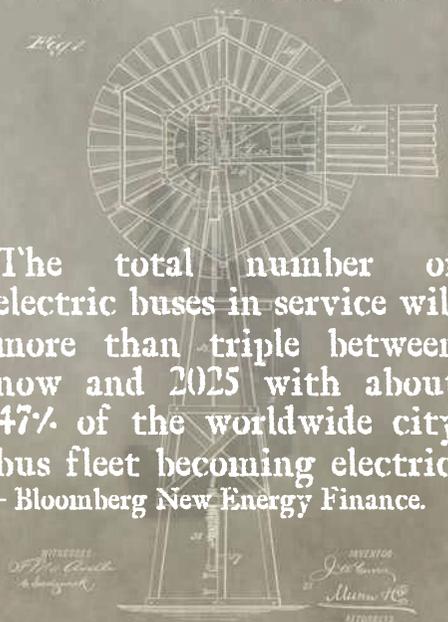


WINDMILL

J. W. CURRIE
WINDMILL

No. 409,932.

Patented Aug. 27, 1889.



The total number of electric buses in service will more than triple between now and 2025 with about 47% of the worldwide city bus fleet becoming electric.
- Bloomberg New Energy Finance.

SCANNING THE HORIZON...

As stated it's difficult if not impossible to discuss the energy and transportation sectors without mentioning innovation. From Edison's light bulb to unconventional production or clean energy, there are plenty of examples.

Take a look at just a few figures, unconventional gas now accounts for 40% of US natural gas production leading to a glut that has provided US manufacturing & chemical companies the benefit of lower input costs and for the US to become a net exporter. Renewable technologies accounted for 43% of total power capacity added in 2016. The International Renewable Energy Agency projects that the cost of battery storage for stationary applications will drop up to 66% which should in turn stimulate a 17-fold growth in global installed battery storage. Stationary battery systems are a central cog in the future of renewable energy solutions.

Distributed electrification technologies enables the key changes in the areas of electricity generation, supply and distribution. In the future such changes will be driven by a large number of market players, from major corporations and grid operators to regional alliances and private micro units. Increasingly renewable energy will be produced on a decentralized basis. Digitalized applications and services will affect all levels of the electrical system. "Smart" converters will be added to passive grid components such as switches and transformers. New storage technologies are required, along with solutions that facilitate the quick recharging of batteries as well as mobile battery solutions which are at the core of the spread of "e-mobility."

This will not just be for the much publicized electrical cars, in fact we see the urban transit infrastructure such as public buses, refuse removal and tram services as well as goods/services delivery transportation as more attractive initial avenues for wide and profitable adaption. Scalability around energy hubs, set routines and fixed routes makes them ideal for electrification and eventually automation. Major global cities are already leading the way in this space and state and national governments led by China are pushing aggressively to implement low-emission strategies for their urban spaces. Another interesting area is electrified and eventually fully automated shipping solutions transporting cargo around the world. Yara International, the innovative Norwegian agricultural crop solutions group, will take delivery of the world's first fully electric and autonomous containership with zero emissions later this year.

When looking at the future of innovation and especially at the energy and transportation segment it's key to consider the impact of exponential growth. The pattern-seeking human mind is built for the observable linear universe, but it has cognitive difficulty recognizing and understanding exponential growth. Using Moore's Law, the current growth rate of new technologies roughly doubles every two years. In the transportation sector, the global penetration rate of EVs was 1% at the end of 2016 and is now about 1.5%. However, a doubling every two years of this level of usage would lead to an automobile market that primarily consists of EVs in approximately 12 years. A side effect would be a reduction in gasoline demand and subsequently in international oil revenues to a degree that is unfathomable to the linear-thinking mind.

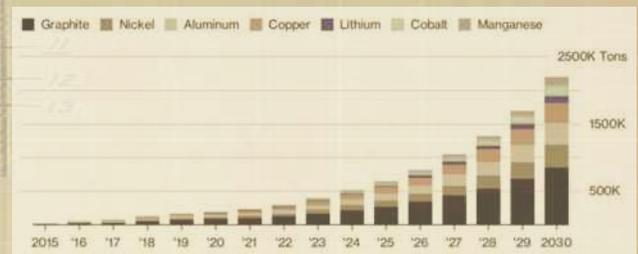
The energy landscape is changing rapidly, nations, companies and investors better take note. As discussed renewable energy sources are well into their exponential growth curves and at this juncture ahead of EVs. **Albert Einstein is rumored to have described compound interest - another form of exponential growth - as the most powerful force in the universe. Success loves preparation. Investors best be ready for some real change.**

It's all about the Batteries...



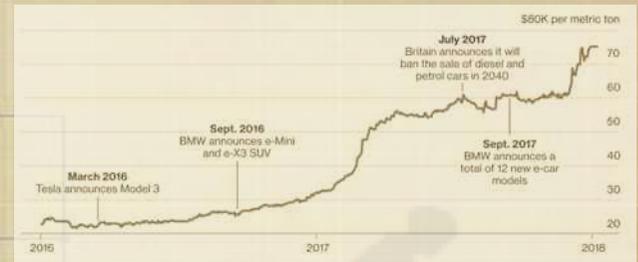
Demand surge...

Metals & materials demand from EV lithium-ion batteries.



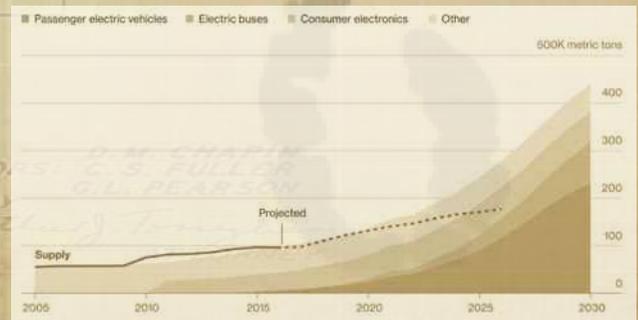
Cobalt prices rapid rise...

Cobalt prices jump amongst the largest in commodities.



Cobalt a scarce metal in high demand...

Finite supply meets infinite demand.



Sources: BNEF, LME, USGS, Avicenne & CRU.

AUTOMATION FRIEND OR FOE?

The last sector we will look at in this report, with potential for innovation at the center of an economic segment with strong supporting fundamental trends, is Automation including A.I. ("The Answer" in this context is Artificial Intelligence and not Alen Iverson) and how it can offset the demographic challenges, with declining birth rates and aging populations, faced by the developed world and China. And perhaps even turn the common perception; that a 'graying' economy is automatically a declining one, upside down. Automation could provide the productivity boost for economic growth projections that would otherwise be hard to reach.

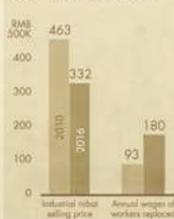
A recent study by Mckinsey Global Institute calculated that automation could increase global growth by 0.8% to 1.4% annually, assuming that people replaced by automation largely rejoin the workforce in other capacities. A study by Bain Macro Trends Group estimates that as much as \$8 trillion could be invested in automation technologies by 2030. Falling capital costs in robotics and rising labor costs in places like China reduce the payback period for automation and in turn prompt higher investment in automation. China has seen a 10 fold increase in purchases of industrial robots between 2009 and 2015. Japan – who faced these challenges before everyone else – is the leader in this space. With the oldest population in the world Japan has made progress with dealing with a shrinking and ageing labor force. These challenges stimulated research and development in areas such as robotics and domestic automation, while it's only home to less than 2% of the world's population it accounts for 20% of its R&D. Furthermore through its culture of not just focusing on developing new products but on optimizing the industrial process or 'Monozukuri' – literally the "art of making things" & 'Kaizen' the Japanese word for "improvement" as a reference to the business practice of "continuous improvement" – it has established a basis for doing more with less that could put it and its companies ahead of the demographic curve.

The next stage is already well under way, in the past automation has meant industrial robots and computer hardware and software designed to carry out predictable and routine tasks requiring physical strength, exertion and precision and the repetition of logical tasks such as calculation. With robotics, A.I. and machine learning, what we see as 'automation' appears poised to take on a greater share of high-productivity jobs and an array of tasks that were previously the domain of humans. Automation of this sort includes self-driving vehicles and diagnosing disease. In fact automation is set to play a wider role across all the economic sectors we identified earlier – Energy & Transportation, Agriculture & Fresh water, Healthcare & Pharmaceuticals and Military Equipment as well as areas such as mining and retail. Another sector that could be positively affected is the Education sector as for this to be a broad success, displaced workers must be given the opportunity to upgrade their skills effectively and young people entering the workforce will need to have advanced relevant learning under their belt. Lifelong learning will be key to harness the positives of these strong trends, for individuals, companies and governments. Start thinking about it now and if you have young people in your life, the discussion should be started now – How can you become a creator and not just a consumer who exchanges your time doing routine tasks for money? Companies and investors should look at their strategies through the same lens.

The powerful dynamics behind the drive towards further automation...

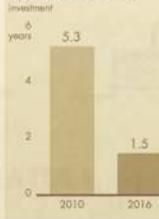
Falling capital costs and rising labor costs in China ...

Price of industrial robot vs. labor



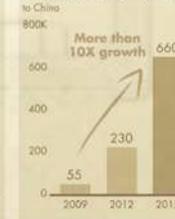
... Reduce the payback period for automation ...

Payback period on automation investment



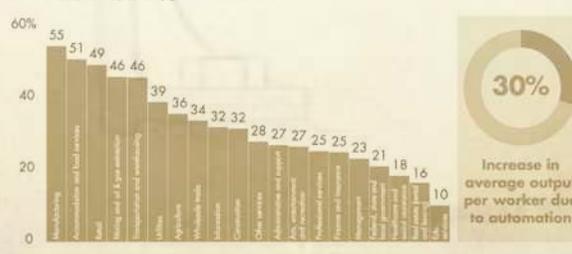
... And prompt higher investment in automation

Annual shipments of industrial robots to China



Notes: Annual wages of workers replaced by industrial robots estimated using rate of three workers per robot and average annual wages in respective years. Source: Financial Times, Bain Macro Trends Group analysis, 2017

Automation-driven labor productivity growth, 2015 vs. 2030



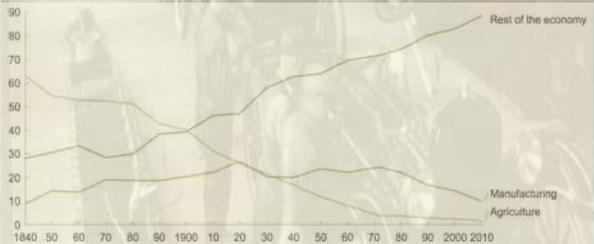
Notes: Labor productivity measured in dollars of gross output per employee; projections do not include baseline forecasts of labor productivity growth. Source: US Bureau of Economic Analysis, US Bureau of Labor Statistics, Bain Macro Trends Group analysis, 2017

Automation seen through the lens of history:

Automation is not a new phenomenon, questions about its promise & effects have long accompanied its advances. More than 50 years ago US President L.B. Johnson declared:

“Automation can be the ally of our prosperity.”

Distribution of labor by sector in the US (1840-2010)



Source: Mckinsey Global Institute.

Humans have always shifted away from work suitable for machines and to other jobs. This was true in the 1930s, when the shift was away from agriculture, through the 1990s and early 2000s, when the shift was largely out of manufacturing.

In short, history is reassuring about the impact of technology on employment. For some workers new technology can be disruptive, over time, if the past is any indication, creation will triumph over destruction.

We are left with a question: When our machines release us from ever more tasks, to what will we turn our attention? With the "bread" taken care of will we be further drawn in by the "circuses" or will idle hands and minds lead to further conflict or will we finally have time to take on more of the problems facing humanity? Time will tell.

IN SUMMARY:

It has been well said that the key to success is to invest ahead of the path of progress. In order to do this one must devise an investment strategy that focuses on monitoring broad trends and implementing active investment strategies that capture such broad changes while avoiding becoming blinded by the bright mirrors in the temple of technology. Generally, as with most investing related matters timing is key, watch for sustainable long-term trends in society, technology and the global economy to gauge when specific sectors are prone for disruption and Mr. Braudel's "ceiling that can resist the pressure no longer" so we are set for a rapid acceleration of a technical breakthrough in the selected sectors.

3 Sheets-Sheet 1

Taking the Macro & going Micro - Developing an investment universe:

It has been the case that the nature of industrial innovation in our chosen sectors tend to be housed within larger companies. Such companies has significant R&D budgets and the capability to buy up smaller operators with strong ideas, patents and human capital that can be leveraged within a larger organization with global networks and decades of experience in implementation and bringing solutions to market. An investor can find good balanced long term risk/return opportunities in large public companies across our chosen sectors to act as a strong foundation for an innovative technology focused segment of the portfolio. With the comparatively predictable and ready liquidity of such positions one can allocate more concentrated positions to high-conviction positions with the ability to operate effective risk management strategies and underpinned by greater transparency – price discovery as well as proven track records and public filings. . In some cases sector ETFs can also be a useful tool for capturing a broad developing trend. This can be complimented by more aggressive positioning directly in Venture Capital type investments – directly and/or via funds – if you have the required time horizon, risk appetite and ability to process more complex information inputs.

Caveat Emptor before entering the temple of technology investment:

There is plenty of positive coverage of the VC industry currently, with stories of 'moon shots' and 'unicorns' as far as the eye can see in Silicon Valley & Alley, Shenzhen, Silicon Wadi and the Silicon Roundabout - billion dollar start-ups are all around if one is to trust the private market valuations (Juicero & Theranos might have been canaries in the silicon mine). The longstanding reality that illiquid investments should trade at a discount has been reversed. The VC fund marketing machinery is out in full effect with geniuses-du-jour holding court discussing the next 'new new' thing about to disrupt our world at fancy conferences. Even more frothy is the 'new new new thing' the so-called ICO market where you get a 'token' (Something akin to a mix of company scrip & a token you get at the supermarket to release a shopping trolley but electronic) from a business with nothing more than a 'white paper' to back up its supposed astronomical valuation and little in the way of old fashioned things like a legal agreement or an actual share of the business is apparently required. The words of J.K. Galbraith springs to mind;

"There can be few fields of human endeavor in which history counts for so little as in the world of finance. Past experience, to the extent that it is part of memory at all is dismissed as the primitive refuge of those who do not have the insight to appreciate the incredible wonders of the present."

Before immersing yourself into the glossy pool of promotional materials of the VC Fund industry, for a variant perception, take time to review the 2012 study by The Kaufman Foundation; "We have met the enemy...And he is us: Lessons from 20 years of the Kauffman Foundation's investments in Venture Capital Funds and the triumph of hope over experience." In summary here are some of their conclusions: "Top-quartile & Vintage-Year performance reporting is, at best not fully informative, and is, at worst, misleading. The average VC fund barely manages to return investor capital after all fees are paid. VC mandates do not produce "VC returns" that exceed a public equity benchmark by 3-5% per year. The life of a VC fund is frequently longer than 10 years. VC funds are structured to invest capital for 5 years and to return capital within 10 years, but we see a large percentage of our fund lives extending to 12 to 15 years. Big VC funds fail to deliver big returns. We have no funds in our portfolio that raised more than \$500 million and returned more than two times our invested capital after fees."

Spotting a technology driven bubble - The key conditions:

The emergence of a new and potentially transforming technology about which extravagant claims can be made with apparent justification. A climate of relatively easy money and credit conditions. General investor and consumer optimism. A wave of new publications promoting the merits of the new technology. An efficient and productive supply machine, capable of creating a host of new ventures to meet investor demand. Suspension of normal valuation and other assessment criteria. Early success stories delivering copious and reinforcing injections of the notorious 'Fear Of Missing Out' (FOMO) drug.

LETTING HISTORY BE THE GUIDE...

"My two main conclusions are that technology develops cumulatively, rather than in isolated heroic acts, and that it finds most of its uses after it has been invented, rather than being invented to meet a foreseen need. (...) Because technology begets more technology, the importance of an invention's diffusion exceeds the importance of the original invention. Technology's history exemplifies what is termed an autocatalytic process: that is, one that speeds up at a rate that increases with time, because the process catalyzes itself." - Jared Diamond 'Guns, germs & steel - A short history of everybody for the last 13,000 years.

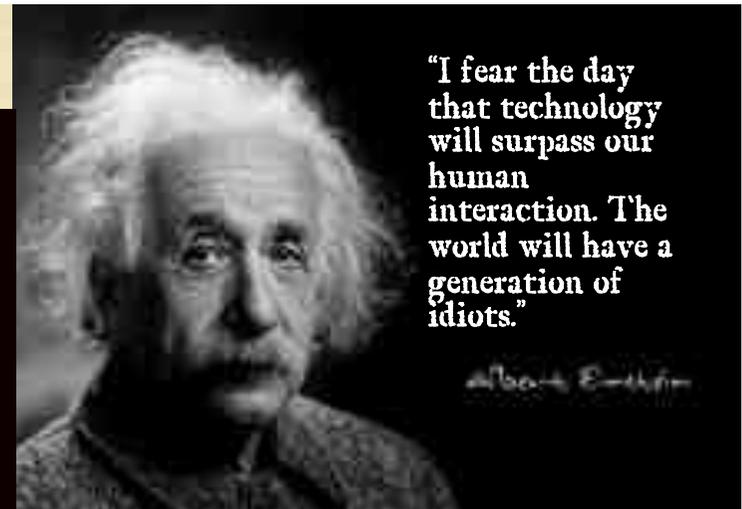
"Real energy expansion thus began with the mining of hydrocarbons, which added a vertical dimension to the energy frontier. (...) Canals solved much of England's internal transport problem at the same time as Newcomen's simple steam engine drained the mines to expand the vertical frontier downward. On the basis of Newcomen's work Watt in the 1770s produced the first steam engine efficient enough to be used off the coalfield. This, plus Arkwright's contemporaneous software innovation of the factory system, began the Paleotechnic phase of the industrial revolution. These innovations, all British in origin, were more than enough to ensure British success in the fourth world leadership cycle at a time when British commercial and advanced organic polity seemed in decline in the face of France and revolutionary America." - P.J. Hugill 'Geography, Technology & Capitalism - World trade since 1431.'

Random thoughts from the journey...

Don't judge a book by its cover...



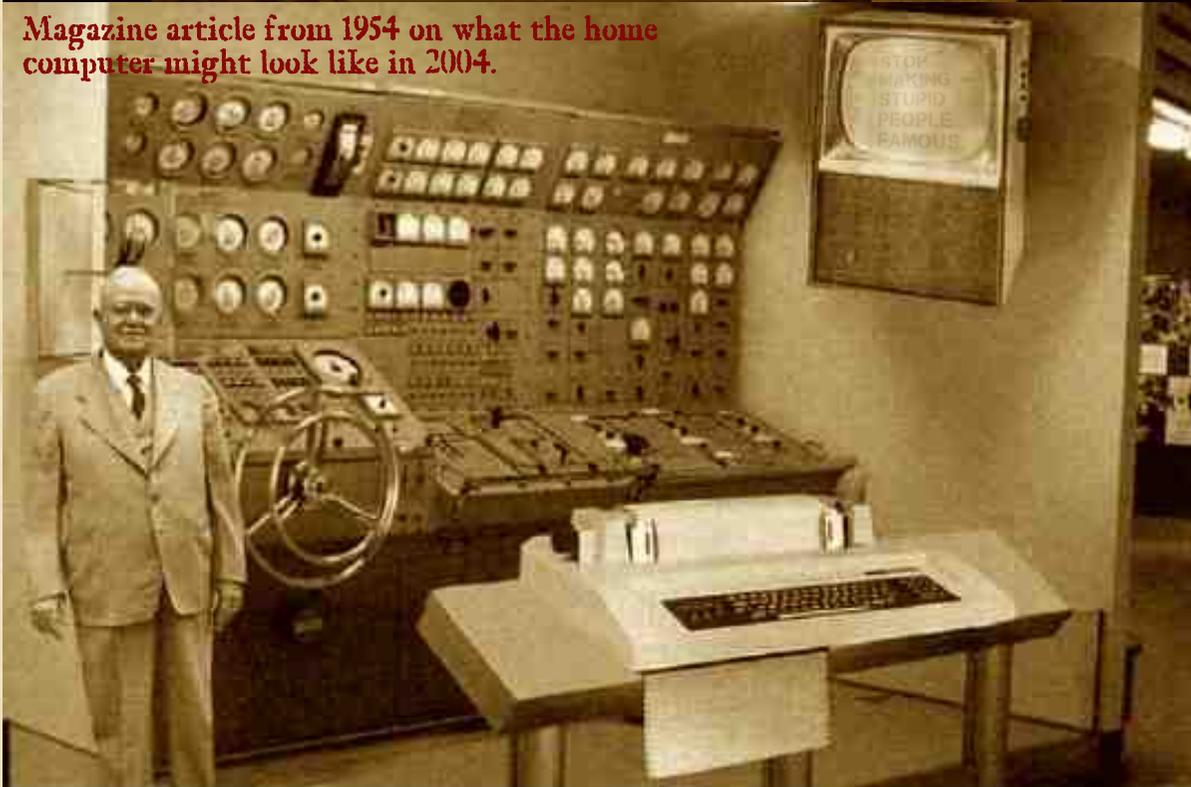
Jeff Bezos 1999



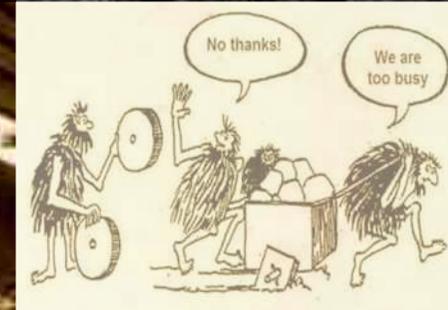
"I fear the day that technology will surpass our human interaction. The world will have a generation of idiots."

Albert Einstein

Magazine article from 1954 on what the home computer might look like in 2004.



Scientists from the RAND Corporation have created this model to illustrate how a "home computer" could look like in the year 2004. However the needed technology will not be economically feasible for the average home. Also the scientists readily admit that the computer will require not yet invented technology to actually work, but 30 years from now scientific progress is expected to solve these problems. With teletype interface and the Fortran language, the computer will be easy to use.



Timing 'an idea who's time has come' can be difficult...

We tend to overestimate what can be achieved in a year or two & underestimate what can be achieved over decades.

When it comes to predictions it's prudent to speak in probabilities not certainties. The ability to properly anticipate change is predicated upon detached analysis of fundamental information, applying that information to imagine a plausible world different from today's.

When investing in innovation for maximum returns you are investing around things that have not happened yet. Bring your imagination and a large dose of pragmatism and understanding of the lessons of history.

"INNOVATION IS CHANGE THAT UNLOCKS NEW VALUE." - J. Notter,

SOURCES & INSPIRATION...

In the words of Sir Isaac Newton: "If I have seen further it is by standing on the shoulders of Giants." On this page we humbly give thanks to those great individuals, source materials & books that made us think about things differently and provided us with the insights shared in this report.

The Books:

Civilization & Capitalism 15th–18th Century by **F. Braudel**.

The idea factory: Bell Labs & the great age of American innovation by **J. Gertner**.

Geography, technology & Capitalism: World trade since 1431 by **P.J. Huggill**

The New New Thing by **M. Lewis**

Guns, germs & Steel by **J. Diamond**

Engines that move markets: Technology investing from railroads to the internet & beyond by **A. Nairn**

Sweetness & Power: The place of sugar in modern history by **S.W. Mintz**

Watch this and be inspired...

Sail around the farm with **Bren Smith** for a new refreshing perspective on life, innovation & the search for a better way to do things:

<https://www.youtube.com/watch?v=j8ViaskIDSeI>

Take a trip with **Monica Araya** to a small country with BIG IDEAS & be inspired to rethink how we have been doing things & how we can do it better:

https://www.ted.com/talks/monica_araya_a_small_country_with_big_ideas_to_get_rid_of_fossil_fuels

For an abundance of 'outside the box' thinking watch **Peter Diamandis** talk about the path forward:

http://www.ted.com/talks/peter_diamandis_abundance_is_ourfuture-t-941438

The Reports:

Rethinking transportation 2020–2030. – **RethinkX**

Beyond the Supercycle: How technology is reshaping resources. – **Mckinsey Global Institute**

This army of AI robots will feed the world – **Bloomberg Businessweek**

This company's robots are making everything and reshaping the world. – **Bloomberg Businessweek**

Labor 2030: The collision of demographics, automation & inequality. – **Bain & Company**

A future that works: Automation, employment & productivity. – **Mckinsey Global Institute**

We have met the enemy...and he is us: Lessons from 20 years of investing in Venture Capital funds & the triumph of hope over experience. – **Kauffman Foundation**

"Of all the things, I liked books best."

– Nikola Tesla

ABOUT LIBRARIVM:

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We offer global accredited investors such as asset managers, family offices and institutional investors with monthly and quarterly publications providing an independent overview of global macro economic and geopolitical events and their implications on the world of investing.

We also provide intra-monthly event driven insights as a part of our constant horizon scanning services.

Our services can also be employed on a retained basis, providing the client direct & always confidential access to our team on an on-going basis allowing us to act as an independent sounding board for our clients ventures.

We prefer to work with a relatively small and select group of active clients allowing us to provide them and their projects with our full attention and as such we operate a limited amount of such partnerships.

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