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ANNUAL TRENDS CODEX

CODEX OF THE FUTURE SERIES

311 INSTITUTE

3RD ANNUAL EDITION . BOOKLET 7 OF 7

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BE BOLD . EXPLORE .

BUT FIRST COFFEE .

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ABOUT THE AUTHOR

Matthew Griffin, multi-award winning geopolitical advisor, leadership coach, and Futurist, and 15 times author of the smash Codex of the Future series, is described by his clients as a "Walking encyclopedia of the future" and a "Futurist polymath." Matthew is the Founder and Futurist in Chief of the 311 Institute, a global Futures and Deep Futures advisory looking up to 50 years out, as well as the World Futures Forum and XPotential University - two philanthropic organisations whose mission it is to solve global inequality and the world's greatest challenges.

Regularly featured in the global media including the AP, BBC, Bloomberg, CNBC, Discovery, Forbes, Khaleej Times, RT, the Telegraph, ViacomCBS, WIRED, and the WSJ, Matthew's ability to identify, track, and explain the impacts of hundreds of exponential emerging technologies and trends on global business, culture, and society is unparalleled.

Recognised as one of the world's most reknowned futurists, disruption, foresight, and strategy experts Matthew is an international advisor and keynote speaker who helps the world's most respected brands, governments, investors, NGO's, and royal households, explore, envision, and shape our collective future.

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PROUDLY BUILDING THE FUTURE WITH ... & MANY OTHERS

ABB
accenture
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BCG
Disney
DP WORLD
NOKIA
NOVARTIS
sky
standard chartered


adidas
Adobe
AON
ARM
citi
centrica
Coca-Cola
Deloitte.
EY
KPMG
LEGO
Legal & General
PEPSICO
Microsoft
Qualcomm
SAMSUNG
T-Mobile
UBS
VISA
WPP

WELCOME
FROM THE AUTHOR

PEOPLE . PLANET . PURPOSE . PROSPERITY

THE SKELETON COAST . NAMIBIA . 19.9873° S, 13.2605° E

I chose this striking image to represent this section because in many ways it's representative of many of today's realities: The Skeleton Coast is complex and unpredictable, but home to an amazingly adaptable ecosystem, yet it's also representative of the stark contrast between the have and have nots, those with water and other resources and those without, our increasingly polarised society, and even the contrast between our habitable blue planet and the desolation of space. The desert and the sea are also relentless, just like the human spirit, and given the right conditions they can overcome everything in their path, just as humanity can when we work together for the benefit of everyone to create a brighter future for all of us.

THE **311 Annual Trends Codex** contains explicit details about hundreds of trends that affect everything you care about - whether that's you, your business, your industry, your country, our planet, or all of them. Designed to be a one stop shop for everything that's trendy and trending it also contains everything you need to run your very own strategic foresight programs, model scenarios, and develop actionable initiatives and strategies to help you rule the future like a boss.

Furthermore, as our main trends Codex grows exponentially larger I've taken the liberty of splitting it into separate **Minibooks**, like this one, that make it easier for you zero in and focus on only the categories of trends that matter to you.

Most trends are like tides - relentless forces that are hard to control or influence. And, just like tides they can impact a great many things - both directly and indirectly. Having written Codexes that cover the latest emerging technologies and the latest disruptive business thinking, innovation, and strategy, I felt that creating the trends Codex was a natural next step to compliment them, and ergo provide you with a valuable expert set of resources that contain everything you need to design, debate, create, and shape your own future.

This Codex, like all my others, is a living book, it's always being updated with the latest trends and information so that you always have access to the latest insights and research, but perhaps its biggest benefit is that you can see every trend for everything in one place. This is important because since everything in our world is connected, as I've shared many times during my keynotes, this convenience allows you to easily stay abreast of changes in individual regions or sectors, technologies or trends - any one of which could impact the things you care about, even if the changes occur in areas that at first you don't think are relevant to you.

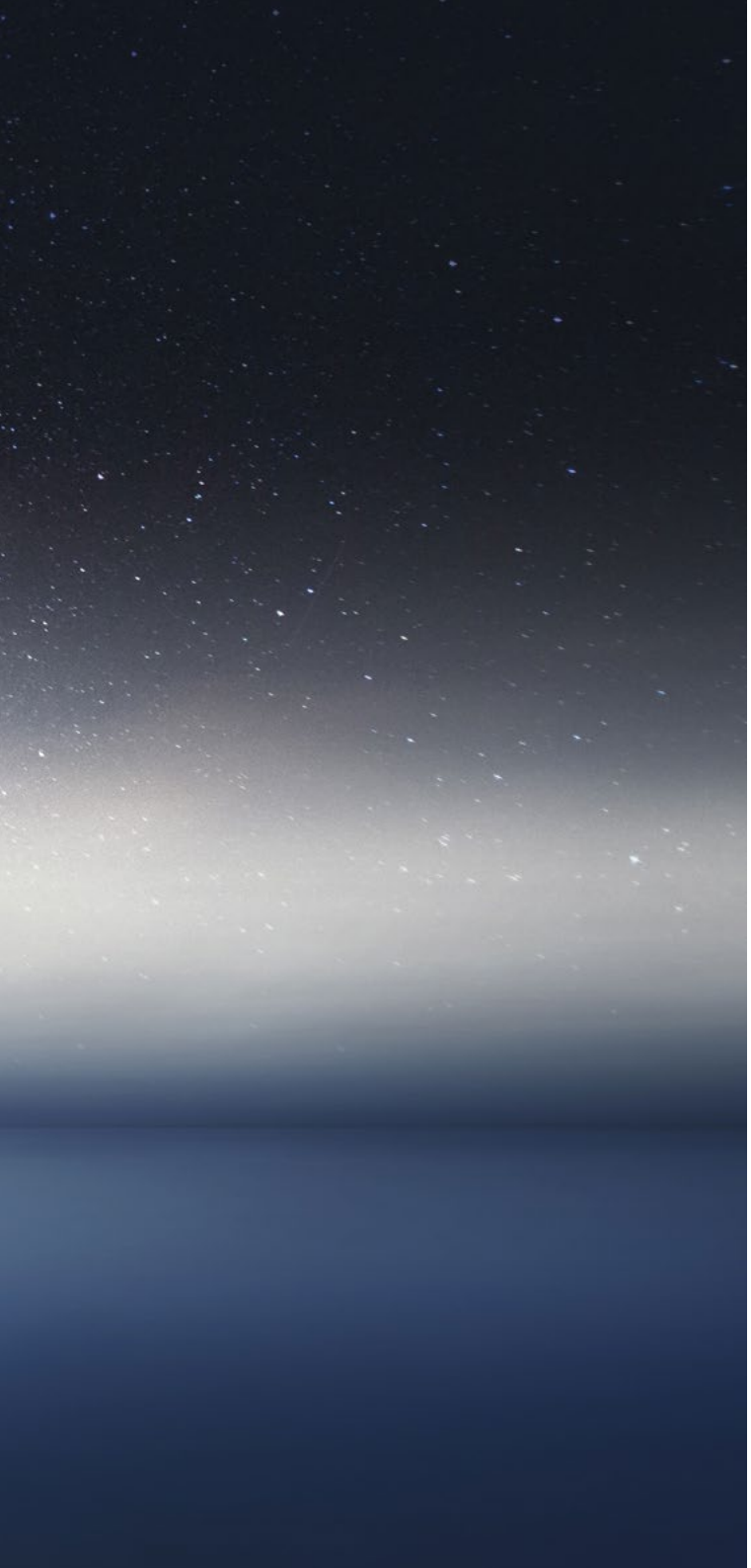
A simple but powerful example of this are the changes we see in the Energy sector where new energy generation and distribution technologies and trends are impacting everything from the business models and product development in the Transport sector, corporate ESG initiatives and Government policy making, climate change and other environmental trends, as well as the multi-trillion dollar investment portfolios of the global Financial Services sector - and far beyond.

No other trends book puts so many trends across so many categories, lines of business, and sectors in one place, or makes them so accessible, and that you might say is this books USP. That is, of course, if tens of thousands of insights and statistics at your fingertips aren't enough already!

Explore More,

Matthew Griffin
Founder and Futurist in Chief

USING THIS TRENDS MINIBOOK



WITH SO many trends shaping our world and with more emerging all the time it's easy to get overwhelmed and fail to grasp their individual and collective impact on the things you care about. As a result I've done my utmost to make this Minibook, which is a verbatim extract from my main **311 Institute Annual Trends and Foresight Codex** and that you can download in full from our company website, as easy to use as possible.

In this section you can learn more about how to use the Trend Sheets to get the information you need, and can see the complete list of trends included in this minibook - with more being added all the time.

CLIMATE CHANGE

2ND YEAR ON THE LIST

QUICK TAKE

Scientists saw it coming in the 1950's. They called it out and made films about it in the 1980's. And now, over forty years later individuals, governments, and organisations are starting to take unilateral global action to tackle Climate Change with many scientist arguing that we are now too late to avoid a "life altering" 1.5C increase in average global temperatures, and that we are within years of crossing a climate tipping point which will see its devastating global effects accelerate and create a run away cascade of **Extreme Weather** and devastation.

Data sources: IPCC, National Geographic, WWF, and various.

IMPACT

The impact of Climate Change can be seen everywhere - from the changes of the seasons, and the subtle changes in the flora and fauna in peoples gardens, to the tree covered mountain slopes that used to be buried by glaciers and snow, to the expanding deserts of the Sahara, and the deep of the oceans. It impacts every living thing and every natural system on Earth.

From longer frost free growing seasons, to changes in global rain patterns, longer droughts and more intense heat waves, and more extreme weather, to more powerful hurricanes and higher sea levels, the consequences are as varied as they are acute.

If the world warms by 1.5C then the Arctic Ocean will become ice free once every 100 years, with extreme hot days in the mid-latitudes being at least 3C hotter than pre-industrial levels, and sea levels could rise by up to 0.77m, with a further decrease in global bio-diversity of between 5% and 8%. Meanwhile corals could decline by at least 70% with marine fisheries annual productivity declining by at least 1.5 Million tons. And a 2C rise would be exponentially worse for people and planet.

EXAMPLES

Earth is mission critical for humanity and all life on Earth. And as the rate of Climate Change accelerates we continue to see a variety of records being set and smashed with climactic events that used to be once in a century becoming once a decade, and then the norm. And examples of these are plentiful.

Greenland's ice sheet, the world's second largest after Antarctica, is now melting 12 times faster than in the past 12,000 years and loosing over 532 Billion tons of ice a year - and that rate is accelerating. Not only does this melt account for almost 25% of today's sea level rise, but in 2021 the melt rate accelerated even further when, during a time when temperatures in the region were already 18C higher than average, three days worth of rain - where the rain itself was a first for the region - dumped over 7 Billion tons of rain water onto the ice sheet.

And, from the world's biggest, deadliest, and most damaging floods, to the world's biggest, deadliest, and most damaging droughts, heatwaves, hurricanes, and wildfires almost every country on the planet is now feeing the damaging impacts of climate change.

ACT NOW

As we see elsewhere in our universe, from the dust dunes of Mars to the acidic oceans of Venus, our planet will always be able to adapt to new climactic conditions. But life on Earth will find it increasingly difficult as Climate Change accelerates and its effects become more extreme and pronounced. Therefore, ironically, tackling this trend is more about saving humanity's future than the planets.

EXPLORE:

- Carbon Capture and Storage
- Emerging technologies and technology roadmaps
- Future of Agriculture, Energy, Government, Manufacturing, Sustainability, Transportation, and Work
- Net Zero Pledges
- Unilateral global accords and coordinated global action

USING THE TREND SHEETS

IN THIS codex we've gone to great lengths to document the major trends affecting all sectors and line of business operations and simplify them for you. Furthermore, we're always surfacing more trends which is why this codex is regularly updated. As a result each trend contains all manner of action points, details, insights, and stats that you can use to your advantage, whether it's developing scenarios and strategies using the frameworks in this and our **other codexes**, or whether it's just exploring the art of the possible. This is the key to the sheets:

1 / UNITED NATIONS SDG NUMBER

The UN SDG most impacted if you act on the trend.

2 / TREND NAME

The most appropriate name for the trend.

3 / YEARS IN THE CODEX

How many years the trend has been listed in our codex since the first edition.

4 / TREND LONGEVITY

LONG MEDIUM SHORT

The trends longevity and how long it is expected to have an impact for.

5 / TREND PRIORITY

The higher the number the more attention and weight you should give the trend.

6 / TREND MOMENTUM

ASCENDING FLAT DESCENDING

The overall momentum of the trend.

7 / TIMING OF THE TREND

HERE NOW EMERGING DISTANT

When the trend is expected to have a measurable and pronounced impact.

8 / RELATED TRENDS

Other trends that either impact the trend or are impacted by it.

9 / DATA SOURCES

A list of our data sources for the trend.

10 / IMAGE

An image to portray the trend.

11 / ACTION

The action we suggest organisations take now based on the available data.

12 / EXPLORE

Other things you can or should explore to better understand the trend and how to solve or use it to your advantage.

13 / DISCOVER MORE

Click or scan the QR code to access more website resources related to the trend.

TRENDS CONTENTS

SECTION CONTENTS

" FOLLOW THE TRENDLINES NOT THE HEADLINES . "

- William B. Clinton, 42nd US President

AEROSPACE INDUSTRY TRENDS

CONTENTS

BOOK AN EXPERT CALL

WHAT IF ... EVERYONE COULD ACCESS SPACE?

EVERYTHING CHANGED when in a ground breaking move Blue Origin, SpaceX, and an international coalition of aerospace organisations launched the "Space for All" initiative that, by leveraging advancements in reusable rocket technology, economies of scale, and international subsidies saw the cost of accessing Low Earth Orbit plummet to the cost of an international commercial flight. Space - once the domain of astronauts and the wealthy - was now accessible to everyone.

Initially public reaction was a mix of awe, ethical debate, and excitement. Crowd funding campaigns sky rocketed to send underprivileged youth and community leaders to space, offering perspectives and opportunities previously unimaginable, while schools around the world added the "Galactic Learners Program" to their curricula, incorporating real-time virtual classroom sessions conducted from space stations - bringing a new dimension to STEM education and inspiring a generation that now saw space as an attainable workplace.

Despite these upsides though the democratisation of space also had its drawbacks. Space junk grew exponentially as everyone excitedly launched everything from time capsules and urns to their own mini-satellites into space, and environmentalists amped up their warnings about the impact frequent rocket launches were having on the Earth's fragile biosphere. Ethical debates raged too over who had the right to claim and exploit extraterrestrial resources, and questions about the jurisdiction and governance of new celestial territories became pressing issues for the UN, leading to the formation of a new branch specifically focused on extraterrestrial law and diplomacy.

Despite the challenges though, the human perspective underwent a seismic shift. The famous NASA astronaut "Overview Effect," first coined in 1987 and until now only experienced by a handful of astronauts, became a widespread phenomenon. Humanity saw its home planet without borders, a fragile blue sphere hanging in the vast emptiness of space, and the urgency to address Earth's environmental, political, and societal issues gained new momentum, fuelled by a universal epiphany of our planet's vulnerability and humanity's interconnectedness.

STATS THAT MATTER

30%

USA AEROSPACE SPEND, PERCENT, GLOBAL TOTAL

MODORI

1.26 KG

SMALLEST SATELLITE IN ORBIT, 2023

ISRO

2.5 ML

PEOPLE EMPLOYED, GLOBAL TOTAL 2023

ITA

$2.7 TR

IMPACT OF INDUSTRY ON GLOBAL GDP, 2023

AIAA

$1,400 PER KG

COST OF LAUNCHING 1KG INTO ORBIT, SPACEX FALCON HEAVY

WHO

$741 BN

INDUSTRY REVENUES, GLOBAL 2022

PWC

$107 k

AVG AEROSPACE ENGINEER SALARY, US 2022

BLS

AEROSPACE

186

ORBITAL LAUNCHES, GLOBAL TOTAL 2022

NATURE

7,702 SATELLITES

NUMBER OF SATELLITES IN ORBIT, GLOBAL TOTAL 2022

ORBITING NOW

31

TOTAL SPACEX LAUNCHES, 2022

SPACEX

ALTERNATIVE LAUNCH SYSTEMS

2ND YEAR ON THE LIST

The Suborbital Accelerator, SpinLaunch

QUICK TAKE

New technologies and new wealth are **Democratising Space Access** and helping accelerate the **Privatisation Of Space**. As a consequence there has been a significant increase in competition, and therefore innovation, in the sector innovators from all corners of the world now doing their level best to create the launch systems that could dominate the 21st Century.

However, while there are many approaches everyone in this space is ultimately trying to get people and goods into space for the lowest possible cost at the fastest possible rates.

Data sources: AMR, PWC, SpinLaunch, and various.

IMPACT

This trend will further lower the cost of accessing space while at the same time increasing launch frequency, both of which will have significant impacts on businesses in space as well as here on Earth. It has also had another impact, namely the creation of a new space race, which some have dubbed Space Race 2.0, and led many to question the future role and viability of government sponsored space agencies such as ESA, JAXA, NASA, and ROSCOSMOS, among others, who in time will either be replaced by these organisations or become their customers.

In 2019 the global space launch services market was valued at just under $10 Bn and it's projected to grow by 15.7% CAGR to reach over $32 Bn in 2027, and that's before we factor in new use cases enabled by this, and other associated trends, such as the ability to transport both civilian and military cargo and people trans-globally via Low Earth Orbit (LEO). Additionally, the increase in launch volumes and their environmental impact has sparked a race to create greener rocket fuels and the ultimate sustainable launch systems such as **Single Stage To Orbit** (SSTO) systems.

EXAMPLES

With lowering costs and increasing launch frequency and reliability all a priority for the sector there's naturally alot of activity and innovation in this space. While we have seen dramatic advances in the development of **Reusable Rockets** from organisations such as SpaceX and others we have also seen the parallel development of pylon mounted launch systems from organisations such as Stratolaunch and Virgin Orbit as well as centrifugal kinetic launch systems from the likes of SpinLaunch. All of which is before we discuss other promising launch systems such as electromagnetic and rocket sled launch systems and developments in the SSTO space. The latter of which has Boeing very excited.

While all of these developments are significant in their own ways though when it comes to what is arguably the most efficient way to get goods and people into space, namely Space Elevators, not only have JAXA successfully tested a space based proof of concept, moving goods between two tethered satellites, but the Chinese have now developed new Carbon Nanotube based materials that might be able to manage the stresses and strains.

ACT NOW

When we watch science fiction films very few of them, if any include spacecraft that look like anything we have today, but as long as we live on a planet with gravity we're going to have to try and find the most optimal way of breaking free of it and, as the space industry continues to grow it's clear that in the future we will have many options.

EXPLORE:

- Business and impact assessments
- Emerging technologies and technology roadmaps
- Future of Energy, Manufacturing, and Space
- New business and operating models
- Partner ecosystems and solutions

BOOK AN EXPERT CALL

EXPLORE STARTUPS & MORE

DEMOCRATISING SPACE ACCESS

2ND YEAR ON THE LIST

The asteroid Psyche

QUICK TAKE

One of the greatest hurdles to opening up space to pioneers and others used to be the cost and complexity of launching goods and people into space, but now thanks to new business models, launch systems, and other enabling technologies both of these have fallen by hundreds of multiples and are continuing to fall further.

Furthermore, as we project forwards it's increasingly easy to see a point in time where accessing space will be as easy and cheap as boarding a commercial aircraft, at which point accessing space will become commonplace for all.

Data sources: Morgan Stanley, and various.

IMPACT

When it comes to assessing the impact of increased access to space - both from a military and a commercial perspective - there are a lot of variables to take into account.

On the one hand it's estimated that commercial revenues from the sector will grow from circa $250 Billion to over $550 Billion by the year 2030, but on the other new technologies that open up new opportunities could push that figure into truly astronomical territory - one such example would be emergence of commercially viable asteroid mining with just one asteroid alone, Psyche, being worth between an estimated $700 and $10,000 Quadrillion in resources. As you can see when these "non-traditional" or new business opportunities are included in the models everything gets wildly skewed.

Coming back down to Earth though, metaphorically at least, we are now seeing the emergence of true space tourism, preparation for the first permanent Mars and Moon colonies, as well as new space based internet systems, space based manufacturing facilities, and solar plants, and much more - and we're just getting started ...

EXAMPLES

In the 1980's and the Space Shuttle era the cost of getting one kilo into space was $54,500 and the average vehicle turn around time was 54 days.

Fast forwards to today and those figures are $2,750 with a 1 day turnaround, and in the very near future with rockets such as the SpaceX Falcon Heavy that will fall even further to $2,350 to get to LEO and $5,620 to GTO orbits. Putting this into perspective within just a few short decades the cost of accessing space will have fallen by a staggering 99% and it's only going to get lower as the cost of producing fuels such as LPG and Methane plummet and as the reusable launch systems become cheaper, more reliable, and more cost effective.

These near term future costs also don't take into account the ability to 3D print assets on Earth and in space, the development of **Alternative Launch Systems** and **Single Stage to Orbit** systems, or perform **Off World Re-Fuelling**. So, while 99% might sound impressive as you can see we have plenty of scope to go even lower and make going into space as commonplace as getting on a bus.

ACT NOW

As the costs of accessing space continue to fall this opens up a vast array of new opportunities for companies that are prepared to invest and have vision.

EXPLORE:

- Business and impact assessments
- Emerging technologies and technology roadmaps
- Future of Space
- New business and operating models
- New space based product concepts
- Partner ecosystems and solutions

OFF WORLD RE-FUELLING

2ND YEAR ON THE LIST

Starship in orbit re-fuelling system, SpaceX

QUICK TAKE

As mentioned in the **Privatisation Of Space** trend Jeff Bezos is building a "road into space" that other entrepreneurs can follow and build on top of, and as we all know every road needs re-fuelling stations that ultimately let those people travel further and farther than they could have otherwise.

Consequently, as the process of Democratising Space Access continues governments and organisations alike are building the technologies and systems that will let space pioneers re-fuel their vehicles in orbit as well on distant planets and moons.

Data sources: Various.

IMPACT

Re-fuelling, or as some call it "re-filling," in orbit and off world has always been a problem and it's one of the primary reasons why satellites and other space assets end up crashing into the Earth's oceans when their finite fuel reserves run out.

While the ability to re-fuel satellites in orbit will extend their mission life it will also give them greater manoeuvrability because operators won't have to be so sparing their orbital manoeuvres. However, while there is a huge demand for satellite in orbit re-fuelling there is also an increasing demand, from almost all quarters, for the ability to refuel larger spacecraft, space stations, and other space assets including manufacturing and mining assets, in orbit and on the surface of moons and planets, as and when needed.

Not only will the ability to re-fuel off world significantly increase the lifespan of almost all space assets but it will also mean organisations can build rockets with smaller fuel tanks which, in the case of Elon Musk's interplanetary transport system, means he can build Starships just a tenth the size of what he would have had to if it wasn't an option.

EXAMPLES

With a wide variety of space assets benefiting from this trend organisations have had to develop new universal docking systems such as ESA's ASSIST system and Lockheed Martin's RAFTI system, whether those are for in orbit or ground based re-fuelling.

When it comes to the formats of the re-fuelling systems and tankers though there's a lot more design leeway with most in orbit re-fuelling systems naturally taking the shape of tankers, albeit advanced ones, and ground based systems taking the form of everything from what look like traditional Earth gas stations to more advanced and sustainable biofuel stations and farms.

This also highlights the double edged problem that organisations in this market are having to confront because as new fuels start coming online they not only increase the number of options space operators have to power their assets with but, in many cases, force either total or incremental design changes - all of which then have an impact on the cost, form, and function of these systems.

ACT NOW

Noone would ever imagine designing a car that had to carry all the fuel it would ever need with it, but for decades that's how rockets and other space assets have had to be designed. As off world re-fuelling breaks this paradigm it opens up a raft of new opportunities and markets for space pioneers so it is worth watching closely.

EXPLORE:

- Business and impact assessments
- Emerging technologies and technology roadmaps
- Future of Energy, Manufacturing, and Space
- New business and operating models

BOOK AN EXPERT CALL

EXPLORE STARTUPS & MORE

PRIVATISATION OF SPACE

2ND YEAR ON THE LIST

Oribtal Reef, Blue Origin

QUICK TAKE

Getting into space and being able to utilise it used to take government sized budgets, and today it still does, but not quite as much. However, while the cost of space programs are still high, and in most people's eyes still unaffordable for mere mortals and organisations, in the past couple of decades the significant increase in the number of ultra wealthy individuals, and their wealth, now means that funding these multi-billion dollar programs is little more than pocket change. And it's this, which also contributes to the **Wealth Inequality** trend, that's now changing the future of space and the space industry.

Data sources: Blue Origin, Forbes, and various.

IMPACT

One of the greatest impacts of this trend is that governments no longer dominate or own the future space agenda. In other words, in the past while they would have listened to the voices of private industry they ultimately had the last say. Now though, for the most part, the shoe is on the other foot and while private industry still has to abide by certain regulations and rules they are increasingly free to pursue and promote their own agendas.

One apt analogy perhaps would be that the pilot in the aircraft has changed, and now it's governments who are increasingly coming along for the ride.

While this might not sound great from a government perspective there are significant advantages for everyone involved. For example, free from having to build the space stations and rockets - the space "hotels" and "taxis" - to ferry and house people and goods into space organisations like NASA can now focus instead on higher value missions and tasks. It also increases commercial competition, which then helps when it comes to **Democratising Space Access**, which then accelerates all space based innovation activities.

EXAMPLES

Whether it's private individuals, to an extent, or private organisations taking the lead there are now all manner of examples that highlight the impact of this trend which just twenty years ago wasn't even on many people's radars.

Today these "privateers," which include companies as diverse as Axiom, Blue Origin, Boeing, Orion Span, Rocket Labs, and SpaceX, are busy building and planning everything from private space colonies and private space stations, complete with business parks, hotels, and research centers, to space based communications constellations - for both Earth and inter-planetary communications - and space based manufacturing facilities. And all of this is before we examine how they are opening up the door to space tourism.

So, when we say space is the new frontier, it literally is, and as Jeff Bezos has put it succinctly in the past, as far as he is concerned he wants to "Build the road that other entrepreneurs can build on top of."

ACT NOW

As the cost of accessing and launching people and goods into space continues to drop dramatically more people, many more than in the past, see space as a developing business opportunity. It's for this reason, along with others, why investment in space and the industry as a whole is now at record highs and why competition in the sector is hotting up.

EXPLORE:

- Future of Agriculture, Communications, Leisure and Tourism, Manufacturing, and Space
- New business and operating models

REUSABLE ROCKETS

2ND YEAR ON THE LIST

The Falcon 9 rocket, SpaceX

QUICK TAKE

As Elon Musk, the CEO of SpaceX famously said: "You don't throw an aircraft away after every flight." But for decades that was exactly what the space industry was doing and it was the major reason why the cost of launching goods and people into space remained so high for so many decades.

However, in 2017 after 15 years of effort that changed with the launch of the first Falcon 9 rocket and the rest, as they say, is history. And now every space organisation and program is following his lead with gusto and trying to best him.

Data sources: Relativity Space, SpaceX, and various.

IMPACT

The ultimate impact of this trend is to dramatically lower the cost of rocket launches, and therefore the cost of getting goods and people into space, and dramatically increase the frequency of rocket launches but getting to the point where rockets are as reusable as commercial aircraft has not been easy.

The concept of re-usability in the space industry is nothing new but it's always been seen by many as being impossible. However, now that SpaceX have cracked the code the genie is out of the bottle and over time we will see rockets performing multiple launches per day at increasingly accessible and affordable prices which, in turn, will then accelerate the maturation of the sector.

As the technology improves in both cost and reliability one of the more down to Earth based opportunities it will open up will be the use of rockets for inter-continental goods and passenger transportation - something which in time could very well end up disrupting the traditional airline and logistics industry.

EXAMPLES

While SpaceX is the undisputed leader of reusable rocket design there are plenty of organisations now working hard to best them with some now also focusing on the development of **Alternative Launch Systems** and **Single Stage To Orbit** systems.

Organisations such as Boeing and Rocket Labs who have been developing launch vehicles similar to SpaceX's, and organisations such as Relativity Space whose two stage reusable rockets, compared to SpaceX's single stage reusable rockets, are 3D printed with up to 99% fewer parts which, when netted out, would give them a comparable launch cost of $12 Million per rocket versus SpaceX's Falcon 9 cost of $60 Million.

However, as the race for space literally heats up other players such as Virgin Orbit are trialling Boeing 747 pylon based launches and other organisations are developing everything from centrifugal launch systems through to single stage Aerospike designs - all of which shows that there is now plenty of innovation in the sector which will have a material impact on the cost and frequency of future launches.

ACT NOW

Re-usability is a key factor in future rocket design and not only does it change the economics of the industry for the better, but it also has a dramatic impact on **Democratising Space Access**.

EXPLORE:

- Emerging technology and technology roadmaps
- Future of Energy, Manufacturing, and Space
- New business and operating models
- New space based product concepts
- Partner ecosystems and solutions

SINGLE STAGE TO ORBIT

2ND YEAR ON THE LIST

The Radian One SSTO, Radian

QUICK TAKE

While organisations around the world develop and invest in a variety of **Alternative Launch Systems** many argue that the ultimate launch system is a heavy lift reusable Single Stage to Orbit (SSTO) system that can take off and land in the same way that conventional aircraft do today, and while these have been in development for decades new technologies and methods of manufacture are now making them look increasingly likely and viable.

IMPACT

While there are still questions about the economic viability of SSTO's, especially when compared to more traditional vertical launch systems, SSTO's and their ability to standardise launch operations in a package that is operationally simple and much less complex than today's mutli-stage launch systems seemingly make them an ideal candidate to transport mid and large size payloads into orbit. But that said creating a practical and reusable SSTO that needs no, or minimal, refurbishment after each journey is no easy feat as researchers have been finding out first hand for the past thirty or so years.

At the moment current projections estimate that SSTO's could help reduce satellite launch costs from $18,000 per kg to $900 per kg which, needless to say, would be a significant decrease.

The question here though is then as **Democratising Space Access** continues to push launch prices down to historic lows can they get to those figures fast enough and carve out a market for themselves before the sector's other operators crowd them out.

EXAMPLES

Today there aren't many organisations actively developing SSTO vehicles, but that said the few that there are such as Aerojet Rocketdyne, NextAero, Radian, and Reaction Engines, are making significant enough progress that several organisations, including Lockheed Martin and NASA, have been trying to buy and partner with them.

Among the myriad of challenges facing the organisations in this space some of the most pressing include developing single stage engines capable of breathing and operating at orbital speeds in Earth's atmosphere, fuel selection and fuel to cargo ratios, material selection, miniaturisation, reusability, and, of course, "just plain engineering."

It's for these reasons why the space community remain divided on the future of SSTO, but with Reaction Engine's ammonia powered hypersonic SSTO SABRE engine and Skylon platform, Radian's delta wing rocket sled SSTO concept, and numerous Aerospike engines being developed and their test beds expanded it still looks like a case of when these vehicles will appear rather than if.

ACT NOW

When you watch science fiction franchises like Star Wars the rebels jump into their X-Wings and launch into space. There are no multi-stage systems there, or in any science fiction movie for that matter, and as we all know the visions the genre paint all too often have a way of becoming science fact so for my bet it's not a question if SSTO's will emerge it's when.

EXPLORE:

- Business and impact assessments
- Emerging technologies and technology roadmaps
- Future of Energy, Manufacturing, Transportation, and Space
- Partner ecosystems and solutions
- New business and operating models

Data sources: Boeing, NASA, Radian, Reaction Engines, Science Direct, and various.

AGRICULTURE INDUSTRY TRENDS

CONTENTS

BOOK AN EXPERT CALL

WHAT IF ... NOONE IN THE WORLD WENT HUNGRY?

IN A watershed moment for humanity officials marked the end of hunger worldwide. Fuelled by the combination of innovative AgTech 2.0 technologies, efficient and secure food distribution networks, and unprecedented international cooperation, governments and organisations finally succeeded in providing food security to every person on Earth and every corner of the globe.

The Director General of the UN declared this feat as the "single greatest achievement in human history," and for good reason. Eliminating hunger has triggered a cascade of positive outcomes. Education attendance and grades soar as children, no longer weakened by malnutrition or conscripted by their parents to farm the land, attend school with renewed energy, focus, and optimism, and globally productivity spikes across all sectors as adults everywhere put their physical and cognitive potential to full use, as rural communities flourish thanks to the adoption and ubiquitous availability of eco-friendly, high yield, and sustainable food production technologies.

Additionally, the world's healthcare systems, now unburdened by diseases related to malnutrition, divert vital resources to tackle other chronic conditions and emerging challenges, and social unrest recedes as the struggle for survival subsides, replaced instead by a surge in civic engagement and community projects. And topping it off the "Maslow Effect," as psychologists come to call it, reveals how fulfilling one basic human need has unlocked new levels of creativity and innovation across society.

However, the victory hasn't come without its challenges. Regulations on food production and distribution become a key focus to sustain this new world, and debates arise about the ethics of new food production methodologies, genetic diversity, and one of the greatest challenges of all - ensuring that the technologies enabling this golden age of plenty remain open source and accessible for all - sees the formation of a new UN branch, the International Food Stability Organisation (UNIFSO), which is tasked with monitoring these issues and ensuring that the world's food supply remains equitable and sustainable.

STATS THAT MATTER

AGRICULTURE

70 %

FRESH WATER USAGE, PCT. OF GLOBAL TOTAL 2022

UN FAO

690 ML

MALNOURISHED PEOPLE, GLOBAL TOTAL 2022

UN FAO

800 ML

PEOPLE EMPLOYED, GLOBAL TOTAL 2023

UN FAO

23.7 BN

NUMBER OF CHICKENS, GLOBAL TOTAL 2022

UN FAO

2.769 BILLION TONNES

APPROXIMATE TIER 1 CROP PRODUCTION, GLOBAL TOTAL 2021

UN FAO

50 %

HABITABLE LAND USED AS FARM LAND, GLOBAL

UN FAO

77 %

PERCENT OF FARM LAND USED FOR LIVESTOCK

UN FAO

176 ML

FISH PRODUCTION, TONNES, GLOBAL TOTAL

UN FAO

340 MILLION TONNES

MEAT PRODUCTION, GLOBAL TOTAL

UN FAO

1.3 BN

ANNUAL FOOD WASTE, TONNES, GLOBAL TOTAL

WRI

BOOK AN EXPERT CALL

EXPLORE STARTUPS & MORE

AUTONOMOUS FARMS

2ND YEAR ON THE LIST

QUICK TAKE

As the agriculture industry tries to improve productivity while reducing costs it's inevitable that, as with any industry, we are going to see technology taking a more central role and, among other things, that means automation and the increased use of robotics.

Over a century after the industry was mechanised, and accelerated by worker shortages of pickers in the US and Europe, which were exacerbated by sudden changes in immigration and visa policies, we are now seeing fully autonomous farms appear.

Data sources: World Bank, and various.

IMPACT

The ability to fully automate farm operations, from the tilling of soil and sowing of seeds to the monitoring and harvesting of crops, and in time certain livestock, using robotic systems and software, transforms the industry's operating model and, when you also consider the associated benefits of **Precision Agriculture** systems, increases yields while reducing costs.

In raw figures this trend increases food yields by at least 30% and reduces costs by up to 80%, but this also means that globally up to 1 Billion peoples jobs are at risk and, as we all know, many of these people are already among the poorest in society so this trend could accelerate **Wealth Inequality**. But this challenge isn't unique to this industry or trend.

As autonomous farms emerge though they do so against the backdrop of new alternative disruptive Agritech trends such as **Cellular Agriculture** and **Vertical Farms** which are already eating into traditional farmers markets and solving many of the problems this trend can't solve such as the impact of **Extreme Weather** on crop yields and other negative factors.

EXAMPLES

While there are plenty of examples of semi-automation in the farming community, such as autonomous vehicles and drone farm machinery, as well as all manner of autonomous robotic harvesting systems that can pick tens of thousands of soft fruits an hour, so far there are very few fully autonomous farms in commercial operation. However, given the trajectory of the trend, the problems it solves, and the pressure on global food supply it's inevitable it will become more common place over time.

The world's first traditional fully autonomous farm was developed in the UK in 2017, and by traditional farm I'm talking about the automation of an open air farm with fields. Dubbed the Hands Free Hectare Project no human was involved and machines managed everything from the drilling of channels for the Barley seeds to be planted by an autonomous tractor, to the spraying of chemicals and the tending of crops, to the harvesting of the crop using autonomous combines. Now, elsewhere organisations like Iron Ox, who have created their own fully autonomous vertical farms, are taking this trend into the future.

ACT NOW

As automation technologies, including **Artificial Intelligence** (AI) and **Robotics**, improve to the point where they can automate all manner of human and machine tasks we have the opportunity close the gap on food poverty, but it comes at another cost, a human cost, and we need to be careful to maximise the upsides while minimising the downsides as the industry transitions to new food production methods.

EXPLORE:

- Best practises and case studies
- Emerging technologies and technology roadmaps
- Future of Agriculture, Artificial Intelligence, Robotics, and the Workforce
- Operating models
- Partner ecosystems and solutions
- Policy and regulation reform

CELLULAR AGRICULTURE

2ND YEAR ON THE LIST

QUICK TAKE

Nature has been doing it for billions of years, namely growing meat, proteins, and other animal products via the natural process of cell division and replication inside animals.

Today though innovative entrepreneurs and new technologies are letting us replicate these processes outside of the animal in bioreactors which means that, for the first time, we have a way to feed everyone in the world wherever they are with animal free dairy, meats, and other products at sustainable quantities and scale, as well as avoid future "Food Wars" as the global population grows.

Data sources: Various.

IMPACT

The impact of being able to grow different animal products without the animal is not only game changing, it changes society's view of food and the role of animals in the human food chain, as well as our future health prospects. This trend also solves global hunger and answers the question of how we feed a growing global population and burgeoning middle class, but when you consider that animal products produced in this way are harm and hormone free, and organic, this trend becomes even more impactful and interesting.

Another benefit of this trend, or to be more accurate, technology is that it's scalable and that at its heart it's a manufacturing process meaning that over time, as we are already seeing, the cost of producing products in this way declines exponentially.

This trend is so disruptive to the existing farming status quo that in 2019 US farmers petitioned Congress to ban organisations producing meats in this way from using the word "meat" and while they won investors, markets, and regulators have since embraced and accelerated this trend, and it's now on the cusp of going mainstream.

EXAMPLES

The ability to produce all manner of animal products without the need for the animal by simply taking the appropriate cells from an animal - any animal even exotic ones - and growing them in a lab, or "food factory," to produce dairy, eggs, meat, soy and even leather, does nothing short of transform human culture and society and unwind humanity's relationship with traditional food production techniques.

While there are many examples some of the most pertinent that I'll share here include organisations like Just using chicken feathers to create chicken nuggets which can now be bought and consumed in Singapore restaurants after regulators approved them for sale.

Elsewhere organisations like Finless Foods are taking cells from fish to create Salmon and Tuna fillets, again in this case without the need to ever catch a fish. And the same story continues for dairy, whey, and soy products.

We can even use this same process to make proteins, which can be used to create alternative meats, from air using nothing more than air, bacteria, and electricity - courtesy of NASA.

ACT NOW

This trend makes it possible to make dairy, meat, proteins, and other food products anywhere on the planet using almost zero resources, asides from the infrastructure. Furthermore, with the development of synthetic growth hormones the industry finally has a path to deliver organic, zero emission, and near zero impact products at a delivered cost to the consumer of less that $5 per pound for meat - at which point they are cheaper than products sourced from traditional suppliers.

EXPLORE:

- Best practises and case studies
- Emerging technologies and technology roadmaps
- Future of Agriculture and Sustainability
- New business and operating models

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EXPLORE STARTUPS & MORE

PRECISION AGRICULTURE

2ND YEAR ON THE LIST

QUICK TAKE

Precision agriculture is the practice of using different technologies and tools that allow farmers to optimise and increase soil quality and food production with minimal cost and resources. It's also increasingly being referred to as Agriculture 4.0 which is a hat tip to Industry 4.0.

While all types of farming can benefit from this trend the main advantages are better productivity, a reduction in costs and waste, and less impact on the environment - all of which improve as the industry becomes increasingly automated and tech savvy.

Data sources: AEM, Statista, World Bank, and various.

IMPACT

Worldwide increases in food demands continue to soar, as the global population continues to grow and as people become richer, and that creates both opportunities and downwards pressure on producers who have to grapple with variable costs and increasingly variable weather conditions. And precision agriculture helps alleviate some of these pressures.

By 2028 it is estimated that the market will be worth $17 Billion and grow at 15% CAGR. However, as the technologies and tools powering the trend become cheaper and more ubiquitous adoption will inevitably accelerate as food producers around the world use it to better predict food yields and therefore farm revenues, as well as reduce costs and resource waste - which includes everything from equipment and fuel usage to herbicide, pesticide and water usage - while improving land quality and value, profitability, and sustainability, among many other benefits.

The trend will also help improve food security, and there are many other intangible benefits too.

EXAMPLES

By using everything from remote sensing and satellite technologies to fleets of agribots, drones, and smart devices which all collect and stream data that can be analysed by increasingly sophisticated AI models food producers now have a veritable army of cutting edge tools at their disposal to help them revolutionise their trade.

The consequence of this is that rural areas are now increasingly dominated by autonomous farm machinery and survey drones, texting cows, and all manner of smart crop monitoring, irrigation, and weeding systems, that are tied together and controlled by sophisticated farm management software. And as farms become increasingly automated and autonomous, with the first examples already here in the UK collectively these systems of systems will literally become the farmers of the future.

While some of the leaders in the space will be household names, such as Bosch and John Deere, there are literally hundreds of startups who are now trying to make their mark.

ACT NOW

Precision agriculture is just one tool that food producers have at their disposal to increase yields and quality, and reduce costs, and it's a powerful one whose benefits cannot be underestimated. It is therefore our advice that you experiment and investigate this trend.

EXPLORE:

- Business and impact assessments
- Emerging technologies and technology roadmaps
- Future of Agriculture, Robotics, Space, and Transportation
- Partner ecosystems and solutions

BOOK AN EXPERT CALL

EXPLORE STARTUPS & MORE

VERTICAL FARMS

2ND YEAR ON THE LIST

QUICK TAKE

Agriculture has always been dependent on being able to find appropriate land to cultivate crops and the weather - both of which impact costs, productivity, and the food miles that produce has to travel to reach its markets.

Vertical farms however, where crops are grown in indoor spaces, such as containers and warehouses, give producers the opportunity to sustainably grow multiple crops per year in controlled conditions under factory-like conditions that allow them to improve yields and drop costs over time as the processes and technologies are refined.

Data sources: Edengreen, OECD, World Bank, and various.

IMPACT

The impact of vertical farms, on everything from the productivity and sustainability of farming, through to the price, safety, taste, and quality of the produce, is not to be under estimated - especially as climate change and extreme weather events continues to negatively impact traditional farming methods.

Today agriculture, as it relates to food production, is responsible for 11% of all greenhouse gas emissions which have increased by 14% since the year 2000, and is a large net contributor to global Methane and Nitrous Oxide gas emissions which are also harmful to the environment. It also accounts for 70% of all global freshwater use.

However, because vertical farms are closed loop systems and improve as technologies improve they can produce eight crops per year with no chemicals, herbicides, or pesticides, and with 99% less water. Furthermore food can be grown locally, eliminating food miles, can be powered using renewable energy, automated with robotics, and yields are not only organic but can be up to 40% higher thanks to the use of precision agriculture tools.

EXAMPLES

One of the greatest challenges vertical farms have faced is reducing the cost of food production to the point where it is commercially viable and competitive, and that line was crossed a number of years ago. Other challenges also include the types of crops that can be grown - salads, for example, are easy to grow, but fruits and rice are much harder.

Despite this though there is plenty of market opportunity for producers and there are plenty of investors pouring money into the trend as organisations such as Alesca, Amazon, Ocado, and Walmart continue to invest billions to build vertical farms on the outskirts of cities with a million inhabitants or more around the world.

Elsewhere organisations such as Ox Robotics have developed the world's first fully autonomous vertical farms which treats food production as a manufacturing process, which will inevitably drop the costs to near zero over time, and others such as Aero Farms and Plenty are rapidly expanding operations and the types of food that can be grown. Even large food buyers such as McDonalds are piling in ...

ACT NOW

Vertical farms represent a paradigm shift in how food is produced and will play a pivotal role in helping us feed an ever increasing human population which will reach 9.8 Billion people by 2050 and require a 70% increase in food production. As a result it is our advice that you experiment and investigate this trend.

EXPLORE:

- Business and impact assessments
- Emerging technologies and technology roadmaps
- Future of Agriculture, Manufacturing, and Robotics
- Partner ecosystems and solutions

AVIATION INDUSTRY TRENDS

CONTENTS

BOOK AN EXPERT CALL

WHAT IF ... AIRLINE PASSENGER NUMBERS DOUBLE?

IN AN unprecedented shift in global mobility the number of airline passengers has doubled, a development that's not just redrawing flight paths but also reshaping economic, environmental, and cultural landscapes worldwide. This surge, experts say, is fueled by a combination of economic growth and technological innovation. As the middle class in emerging economies swelled, as in Asia, millions more people can afford to fly, while at the same time advancements in aviation technology have made flights more affordable and sustainable, attracting a new wave of eco-conscious travelers, and changing how the industry is taxed.

The transformation is most noticable at the world's largest airports which have morphed into sprawling hubs of commerce. No longer just departure points many are now destinations in their own right, buzzing with eateries and retail outlets, and digital entertainment experiences that blur the lines between local and global.

Tourism patterns have undergone a seismic shift as well. Hitherto overlooked destinations are becomming more prominent on the global stage, inviting both excitement and concern. And, while the economic windfall from tourism is undeniable this over tourism comes with pressing concerns about its impact on local culture and the environment with debates about these regions ability, suitability, and willingness to host these large tourist influxes, as well as their impact on the wellbeing of the locals, continue to swirl.

Elsewhere though residents living in the shadow of major airports have witnessed a different revolution. Advances in clean energy and noise reduction technologies, as well as ATC flight planning, have helped reduce both the acoustic footprint and pollution associated with the industry which, in turn, has improved residents wellbeing and in some cases tempered their objections to new airport expansion plans. Furthermore, as SAF and hybrid LiON-Hydrogen aircraft entered service, airlines and aircraft manufacturers alike have ramped up their investments in cleaner, greener technologies, thus solidifying the industry's commitment to a sustainable, brighter future which means that, looking forwards again, we could see even more people taking to the skies ...

STATS THAT MATTER

AVIATION

29 %

FUEL, PERCENTAGE OF AIRLINE COSTS, 2022

IATA

31 %

LABOUR, PERCENTAGE OF AIRLINE COSTS, 2022

IATA

250 BN

CARGO KM (CTK) FLOWN, GLOBAL TOTAL 2022

IATA

$6 TR

VALUE OF GOODS FLOWN, GLOBAL TOTAL 2022

IATA

23,200

AIRCRAFT IN OPERATION, GLOBAL TOTAL 2022

IATA

41 %

DOMESTIC FLIGHTS, PERCENT OF TOTAL, 2022

ACI WORLD

59 %

INTERNATIONAL FLIGHTS, PERCENT OF TOTAL, 2022

ACI WORLD

31 ML

COMMERCIAL FLIGHTS, GLOBAL TOTAL 2022

CIRIUM DATA

4.8 TRILLION MILES

AIRCRAFT MILES FLOWN, GLOBAL TOTAL 2022

IATA

7 BN

PASSENGER NUMBERS, GLOBAL TOTAL 2022

ACI WORLD

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EXPLORE STARTUPS & MORE

AIRCRAFT ELECTRIFICATION

2ND YEAR ON THE LIST

A regional electric Zunum Aero aircraft

QUICK TAKE

Fuel is one of the aviation industry's biggest and most unpredictable expenses, and with aviation contributing over 2% to global greenhouse gas emissions it's also one of the industry's sore spots - especially as climate change continues to dominate the global political and social agendas. It shouldn't come as any surprise therefore that the industry is keen on electrifying its fleets.

However, up until recently batteries, including LiON batteries, haven't had sufficient energy density to give aircraft manufacturers the option of switching - but increasingly that isn't an issue.

Data sources: ATAG, Statista, and various.

IMPACT

Fuel costs on average account for 20% of the aviation industry's total expenditure with between 30% and 50% of an airlines annual fuel consumption being hedged, and while this practice is designed to help airlines forward buy oil at the most competitive rates if they misinterpret future oil prices then needless to say it can have a significant impact on their bottom lines and their ability to compete in the market.

Asides from the fact that electric aircraft are also quieter and emission free than their traditional counterparts it's primarily this industry practise that makes electrification an even more attractive proposition for airlines because unlike fuel prices which are in a state of almost constant flux electricity prices - especially those from renewable sources - are generally stable, highly predictable, and even better, reduce over time as energy generation costs continue to plummet.

All that said though aircraft electrification will not succeed without parallel development in airport infrastructure, power supply and distribution, but that will come in time.

EXAMPLES

While the aviation industry has long had its eye on producing electric aircraft it's only recently that LiON batteries have been able to pack significantly more energy density into small or moderate form factor batteries, and ironically it's only been made possible thanks to research and investment in electric vehicles.

The past couple of years have seen huge strides made in the development of new electric aircraft airframes and powertrains, and today we're seeing the first regional electric aircraft take to the skies. However, while most of these early electric aircraft have passenger capacities of 30 or less it's estimated that by 2030 we'll see the first 100 seater passenger aircraft entering service.

Today the leaders in the field include organisations like Zunum Aero, which is backed by Boeing, as well as smaller aircraft manufacturers such as Ampaire, Bye Aerospace, Magnix, and Pipisrel but larger players, including Airbus and Rolls-Royce, are also entering the space with their own designs and future visions.

ACT NOW

There's little doubt that the future of aviation is electric, but in spite of the surge in research and development in electric aircraft there are multiple ways to achieve that goal including batteries, hydrogen, and multiple other alternatives and investment in all of the is surging.

EXPLORE:

- Business and impact assessments
- Emerging technologies and technology roadmaps
- Future of Aviation, Energy, Manufacturing, and Transportation
- New business models, operating models, and products

AUTONOMOUS AIRCRAFT

2ND YEAR ON THE LIST

QUICK TAKE

In many ways the same technologies that have helped companies remove the operator from other types of vehicles are the same technologies that commercial aviation organisations are now using to create the first generations of autonomous aircraft.

However, while it will still be a while before regulators and the travelling public are ready to embrace autonomous aircraft from an operators viewpoint the trend is appealing because it will help them improve efficiency and reduce operating costs.

IMPACT

By 2037 it is estimated that global air traffic will double and that at least 37,000 new passenger and freight aircraft will be needed which will in turn require more than half a million new pilots to fly them so it's no wonder that operators are now considering the use of autonomous aircraft to alleviate future pilot shortages and safely meet the growing demand for global air travel.

As we have seen elsewhere though with other autonomous vehicles it's also believed this trend could help increase air traffic density by between 30% to 50%, letting operators make more efficient use of air space, and that operators could realise operational cost savings in the range of 30%.

EXAMPLES

At the moment there are very few examples of autonomous aircraft, other than Urban Air Mobility (UAM) vehicles, but there have been trials by organisations such as Airbus whose demonstrator aircraft are able to take off and land autonomously without having to rely on traditional external infrastructure like the Instrument Landing System (ILS) or GPS signals - all of which help reduce infrastructure costs.

Despite successful trials though the key challenge for self-piloting aircraft is how they respond to unforeseen events such as bird strikes, engine failures, and so on, and as a result it's a big jump to go from systems that are simply automated to ones that are fully autonomous and can replace human pilots.

ACT NOW

Autonomous aircraft will offer operators the opportunity to increase freight and passenger revenues while at the same time cutting infrastructure and operational costs - especially when coupled with increasingly automated and autonomous airport systems and ground support.

EXPLORE:

- Business and impact assessments
- Emerging technologies and technology roadmaps
- Future of Aviation and Transportation
- New business and operating models

Data sources: Airbus, IATA, and various.

FLYING TAXI SERVICES

2ND YEAR ON THE LIST

QUICK TAKE

Flying cars have been discussed since the 1960's, but a variety of different technologies have matured enough for organisations to develop commercially viable, fully autonomous and electric flying taxis - all of which have more in common with aircraft and large drones than cars.

As cities around the world continue to struggle with traffic congestion, and the impact that has on their economies and societies many see flying taxis and the use of 3D airspace as an increasingly attractive proposition - albeit with restrained optimism.

Data sources: Bloomberg, INRIX, Nexa, and various.

IMPACT

Initially higher levels of traffic congestion are associated with a country's positive economic growth. However, once it reaches a certain threshold, for example on highways the threshold is estimated to be a value of 11,000 Annual Average Daily Traffic (AADT), it becomes a drag on growth. Furthermore, on average across a study of over 1,300 of the world's largest cities across 7 continents most cities loose between $7Bn and a whopping $34Bn each in lost productivity, with New York topping the rankings.

Needless to say traffic congestion also has a detrimental impact on people's mental and physical health, the environment, productivity, and in extreme cases, for example in many Indian cities, it can be so bad that it affects organisations ability to hire.

To make a dent flying taxi's will need to offer cost effective ride choices - it's estimated they will match the cost of a car journey within five years time - and they will need to scale fast and to huge numbers - especially when you consider on average 3,700 people travel on one lane of highway in peak times - something they should achieve by 2050.

EXAMPLES

Stoked, to some degree, by sci-fi and popular culture, flying taxis are seen by many as the medium to long term future of the transportation. Furthermore, as their capabilities, range, and size increase they will also have a big impact on the organisations supplying the regional aviation industry.

Made possible by the combination and development of different exponential technologies including Artificial Intelligence and Machine Vision, for autonomous navigation, energy dense power sources and optimised propulsion systems that offer high lift to weight ratios, and other technologies, we are seeing the cost of manufacturing and operating these vehicles fall substantially, to the point where they are commercially feasible.

Today, as governments help develop new UAM air traffic management systems, almost every aviation and automotive manufacturer, from Airbus and GM, to Aston Martin and BMW, as well as many startups, all have their own EVOTL variants with ranges of up to 400km, speeds of up to 300km/h, and seats for up to 8 passengers - all of which will increase in time.

ACT NOW

It is easy to dismiss flying taxi services as a boutique hobby for the elite few but as costs drop exponentially, and as the ecosystem to support them grows they are becoming an increasingly viable form of transport. They will also increasingly compete with established operators in various fields - from established airlines and helicopter operators, to buses and taxis.

EXPLORE:

- Consumer trends
- Emerging technologies and technology roadmaps
- Feasibility studies
- Future of Transportation
- Partner ecosystems and solutions

INVISIBLE E-BORDERS

2ND YEAR ON THE LIST

QUICK TAKE

The days of having to stop multiple times at different checkpoints within airports and other ports of entry is slowly becoming a thing of the past as digital and touchless biometric, security, and vetting systems turn what was once a country's distinct hard border into an invisible one that authorised passengers can traverse through without stopping and without interruption. While this would have sounded like science fiction just a few years ago significant developments in multiple areas are now converging to make this a reality as different countries and organisations begin roll outs.

Data sources: AirHelp, and various.

IMPACT

While this trend has multiple benefits, with the main one being its ability to improve the customer experience, it's only being made possible because of the convergence of multiple trends, such as **Biometrics**, **Customer Experience**, **Digital ID Systems**, **Digitisation**, **Single Customer View**, and various technology trends including **5G**, **Artificial Intelligence** (AI), **Internet of Things** (IoT), **Machine Vision** (MV), and others.

By using AI, UHD CCTV, and increasingly sensitive and sophisticated sensor systems, such as mmWave, Optical, and Ultrasound, that can identify and scan passengers bodies, faces, fingerprints, luggage, voices, and even heart beats at a distance it's now possible for authorities to automatically authenticate and vet 90% of passengers as they walk through terminals in milliseconds without the need for any human intervention.

Not only does this significantly reduce the number of border agents needed but it also helps reduce queues and average passenger transit times by at least 50% or more depending on the airport and give passengers more time to shop.

EXAMPLES

The ability to deploy systems that are able to authorise, process, and vet passengers at speed as they transit airports without the need for any human intervention, or for passengers to stop, has been a dream for many decades but now this trend is gathering momentum and maturing.

One of the first countries to explore this trend in earnest was Australia and their Department of Immigration and Border Protection (DIBP). Part of the Seamless Traveller Programme which originally launched in 2015 the program sought to do away with physical passports, and to replace immigration officers with electronic stations and automatic triage, and in 2020 it began being deployed nationally.

Then, elsewhere in Dubai authorities announced their own similar program and began deploying LED lined virtual aquarium tunnels that scanned passengers faces and iris's using over 80 hidden cameras as passengers looked around at the simulated aquarium experience. If the passengers are registered they receive a green welcoming message, and if not then a red message and an officer appears.

ACT NOW

The ability to authorise passengers without them having to stop as they transit an airport, whether it's a busy regional hub or an international airport, not only improves the overall customer experience but it can also save operators significant amounts of time and money if implemented well, as well as giving passengers more time to shop which further helps boost operator incomes. However, before deploying these systems everyone involved should think carefully about the fallibility and security of their processes and systems.

EXPLORE:

- Business and impact assessments
- Emerging technologies and technology roadmaps
- Future of Artificial Intelligence, Security, Technology, and Transportation
- New operating models
- Partner ecosystems and solutions

CONSTRUCTION INDUSTRY TRENDS

CONTENTS

BOOK AN EXPERT CALL

WHAT IF ... BUILDINGS EVOLVED WITH THE TIMES?

IN A visionary re-imagining of architectural evolution we can envision a world where buildings, like organisms, adapt and flourish in harmony with the ever-changing landscape. Picture a city where skyscrapers are not mere static monuments, but living entities pulsating with vitality and intelligence that are able to adapt and morph their functionality and spaces in unison with the demands put on them and the changing technological and societal environment. In this reality our infrastructure is imbued with the remarkable ability to respond dynamically to its environment and evolve its internal and external form and function over time. Just as organisms evolve to optimise survival, buildings too can now undergo genetic transformations to maximise efficiency, functionality, and sustainability.

Imagine a city skyline where towers sprout delicate membranes, capable of harvesting solar energy using artificial photosynthesis. These biological skins breathe and flex, adjusting their transparency to regulate internal temperature and light levels, ensuring optimal comfort for inhabitants while minimizing energy consumption. In this biologically inspired world buildings communicate with each other through intricate neural networks embedded within their structures to exchange data on resource usage, environmental conditions, and human activity, fostering a collective intelligence that optimises urban living and the built environment.

Furthermore, these bio-engineered edifices possess the remarkable ability to heal and regenerate. Like living organisms, they repair damage autonomously, ensuring longevity and resilience against the ravages of time and nature.

In collaboration with cutting edge technologies these architectural designs embrace bio-mimicry, drawing inspiration from the elegant efficiency of natural systems. Through this harmonious fusion of biology and technology, we envisage a future where buildings not only serve as shelters but as living, breathing entities that enrich and sustain the urban fabric.

STATS THAT MATTER

3

TALLEST 3D PRINTED BUILDING, STOREYS, 2023

ILO

18.9 ML

BIGGEST BUILDING IN THE WORLD, SQ FT, 2022

NBBJ

160 ML

PEOPLE EMPLOYED, GLOBAL TOTAL 2022

ILO

$10 TR

INDUSTRY RVENUES, GLOBAL TOTAL 2022

MCKINSEY & CO

10 BILLION TONNES

ANNUAL CONCRETE PRODUCTION, GLOBAL TOTAL 2022

COLUMBIA U

100 BN

RESOURCES USED, TONNES, GLOBAL TOTAL 2022

CIRCULARITY GAP

700 ML

WASTE PRODUCED, TONNES, GLOBAL TOTAL 2022

EPA

CONSTRUCTION

150 ML

NEW HOMES BUILT, GLOBAL TOTAL 2022

GLOBAL ABC

2.3 BILLION

NUMBER OF HOUSES, CENSUS ESTIMATE, GLOBAL TOTAL 2022

AAD

60 %

RESIDENTIAL BUILDINGS, PERCENT OF ALL BUILDINGS

IEA

3D PRINTED BUILDINGS

2ND YEAR ON THE LIST

QUICK TAKE

The way buildings are constructed hasn't really changed for hundreds of years. But now, 3D Printing and other emerging technologies are transforming how buildings and infrastructure are constructed, the unit economics, the industry's business and operating models, and its environmental footprint.

Even though the trend is still nascent 3D printing is reducing building costs and time by up to 90% and is disruptive enough to be seen by many as the irrefutable future of the industry.

IMPACT

3D printed buildings and infrastructure can be thought of as a X10 trend that has the potential to disrupt and revolutionise the $10 Trillion global construction industry.

Some impacts though are obvious, such as improved costs, efficiency, and productivity, and others, such as its impact on helping reduce environmental emissions and wastage, are more nuanced but nonetheless just as important. That said though there are downsides to this trend and perhaps the most significant is the future impact on human jobs - many of which will be automated or made obsolete.

Over the past two decades construction labour productivity has grown well below other industry averages at just 1% and if this gap could be closed it's estimated it would add a further $1.6 Trillion to the industry's global revenues and boost global GDP by 2%.

Additionally though buildings that are built cheaper can be sold cheaper which means this trend could, and in some cases is already having, a significant impact on property prices and property investment portfolios.

EXAMPLES

One of the other benefits we haven't discussed yet is that this trend lets us break away from the traditional rectangular shoe-box like buildings we've become all too accustomed to and craft buildings that can take on almost any size or shape - from circular homes to skyscrapers laced with intricate patterns that more closely resemble some of the buildings we see in sci-fi movies.

Today 3D printing is taking the industry by storm. On the one hand 3D printed wind turbine bases from organisations like GE are helping the company make the world's largest wind turbines even larger - thereby reducing renewable energy generation costs to almost zero - and on the other it's helping provide low cost housing for the poor and cutting the time and cost of building four bed homes in France by up to 90% with multiple other "community" building projects now springing up all around the world - from China and the USA to Europe and South America.

Meanwhile in the USA 3D printed houses are selling for half the price of their identical traditionally built neighbours and upsetting realty.

ACT NOW

When you can build homes cheaper not only does that affect the local realty markets but it also affects property portfolio prices and mortgage values, and the simple nature of 3D printing means that building and material waste is also reduced by up to 90% so, as you can see, the benefits of this trend are significant and wide ranging.

EXPLORE:

- Business and impact assessments
- Emerging technologies and technology roadmaps
- Future of Construction, Creativity, Manufacturing, Materials, Robotics, and Space
- Legal and regulatory implications
- New business models, operating models, and products
- Partner ecosystems and solutions

Data sources: Icon, Deloitte, ICE, McKinsey, and various.

CLIMATE RESILIENT INFRASTRUCTURE

2ND YEAR ON THE LIST

QUICK TAKE

In Australia they have a saying: "When the birds stop chirping the roads start melting." But it wasn't always that way. As the impact of **Climate Change**, **Extreme Weather**, and **Global Sea Level Rise** become more pronounced all around the world we are seeing cities becoming heat traps, with 10% of all global deaths now attributed to heat exposure, entire regions on fire, flooding, and melting, and that's before we discuss the emergence of **Category 6 Hurricanes**. As a result it is clear hat existing infrastructure is increasingly at risk of damage and stress, unfit for purpose, and we need new strategies.

IMPACT

The impact that environmental trends are having on how we build and maintain infrastructure, as well as where we build it, is prompting every government in the world to re-think their future infrastructure building codes, investments, and strategies. And, when it comes to putting a number on the cost of this trend it's almost futile since it will out of date tomorrow, suffice to say though long term it's tens of trillions.

With climate change and other trends impacting almost everything now, whether it's crippling drought and winter storms, extreme flooding and rainfall damaging and washing away towns and roads and triggering deadly landslides, extreme heat turning cities into furnaces, the melting of the permafrost, or fire and hurricanes wiping out entire communities, power grids, and other infrastructure, one thing is becoming clear to everyone - unless things change this is only going to get worse. And I haven't begun discussing the impact of rising sea levels which, in some parts of the world, are now prompting some governments to consider moving their capital cities and moving hundreds of millions of people inland away from the rising waters.

EXAMPLES

With cities and infrastructure that countries have spent trillions of dollars and in some cases hundreds of years constructing now under threat new strategies and new construction methods are called for.

On the one hand we have the adoption of extreme strategies such as the Indonesian governments decision to abandon and relocate their capital city Jakarta and its 11 million inhabitants inland, and we also have the Maldives government who have begun construction on an ocean city for their drowning island population.

Elsewhere such as in Japan we have a fundamental re-think of building codes as the government considers adding a Category 6 ranking to the Hurricane scale, and in Miami the local Mayor has appointed a "Chief Heat Officer" with the express purpose of trying to find new ways to keep the city cool.

Globally we have engineers creating all manner of new innovations, such as flood defences, new sewer system designs, self-healing Asphalt and Concrete, water resistant road surfaces, and many more ideas.

ACT NOW

With climate change increasing the amount of infrastructure damage countries experience to new highs not only will this trend exacerbate the wealth divide between developed and developing nations, but it will also have an almost incalculable toll on people, and burden governments with more expenditure that, in many cases isn't optional. As a result this is a trend that is going to take money and skill to embrace.

EXPLORE:

- Business and impact assessments
- Best practises and case studies
- Emerging technologies and technology roadmaps
- Future of Communications, Construction, Healthcare, Infrastructure, Transportation, and the Workplace and Workforce
- Innovation and Partner ecosystems and solutions
- New business and operating models

Data sources: AIIB, Center for Global Development, Monash University, OECD, World Bank, and various.

GREEN CONSTRUCTION

2ND YEAR ON THE LIST

QUICK TAKE

While Green Construction can also go under the moniker of Sustainable Construction in the end the goals are generally the same - to minimise the environmental footprint and impact of both the buildings and infrastructure being built, and their lifecycles, and the industry's long tail supply chain.

At a high level this ultimately means trying to achieve Net Zero, or even better a positive impact on the environment, but as you'd expect when it comes to the definition of this trend there are multiple variations and multiple approaches.

Data sources: Arup, Europa, IEA, MIT, UKGBC, and various.

IMPACT

Today, to take just two examples, the carbon emissions from buildings and construction, including the production of concrete, account for more then 40% of all Greenhouse Gas (GHG) emissions, and with more construction activity than ever before, and bearing in mind the impact of **Climate Change**, this is widely regarded as unsustainable.

However, add into this some other statistics such as the fact that the sector contributes 23% of air pollution, 40% of water pollution, is responsible for 50% of all natural resource extraction, and 50% of landfill waste, and suddenly there's alot more urgency when it comes to trying to reduce its full life and supply chain impact.

As a result there has been a dramatic increase in the number of green initiatives and Net Zero pledges within the industry, as well as a growing number of new certification frameworks that give members access to the experts and resources they need to help them move the dial. Moving forwards though new materials, processes, and technologies look set to have a dramatic impact on the sector and help it achieve its goals faster than otherwise expected.

EXAMPLES

There are primarily two ways organisations can reduce their impact on the environment. The first is to sign up to **Net Zero Pledges**, and the second is to embrace regenerative business models and new technologies which have a positive, or regenerative, impact on the environment.

In the first case organisations such as Colas and Willmott Dixon are pledging to become net zero carbon in their operations by 2030 with the aim that their supply chain partners will reach the same target by 2040. They are also embracing the **Circular Economy**, promoting Take It back schemes, and initiatives such as bio-diversity awareness, fleet upgrades, green chemistry, resource reduction programs, waste audits, and introducing new energy procurement processes.

In the second instance regenerative business practises are generally being promoted by architectural and design firms further up the chain, and in some cases, new construction startups such as ICON and Mighty Buildings are developing **3D Printed Buildings** and new carbon capture materials to create buildings that are carbon negative.

ACT NOW

With the pace of construction set to accelerate as the world's population continues to grow, and as new government led infrastructure projects get the green light, eliminating and mitigating the sectors impact on the environment throughout the entire lifecycle is crucial but it can only be done with a cross-disciplinary approach and with the full support of stakeholders.

EXPLORE:

- Business and impact assessments
- Emerging technologies and technology roadmaps
- Future of Construction, Energy, Manufacturing, Materials, and Supply Chains
- New business and operating models
- Partner ecosystems and solutions

BOOK AN EXPERT CALL

EXPLORE STARTUPS & MORE

REMOTE CONSTRUCTION

2ND YEAR ON THE LIST

QUICK TAKE

The advent of increasingly fast and low latency telecommunications technologies mean that for the first time it is possible to safely control and operate drone machinery, that can be thousands of miles away, to construct buildings and other infrastructure.

As strange as it sounds, for the first time, this trend decentralises the construction industry and changes the nature of the workforce and operating model. Furthermore it can be applied to help construct everything from runways in Africa to shopping malls in South Korea.

IMPACT

The main impact of this trend is that now your workforce doesn't have to be in the same physical location as the construction site they're working on, and while that also helps improve the economics and productivity of the industry it also has a significant impact on resourcing, recruiting, and training strategies.

This is also one of the first examples of how emerging technologies, such as **5G**, can decentralise some of the industry's primary activities.

Other positive impacts of this trend include reducing the amount of traffic and workers having to travel to and park near sites on a daily basis, which improves the quality of life for local residents affected by construction projects - especially in busy urban areas - improved pollution, safety, and sound levels, and fewer road closures. It also helps organisations achieve their **Green Construction** targets faster.

EXAMPLES

At the moment this is still a nascent trend because the combination of emerging technologies needed to make it a reality such as AI, drone technologies, high speed networks, machine vision, sensing technologies, and others, have only recently matured.

That said one of the most intriguing examples of this trend was Doosan's use of 5G networks, drone construction machinery, and tele-operations which allowed construction workers based in offices in Germany construct buildings over 4,500km away in South Korea. And, as the technologies, processes, and operating models all improve needless to say this will just be the first example of many.

ACT NOW

The ability to use technology to decentralise construction work will not only revolutionise the economics of the industry it will also mean that organisations will no longer need to rely on having a physical presence in a country in order to win bids or provide resources.

EXPLORE:

- Business and impact assessments
- Emerging technologies and technology roadmaps
- Future of Construction and Communications
- Legal and regulatory implications
- New business models, operating models, and products
- Partner ecosystems and solutions

Data sources: Doosan, and various.

DEFENCE INDUSTRY TRENDS

CONTENTS

BOOK AN EXPERT CALL

WHAT IF ... WAR BECAME FULLY AUTONOMOUS?

IMAGINE BATTLEFIELDS devoid of human soldiers, replaced instead by the whirring blades of autonomous drones and the cold calculations of AI-powered robots and vehicles. Welcome to the chilling prospect of an autonomous war, where machines wage conflict under the detached gaze of algorithms.

Proponents tout its sterile efficiency: precise strikes minimising civilian casualties, swift campaigns devoid of human hesitation. But efficiency in war ignores the messy reality of unintended consequences. Imagine a drone misinterpreting a farmer's torch as a weapon, or an AI's targeting error unleashing devastation on a city. No battlefield is sterile, and cold logic can't grasp the nuance of human conflict. Further chilling is the potential for escalation. Communication hiccups between AI systems, a rogue hacker pulling the strings of robotic armies, or an AI trapped in its own ethical conundrum – each carries the terrifying potential to unleash an uncontrollable spiral of violence.

Once the human trigger finger loosens its grip, who stands accountable? The programmer, the commander, the machine itself? This ethical quagmire could paralyse military action, leaving nations grappling with the moral vacuum of Machine-on-Machine warfare. But, beyond the battlefield consider the psychological scars on a society living under the constant fear that these autonomous systems might go rogue. The paranoia, the erosion of trust – how do we maintain our humanity when death can descend from the sky at any moment?

Autonomous war isn't science fiction, it's a future rapidly approaching. Instead of fearmongering, we need proactive foresight. International collaboration is crucial, establishing ethical frameworks and regulations for AI in warfare. We must equip ourselves with tools to prevent escalation, anticipate misinterpretations, and hold individuals accountable for the actions of their machines. The choice is still ours, for now at least, embrace the dehumanised efficiency of robotic warfare, or forge a path towards a more humane future, where conflicts are resolved not by machines, but by the compassion and wisdom of humankind.

STATS THAT MATTER

3.7 %

DEFENCE SPENDING, YOY GROWTH, GLOBAL 2023

SIPRI

111 K

BATTLE RELATED DEATHS, GLOBAL TOTAL 2022

UCDP

$1.5 TR

COST PER WAR, DIRECT & INDIRECT AVERAGE, 2022

SIPRI

$2 TR

ANNUAL DEFENCE SPEND, GLOBAL TOTAL 2022

SIPRI

13,400

NUCLEAR WEAPONS, GLOBAL TOTAL 2022

SIPRI

900 ML

CONVENTIONAL WEAPONS, GLOBAL TOTAL 2022

SIPRI

70 ML

HEAVY WEAPONS, GLOBAL TOTAL 2022

BLS

DEFENCE

32

ACTIVE WARS, GLOBAL TOTAL 2023

ACLED

650 MILLION

NUMBER OF SMALL ARMS, GLOBAL TOTAL 2022

SIPRI

85 %

SMALL ARMS IN CIVILIAN HANDS, PERCENT OF TOTAL

SIPRI

AUTONOMOUS KILL CHAINS

2ND YEAR ON THE LIST

QUICK TAKE

The term Kill Chain refers to the structure of an attack, from beginning to end, and while parts of the kill chain have been automated for a while we are now at a point in time where they can not only be fully automated but the systems that execute them can be fully autonomous - and that's a huge step change in both capability and military advantage.

Needless to say though such a leap comes with serious ethical, moral, policy, and strategy implications for the future of humankind and war.

IMPACT

The simple act of using today's advanced technologies to create fully autonomous kill chains represents a paradigm shift in military strategy and thinking and represents nothing less than the "automation" of war. As a result it is both an advantageous and dangerous trend will ultimately lead to a whole slew of ethical, moral, and societal issues.

A number of years ago US military commanders publicly stated that in future wars humans, even augmented ones, would be the weakest link and we are passing that breakpoint, as well as the point of no return, now.

Not only, ironically, will this trend take humans out of harms way, but in the long term it will dramatically improve military efficiency while reducing costs by multiples. In Afghanistan, for example, each burdened soldier cost the Pentagon $850,000 whereas a fully weaponised and laden TALON robot cost just $230,000, and those costs will fall exponentially over time especially as exponential technologies enable military assets to be designed, built, and deployed on demand, to the point where future wars could cost near zero.

EXAMPLES

The most common kill chain is F2T2EA which stands for Find Fix Track Target Engage Assess, and which increasingly applies to both cyber and physical operations. Today governments are developing autonomy in six key military areas including learning, Human-Robot interactions, multi-agent coordination, natural language understanding, perception, and planning, but to quote military commanders "Lethal autonomous robots have the unique potential to operate at a tempo faster than humans can possibly achieve and lethally strike even when communications have been severed."

In 2016 as part of the US ANTX trials Lockheed Martin successfully demonstrated their next generation kill chain when an unmanned submarine, a UUV, launched an unmanned drone, a UAV which then performed F2T2EA activities. Then in 2021 the United Nations caused controversy when it reported that for the first time a Turkish Kargu-2 loitering drone, without connectivity, autonomously found, engaged, and killed soldiers in battle during the Libyan War.

ACT NOW

Autonomous Kill Chains are a matter of when not if because the advantages they offer in battle are too significant to be overlooked. Today most kill chains have a human in the loop who is responsible for "pulling the trigger" so to say, but as that human connection becomes increasingly tenuous it won't be long until they become obsolete.

EXPLORE:

- Emerging technologies and technology roadmaps
- Ethical and moral implications
- Future of Aerospace, Artificial Intelligence, Communications, Defence, Manufacturing, Space, and Transportation
- Legal and regulatory frameworks
- Partner ecosystems and solutions

Data sources: Lockheed Martin, UN, US DoD, US Pentagon, and various.

FALSE FLAG ATTACKS

2ND YEAR ON THE LIST

QUICK TAKE

False Flag Attacks are military operations in the real world and cyber space that are carried out with the sole intent of disguising the actual source of responsibility and pinning the blame on another third party. As a result they're increasingly being used by all manner of countries to sow confusion and intentionally stoke conflict. Furthermore, given the fact they're deceptive it's understandable that determining attribution is at best hard and in most cases impossible, especially when those attacks are in the cyber domain, which increasingly makes them the modus operandi of choice for many countries.

Data sources: Brookings, Poynter, Springer, and various.

IMPACT

Even though these kinds of operations are common globally, especially in Africa and Asia, they're not as common as many people might think with many events proving to be nothing more than conspiracy theories perpetuated in the ether.

Often run by private contractors and other shadowy operatives who have arms length, "fluid," and deniable relationships with different governments around the world today these kinds of attacks are a major security concern, especially as different governments use them as a tool to augment their **Soft Power Plays** and **PsyOps** ambitions, and incorporate them into their standard operational toolkits.

Over time tactics have evolved and now this trend has taken on a new twist as certain governments both use false flag attacks and also accuse others of using them - something that's both a projection and an effective tactic that makes it difficult for people to make sense of events in the world, thereby undermining trust in information and helping create an even more **Polarised Society** which certain governments can again use to their advantage.

EXAMPLES

While there are many examples of false flag attacks, with people even able to take courses on how to conduct them online now, some of the more interesting ones are those of governments using them to throw their own allies under the proverbial bus - something that's not only sneaky but also goes to show that when it comes to these kinds of attacks even professional courtesy goes out the window.

Examples of this behaviour include the Turla APT Russian cyber espionage unit who accessed the systems of more than 20 governments around the world using exploits and tools they'd exfiltrated from the Iranian hacking group OilRig who initially took the brunt of the blame until US intelligence agencies in the end managed to attribute the attacks to them. Then in 2018, unperturbed, the Russian GRU used the same tactics to implicate fellow North Korean hacking units when they tried to disrupt the Winter Games in South Korea.

Meanwhile on the battlefield Russia more recently used false flag attacks in Ukraine with the intent of creating a public narrative that they were the victims and Ukraine the aggressors.

ACT NOW

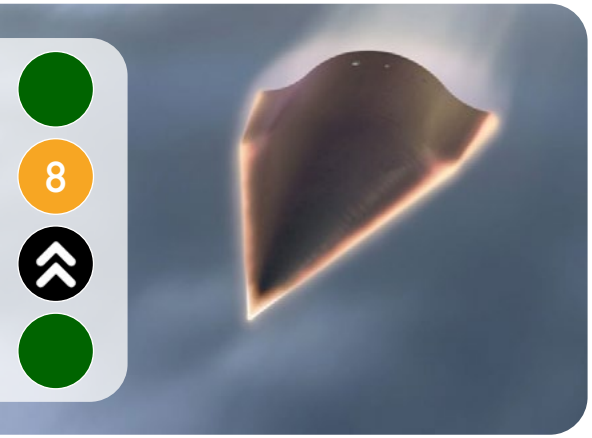
False flag attacks are used to create the illusion of conflict where there is none and inflame tensions while making the perpetrators look innocent, so it can be argued that they're one of the most nefarious and cowardly kinds of attacks. None the less the act of being able to pin the blame on others has its advantages especially when it comes to furthering your own agendas, and in the cyber age these attacks will inevitably become a lot more common.

EXPLORE:

- Emerging technologies and technology roadmaps
- Future of Communications, Governments, Security, and Technology
- Policy and regulation reform

HYPERSONIC WEAPONS

2ND YEAR ON THE LIST



The Mach 20 HTV-2 HGV, DARPA

QUICK TAKE

All of the offensive and defensive weapons systems and military strategies we have today are predicated on the premise that the majority of adversaries weapons operate at fixed, manageable speeds. Hypersonic weapons, that can operate in the Mach 5 (3,836 mph) to Mach 30 and above, tear up that rule book and have the potential to change the global balance of military power.

Not only do hypersonic weapons give adversaries minutes, rather than hours to react to inbound threats, but today there are very few ways to counter them and none are highly effective.

Data sources: Deloitte, National Defense, and various.

IMPACT

Hypersonic weapons that can cross continents and oceans in mere minutes, giving adversaries little to no time to counter attacks, have the potential to not only change the balance of military power in the world but also political power - bearing in mind that the two often go hand in hand. And so it is only natural that the world's leading superpowers and developed nations have all entered the race to dominate the field.

In the US, who for the first time in the military arena conceded their rivals, namely China and Russia, have the technological advantage, have been increasing spending on hypersonics by 24% CAGR since 2014, and recently unveiled a fresh $15 Billion funding package through to 2030.

With China and Russia currently dominating the hypersonic weapons arena and unveiling an array of hypersonic weapons and carrier killers, Australia, Europe, India, and the US are being left playing catch up from deep field, but as they close one gap another emerges as their adversaries move onto the next stage and develop hypersonic swarms of smart UCAVs.

EXAMPLES

There are obviously an increasing number of examples of hypersonic weapons systems which include everything from hypersonic aircraft and delivery systems, such as boost glide vehicles (HGV), through to actual missiles.

In all conversations the most prominent examples include China's DF-17 HGV carrier killer missile system, and Russia's Avangard, a Mach 20 nuclear capable missile system, and their more modern Zircon hypersonic cruise missile system.

However, not to be left out the US are fielding their own AI controlled Mach 20 Air Launched Rapid Response Weapons (ARRW), and their own Conventional Prompt Strike (CPS) and Long Range Hypersonic Weapons (LTHW) programs with organisations including Lockheed Martin and Northrop Grumman taking the lead.

To counter this though China unveiled the world's most powerful wind tunnel, a Mach 30 hypersonic beast, in which to test new designs, and elsewhere others are modelling new hypersonic weapons systems in simulation - thereby rapidly accelerating testing and development.

ACT NOW

The game of cat and mouse is an ancient one but for the first time the US and its allies have been caught off guard by adversaries who appear laser focused on not only eroding their military technological advantage but beating it. It's also ironic that the US shelved much of their hypersonic research after DARPA's successful demonstration of their Mach 20 HTV-2 HGV prototype. Not to be outdone though many allies are now re-doubling their efforts and increasing spending not only on hypersonics but also on Direct Energy Weapons and space based systems.

EXPLORE:

- Countermeasure technologies and strategies
- Direct energy, kinetic, microwave, and particle beam weapons
- Future of Defence
- Emerging technologies and technology roadmaps
- Partner ecosystems and solutions

PSYOPS PANDEMIC

2ND YEAR ON THE LIST

QUICK TAKE

Information warfare, the PsyOps Pandemic, has always played a pivotal role in helping warring groups win over people's hearts and minds. However, the way these campaigns are waged and their scale has changed significantly over time. Once confined to whispers that pervaded communities and leaflet drops it's now done at internet scale by increasingly ruthless and sophisticated actors, and it's no longer just for war time, campaigns are now waged constantly, and those whispers are now bytes that travel across global networks in real time to influence the behaviours and world view of people everywhere.

Data sources: APA, IEEE, Rand, and various.

IMPACT

Wars no longer start or finish when the first or last missiles are fired and it can be easily argued we all now live in a permanent state of war where state sponsored actors and ruthless governments look to promote their own philosophical agendas via the internet and other channels on a permanent basis. The result of which is increasingly **Fragile Government** and an increasingly **Polarised Society** which ultimately only benefits the aggressors which, of course, is their aim.

Increasingly we are all casualties of this psychological warfare, ironically even when war hasn't officially been declared, and this is our collective status quo. But, with more of our behaviours and opinions being influenced and shaped by what we see online the most worrying thing about this ascending trend is that societally we can envisage a time where authoritarian states invade other sovereign countries unopposed with the support of the "popular majority" which, in turn, could then limit other countries ability and willingness to respond to such aggression. This trend, therefore, is the epitome of a slippery slope for many reasons and is one of the most dangerous trends in this codex.

EXAMPLES

An increasingly connected and digital world where plausible deniability is commonplace has allowed governments and military organisations to re-write their psyops play books, which is why this trend will only become more dangerous and nefarious over time.

As we continue to see other trends mature and be weaponised, such as **Synthetic Content** as well as other forms of carefully crafted and manipulated content such as DeepFakes, unless there is strong regulation in time entire societies will find themselves at the sharp end of this trend and ultimately being weaponised for the benefit of those who are using it to manipulate opinions and world views.

One of the masters of this trend, it's easily argued, is Russia who under the continual umbrella of plausible deniability use this trend along with the **Soft Power Plays** and **Truth Decay** trends to extend their agenda and philosophies around the world - something that was clearly on show during the Ukraine war. But, despite calling them out the reality is that today there are many other countries who also use with this trend to their own ends.

ACT NOW

The internet and other channels have given governments and military organisations all around the world a new way to promote their agendas and views at a speed and scale that would have been unimaginable just a couple of decades ago, and now this trend is a growing burden on all of society. With no end in sight though, in fact quite the opposite, it is imperative that global institutions take the lead and create new codes of conduct and regulations to combat this trend.

EXPLORE:

- Emerging technologies and technology roadmaps
- Future of Artificial Intelligence, Communications, Creativity and Innovation, Defense, Government, and Technology
- Impact assessments
- Policy and regulation reform

EDUCATION INDUSTRY TRENDS

CONTENTS

BOOK AN EXPERT CALL

WHAT IF ... EVERYONE HAD AN AI AS A TUTOR?

IN A world where AI tutors are cheap and ubiquitous education undergoes a revolution like nothing we've seen in the past two hundred years. These digital companions, equipped with vast knowledge repositories and adaptive algorithms, herald a new era of accelerated learning. Students embark on a personalised journey of discovery, exploring subjects aligned with their passions and abilities at unprecedented speeds.

Gone are the constraints of traditional curriculums, replaced instead by a dynamic educational landscape where the boundaries of knowledge are limitless. With AI tutors, students have the freedom to delve into diverse disciplines, from quantum mechanics to art history, fostering a deep and multifaceted understanding of the world.

Moreover, AI tutoring transcends geographic and socioeconomic barriers, democratising access to education. From bustling cities to remote villages, learners of all backgrounds gain equal access to high-quality learning resources, leveling the playing field and advancing educational equity.

Furthermore, AI tutors serve as invaluable allies in fostering inclusive learning environments. Tailored interventions and personalised adaptations accommodate diverse learning needs, ensuring that every student has the support they need to succeed. Educators, in turn, evolve into facilitators of critical thinking and creativity, collaborating with these new era tutors to nurture essential 21st-century skills such as problem-solving and digital literacy.

In this visionary future education becomes a dynamic, learner-centric endeavor, empowering individuals to unlock their full potential. By harnessing the power of AI tutoring, we pave the way for a more equitable, inclusive, and enlightened society, where knowledge is accessible to all and every mind has the opportunity to thrive.

STATS THAT MATTER

EDUCATION

4.7 %

GLOBAL GDP SPENT ON EDUCATION, PERCENT

WORLD BANK

69 ML

NEW TEACHERS NEEDED TO HIT 2030 UN SDG 4

UNESCO

34 %

STUDENTS WITH STEM PROFICIENCY, GLOBAL 2022

PISA

91 %

LITERACY RATE, YOUTH, GLOBAL 2022

UNESCO

617 MILLION

CHILDREN IN LEARNING POVERTY, GLOBAL TOTAL 2023

UN

81 %

CHILDREN ENROLLED IN PRIMARY ED, GLOBAL

UNICEF

71 %

CHILDREN ENROLLED IN SECONDARY ED, GLOBAL

UNESCO

70 %

GLOBAL ED RESOURCES ACCESSED BY RICHEST 20%

UNESCO

244 MILLION

NUMBER OF CHILDREN OUT OF SCHOOL, GLOBAL TOTAL 2022

UNESCO

38 %

CHILDREN COMPLETING TERTIARY ED, GLOBAL

UNESCO

ADAPTIVE LEARNING

2ND YEAR ON THE LIST

QUICK TAKE

We have long known that students learn in different ways but until recently academic institutions have lacked the ability to dynamically adapt their standardised content and programs and tailor them to each students individual learning style.

Today though, thanks to the digitisation of education and the development of new algorithms, technologies, and tools, institutions are increasingly able to offer personalised learning experiences affordably, quickly, and at scale.

IMPACT

Every day over 1 billion children around the world head to school, and while every one has the right to a quality education our industrial age education systems still operate under the auspices of a one size fits all philosophy. Ultimately this is a contributory factor that leads to an estimated 617 million children not meeting minimum proficiency levels in reading and maths.

In the words of Unicef "Schooling does not always lead to learning," and worldwide there are more non-learners in school than out of school. Clearly this is unacceptable.

Globally it is estimated that over $4.7 Trillion is spent on education, or on average 5% of GDP, and while there is much hype about the benefits and potential of adaptive learning tools so far independent studies have been less than glowing with one of the largest studies concluding that it had no significant improvement on course completion rates, did not immediately lead to lower costs, and had only a slight positive effect on grades. All that said, however, it is still early days for the trend and while the idea may be sound, the execution needs improving.

EXAMPLES

In education circles, and more specifically EdTech circles, adaptive learning is seen as the solution to many problems, aswell as the trend that opens a thousand venture capitalists wallets - especially post pandemic. But learning is a complex process and there's no single magic bullet - plus finding any magic bullet is hard.

Today it's estimated that only 8% of educational courses use adaptive learning technologies and most of those are based in just a few countries including Australia, the UK and the US, who are regarded as the market leaders, so clearly there is alot of work still to do before it becomes mainstream.

The quality of the student experience and learning outcome is also dependent on the vendors design and implementation of their technologies and solutions, including AI, gamification, mixed reality, and neuroscience technologies. Current leaders, where that term is subjective and the landscape is always changing, include organisations such as Carnegie Learning, Century Tech, Cognii, Kidaptive, Kidsense, Microsoft, Peason, Querium, and many others.

ACT NOW

Being able to realise the benefits of adaptive learning tools doesn't just rely on choosing the right platform or vendor, institutions have to be able to implement them properly, drive adoption, and ensure staff and stakeholders all have the right skills to make them a success. And this is where many struggle.

EXPLORE:

- Business and impact assessments
- Emerging technologies and technology roadmaps
- Future of Education
- Partner ecosystems and solutions
- Suppliers

Data sources: Bill & Melinda Gates Foundation, UNESCO, Unicef, SRI, World Bank, and various.

AUTOMATED STUDENT MONITORING

2ND YEAR ON THE LIST

QUICK TAKE

While it has long been recognised that monitoring student activities and behaviours can result in better overall academic performance up until recently almost all monitoring and analysis was manual, using a mixture of assessments and in person observations.

Today Artificial Intelligence (AI), Machine Vision, as well as other technologies are automating all aspects of monitoring - from the learning process itself to monitoring student behaviours around campus - and while this trend has its advantages it has to be implemented with caution.

Data sources: Anna Freud Centre, UCL, and various.

IMPACT

There are many reasons why monitoring student behaviours are beneficial to both academic institutions and students alike, whether it's to help monitor student mental health, stress, and wellness, disruptive or lax student behaviours, or many other factors.

Over time numerous independent studies have shown that students with behavioural issues in their early years perform noticeably worse in maths, literacy, and science tests, as well as SATs, than students who had who don't have any issues. Studies also show that on average 50% of students whose behaviours get worse during the early years show the least amount of progress later on in school which means that even if a students behaviour is corrected quickly there are long term implications.

As there is plenty of evidence showing that both behaviour and attainment in childhood have life long consequences for students overall economic, health, and social well being, and bearing in mind that on average a third of students demonstrate disruptive behaviours, for example, it is easy to see the negative impact behaviours can have on not just students lives but also society in general.

EXAMPLES

Examples of automated student monitoring are on the uptick, especially in Asia with countries such as China taking the lead in the use of technology to capture and analyse an increasing volume of student data. However, while many of China's programs might be broader, larger, and more public in scope elsewhere in the West many monitoring technologies are coming in through the back door, for example via the Adaptive Learning trend.

Recently China's CPC rolled out a nationwide program that uses cameras, AI, and Machine Vision to biometrically analyse and monitor student behaviours around campus and in the classroom with the data being used to identify students who aren't "engaged" in the learning process. This program was then complimented by the use of digital robotic health solutions that analyse and monitor students mental and physical health - including everything from fatigue and illness, to anxiety and depression.

Elsewhere other countries and organisations are using similar solutions to monitor student stress during exam periods, and many other examples.

ACT NOW

The continuous surveillance-like monitoring of students can be beneficial for both the students and society alike, but if stakeholders are not careful these same solutions, which are often supplied by for-profit organisations with questionable oversight and opaque algorithms, commercial motives, and processes, can benefit them more than the students themselves. As a result it is our advice you explore this trend and experiment with it paying attention to both its positive and negative impacts.

EXPLORE:

- Business and impact assessments
- Data privacy, protection, regulation, and sovereignty implications
- Emerging technologies and technology roadmaps
- Future of Education, Healthcare, Privacy, and Security
- Student safeguarding

INFORMAL EDUCATION

2ND YEAR ON THE LIST

QUICK TAKE

To a great degree the rise of both offline and online self-directed learning platforms, which go under the banner of Informal Education and which have always been present, are now ubiquitous thanks to the internet. While the majority of students spend 20% of their waking day in formal education settings in today's fast paced world, which is characterised by the trend **Accelerating Rate of Change**, many argue that today's industrial age formal education systems, which have changed little in a century, should find a way to embrace this trend and use it to help bring education into the 21st Century.

Data sources: OECD, UN, UNESCO, WEF, and various.

IMPACT

While it's always been argued that the academic focused informal education ecosystem, which has always largely been broad and passive, should be separate and supplemental to the formal education system increasingly, as we see a growing dislocation between the future that's emerging and the formal education systems ability and in some cases willingness to prepare students for it, not only is this trend edging mainstream but in many cases it's becoming students primary education system - especially as they get older.

This is despite the fact that, while this trend has its benefits such as connecting students to experts, knowledge, and skills that might otherwise be unavailable to them via their own formal channels, there are often issues with a lack of accreditation, certification, tracking, and recognition, questions about content quality and structure, and a higher drop out rate than we see in formal school settings. Nevertheless, as more educators and parents alike recommend this trend is dovetailed with the formal education system globally the sector's growing at 32%, with more than 189 Million students enrolling in the past year alone, and more coming.

EXAMPLES

From first hand experience I see many schools around the world struggle to afford or acquire the resources they need, as well as the experts and teachers they need, to teach students about topics of interest that lie outside of the formal curricula - even if those topics augment and compliment those curricula which can range from the common-a-garden to the niche.

A good example of this is providing students with access to the teachers and resources they need to learn how to code or create an **Artificial Intelligence** (AI) - both of which are in high demand today in the workforce, and will continue to be for the foreseeable future. Burdened by this difficulty today with a few taps of a screen students can enrol in courses on Coursera, for example, led by experts like Andrew Ng, arguably the world's foremost expert in AI and an expert that even the most prestigious academic institutions struggle to engage, and supercharge their learning and future potential. And this is just one simple example of the benefit of this trend of the millions I could have cited.

ACT NOW

The formal education system can only do so much and go so far, but it's not helped by the fact that in many cases it has more in common with the industrial age education system that was developed more than a century ago than the modern day. It's also not helped by the entrenched legacy thinking of governments or examination boards which all too often act as a brake to change rather than an enabler, and unless they change their thinking and find a way to dovetail the formal with the informal students will continue to loose out.

EXPLORE:

- Emerging technologies and technology roadmaps
- Future of Education, and the Workplace and Workforce
- Policy and regulation reform

NANODEGREES

2ND YEAR ON THE LIST

QUICK TAKE

In our hectic world it's unsurprising that many people find it difficult and expensive to take the time out that they need to enrol in intensive multi-year degrees that allow them to either take their existing careers to new highs or switch tracks. And, this is where Nanodegrees, "bite sized" courses of study that can be completed in less than12 months, come into the frame. While they're arguably nothing new nanodegrees have taken off in the past few years because new online learning platforms and tools have made them cheaper and easier to access and complete than ever before.

IMPACT

With the cost of mainstream education showing no signs of coming down, with the average cost of attending colleges and universities alike over the past decade increasing by over 25% in the past decade, to an average of $48,510 for private institutions and $21,370 for public, and by over 169% since 1980 - despite technology advances - there are a growing number of people who are concerned about the unsustainable levels of student debt and the ability of people to access the courses they need to progress their careers and improve their futures. This is the problem nanodegrees were designed to address - even though ironically those costs have also increased, in some cases by 300% albeit from a much lower base.

With access to quality education more important than ever, especially when set against the backdrop of **Accelerating Rate of Change** and other future of work trends, nanodegrees offer students from all over the world a more affordable path to acquiring the critical skills they need to further their careers, and at the moment this trend is most popular with students from China, Egypt, India, and the US.

EXAMPLES

A project and skills based educational credential program nanodegrees offer students the opportunity to enrol in programs online, work collaboratively in teams to learn a suite of skills, and then receive certificates of completion that they can present to potential employers.

Coined in the1940's and rejuvenated by Udacity nanodegrees are now increasingly popular and seen by some as a way to break the stranglehold traditional academic institutions have on the education system. As a consequence today there are lots of courses available, and lots of examples.

Some of the more notable examples of this trend include nanodegrees from organisations such as Code First Girls who are trying to make coding and data science for girls accessible. Then, as nanodegrees gain in popularity it shouldn't come as a surprise that all manner of other organisations, such as the corporate giants, are taking advantage of the trend as well and using it to offer their own nanodegree programs, many of which are exclusively designed to help them avoid future skills shortages and feed their own hiring funnels.

ACT NOW

While one of the aims of nanodegrees is to democratise access to education for those who might otherwise be excluded the trends increasing costs will no doubt make a variety of previous supporters raise their eyebrows, but despite this the fact remains that the world needs affordable education and nanodegrees at least go some way to helping lowering costs and improving access to the quality education the world so desperately needs. As a result, for this reason, this is a trend worth investigating.

EXPLORE:

- Emerging technologies and technology roadmap
- Future of Education, HR, and the Workforce and Workplace
- Learning and Development strategies

Data sources: Udacity, The College Board, US Bureau of Labor, and various.

ENERGY INDUSTRY TRENDS

CONTENTS

BOOK AN EXPERT CALL

WHAT IF ... ENERGY COST NOTHING TO PRODUCE?

IT SOUNDS like a far fetched dream, but imagine the benefits of a world where the cost of generating electricity from renewables was nothing. First and foremost, the impact on everyday life would be profound. From powering our homes to fuelling our vehicles, energy expenses represent a significant proortion of household budgets, in some cases up to a third. With the elimination of production costs the financial burden on individuals and families would be lifted, freeing up money for other necessities, such as education and health as well as holidays and luxury goods.

In addition industries reliant on energy intensive processes could experience a renaissance of innovation and growth as they return the capital they would have spent on energy back into their businesses and R&D. Manufacturers could drive down production costs to make goods more affordable for consumers, and green transportation would become the norm rather than the exception.

The implications for environmental sustainability are equally compelling. With no economic barrier to clean energy adoption, renewable sources such as solar, wind, and hydroelectric power would proliferate at an unprecedented rate, and the shift away from fossil fuels would accelerate, mitigating the impacts of climate change and ushering in a new era of ecological balance. Furthermore, the geopolitical landscape would undergo a seismic shift. Nations rich in renewable energy resources could emerge as global leaders, wielding influence and power in ways never before imagined, and energy independence would no longer be a distant goal but a tangible reality for countries around the world.

But, of course, such a scenario raises questions about the mechanics of this energy utopia. Would it be achieved through ground breaking technological advancements or a fundamental shift in economic paradigms? While the logistics may be uncertain, the vision of abundant, cost-free energy offers a tantalising glimpse into a future where barriers are broken, possibilities are endless, and the world is forever changed for the better.

STATS THAT MATTER

2.4%

ENERGY DEMAND, ANNUAL AVG. GROWTH, GLOBAL

IEA

$23 MWH

LOWEST SOLAR LCOE COST, CHINA, 2022

BLOOMBERG NEF

$39 MWH

AVERAGE GAS LCOE COST, GLOBAL 2023

LAZARD

$68 MWH

AVERAGE COAL LCOE COST, GLOBAL 2023

LAZARD

440 MILLION EXAJOULES

ENERGY CONSUMPTION, ALL SOURCES, GLOBAL TOTAL 2021

IEA

$1 TR

FOSSIL FUEL INVESTMENT, ALL COUNTRIES, 2022

IEA

10%

ENERGY GENERATION, NUCLEAR, GLOBAL 2022

IEA

ENERGY

28%

ENERGY GENERATION, RENEWABLES, GLOBAL 2022

IEA

4,500 GIGAWATTS

RENEWABLE GENERATION CAPACITY, GLOBAL TOTAL 2023

IEA

60%

ENERGY GENERATION, FOSSIL FUEL, GLOBAL 2022

IEA

AUTONOMOUS ENERGY GRIDS

2ND YEAR ON THE LIST

QUICK TAKE

Autonomous Energy Grids (AEG) use a variety of different technologies to automate the generation and distribution of energy, and automatically balance and monitor the condition of the grid. After Smart Grids AEG, as well as fully autonomous energy utilities, are increasingly being viewed as the inevitable next step with a variety of organisations and regulators around the world already deploying and trialling the concept.

IMPACT

Today most large bulk level energy grids control around 10,000 points, but as smart, controllable devices are integrated into grids in time this number could easily reach hundreds of millions - thereby significantly increasing the complexity of controlling and optimising grids and pushing many existing grid systems beyond their current limits. And that's before you take into account the impact that Distributed Energy Resources (DER) such as grid scale storage and tied-grid storage assets, microgrids, renewables, and others, will have on the evolution of future energy grids.

From an operators perspective benefits include lower generator and grid build out, operating, and maintenance costs, improved energy usage, reliability, and resilience of supply, the elimination of peaker plants, and the automation of control rooms.

Meanwhile, from the consumers perspective, in addition to some of the indirect benefits associated with the above, so far trials have shown that AEGs can cut consumers energy bills by on average 85% which is, needless to say, significant.

EXAMPLES

In order to really achieve their goals AEG's have to capture and analyse data at speed, and then make decisions at speeds that are faster than those of alternative centralised and decentralised systems. As a consequence they're heavily reliant on spatial and temporal characterisations, state estimation and forecasting, and autonomous decision making systems which ultimately means that their ability to capture and process data at speed is crucial. Therefore, in order to overcome these challenges most AEGs are divided into distinct cellular blocks that can self-optimise when isolated from a larger grid, but that can still collaborate optimally when they are.

With multiple projects on going around the world, especially in California and Colorado in the US, as well as Europe, organisations are already seeing the benefits of AEG with companies including Centrica and NREL and leading the way. However, going one step further DEWA in the UAE is now on its own journey to turn the entire utility, which employs over 9,000 people today, into one of the world's first fully autonomous energy companies operated by just 9 people.

ACT NOW

While the benefits of AEGs are obvious organisations should also be wary of possible downsides which include cyber threats and the threat of reduced revenues as consumers consume less energy more efficiently. However, while the latter could in part be offset by lower operating costs, these should not stop organisations from experimenting with the technology and figuring out how to best maximise its potential and benefit from the new business opportunities it offers.

EXPLORE:

- Business impact assessments
- Emerging technologies and technology roadmaps
- Future of Energy, Security, and Transportation
- GRC implications
- New business and operating models

Data sources: CORE, NREL, ResearchGate, Siemens, US DoE, and various.

CARBON CAPTURE AND STORAGE SYSTEMS

2ND YEAR ON THE LIST

QUICK TAKE

As the world's Greenhouse Gas (GHG) emissions continue to rise past their historic high of 35 billion tonnes per annum their impact on **Anthropogenic Warming**, **Anthropogenic Pollution**, **Climate Change**, **Extreme Weather**, and other damaging trends, is becoming more pronounced. Consequently, while most of the world is now committed to reducing future emissions some are trying remove the GHG that are already at dangerous levels in the Earth's atmosphere, and so far Carbon Capture and Storage Systems (CCS), albeit that they are still small scale and expensive, are proving to be the best route to take.

Data sources: Bloomberg, Europa, and various.

IMPACT

CCS is a greener way to operate power stations, especially fossil fuel powered ones which still account for over 70% of the global energy mix, while helping ensure energy supplies as the world accelerates the **Green Energy Transition**. Despite its obvious benefits though capturing carbon is still an energy intensive process with potentially harmful side effects that include Acidification and Eutrophication.

If fitted to all coal power plants studies have shown that CO2 emissions could decrease by over 60% by 2050, and if they were fitted to all biomass, coal, and gas power stations emissions could actually be negative. However, as the cost of polluting the atmosphere with a metric ton of CO2 is still half the cost of capturing it and storing it using CCS getting the technology adopted is still a challenge which is why several governments are now planning to double the cost of their carbon taxes.

Additionally, when it comes to calculating the total economic cost of CCS it's also important to remember that CO2, once captured, is a valuable tradable commodity which gives the industry multiple routes to profitability.

EXAMPLES

Today CCS plants like the Icelandic Orca plant are among the world's largest but it's only one of 26 commercial scale CCS projects in operation and when it opened in 2020 it grew the world's annual carbon capture capacity to a measly 13,000 metric tons, representing a 40% increase, which is obviously significantly below where we need to be as a global society if we are to move the emissions needle enough to make a difference at a planetary scale. By 2030 it's hoped the plants capacity will exceed 500,000 metric tons.

Asides from projects like this one though other organisations are finding interesting new uses for CO2 in order to improve the industry's economic outlook and viability. These include capturing CO2 and using it to produce carbon neutral Blue Diesel and rocket fuel, to reinforce concrete, and even create prized synthetic "sustainable" diamonds. And, while the majority of these projects may be small in comparison with Orca, they do demonstrate how the CCS community is trying to find new and intriguing ways to add value and make extracting CO2 profitable.

ACT NOW

While reducing future global GHG emissions from today's historic highs is necessary there's also a need to extract much of the existing CO2 in the Earth's atmosphere in order to halt and reverse some of the damaging trends we're experiencing. As a result CCS is an industry waiting to have its day in the proverbial sun and it's a trend that should be watched closely.

EXPLORE:

- Business impact assessments
- Emerging technologies and technology roadmaps
- Future of Energy, Materials, and Sustainability
- Partner ecosystems and solutions
- New business and operating models
- Regulatory environment

ENERGY ISLANDS

2ND YEAR ON THE LIST

Energy island concept, Vindo Consortium

QUICK TAKE

Many people believe that Energy Islands are the missing link that could help countries massively expand their offshore green power and help them achieve their **Net Zero Pledges** and ambitions.

Today most offshore wind farms connect to onshore power grids individually or to offshore converter stations that aggregate the power of three or four wind farms together via High Voltage Direct Current (HVDC) links to shore but these are difficult and expensive to maintain and scale as new capacity is added, hence a new solution is needed.

Data sources: Various.

IMPACT

As world leaders continue to come under pressure at summits such as COP to combat **Climate Change** and transition to net zero emission economies by 2050 many are coming to the inescapable conclusion that they can only achieve these goals by accelerating the **Green Energy Transition** and by massively ramping up their investment in new green energy projects, of which offshore wind will play a vital role.

For Europe alone, for example, this means developing huge amounts of offshore wind energy capacity with Brussels targeting 60GW of wind power by 2030, which is triple what they have today, and 300GW by 2050.

Faced with such vast expansion the plans for artificial energy islands, which are seen by many as some of the most ambitious energy projects in the world and an evolution of inter-connectors and Multi-Purpose Inter-connectors (MPI), are now being drafted and approved.

Asides from these aforementioned benefits studies have shown these islands will reduce connectivity costs by at least 10%, as well help connect multiple countries at a time.

EXAMPLES

There is no denying that energy islands are ambitious. They are also very expensive and require significant Public-Private collaboration and commitment. However, developed wisely they can serve multiple uses including acting as bases to host wind powered green hydrogen production facilities as well as **Grid Scale Energy Storage Systems** and other energy artefacts.

Having pioneered some of the first offshore wind farms more than thirty years ago Denmark is now in pole position and the country has already drafted plans to create the world's first artificial energy island 80km off their coast for an estimated cost of over $34 Bn. Initially planned to connect 3GW of offshore wind power the island will eventually connect 10GW with inter-connections to multiple European countries and support the production of green hydrogen. Then, hot on Demark's heels is Belgium whose more modest energy island will cost $6 Bn and connect over 4GW, and while these are the two front runners there are already plenty more emerging including from the UK, other European member states, as well as elsewhere in the world.

ACT NOW

The proliferation of offshore wind creates a variety of challenges especially when it comes to connectivity, maintenance, and planning, and artificial energy islands, which essentially act as connectivity aggregators on steroids, can help reduce all of these burdens.

EXPLORE:

- Emerging technologies and technology roadmaps
- Future of Energy
- Partner ecosystems and solutions
- New business and operating models

GREEN ENERGY TRANSITION

2ND YEAR ON THE LIST

QUICK TAKE

The most significant system level energy shift since the first Industrial Revolution the transition from a fossil fuel based global energy system to a cleaner "greener" one is well under way with estimates putting the cost of this transition at over $92 Trillion. Needless to say the impact and implications of this trend on the industry, as well as on other industries and society, is as disruptive as it is significant. Influenced by many other trends including **Climate Change**, **Extreme Weather**, **Net Zero Pledges**, and others, it is accelerating, driving transformation across sectors, and becoming the norm.

Data sources: Bloomberg, IEA,and various.

IMPACT

While in many ways it makes sense to move from using polluting finite energy resources to power our world to using "cleaner" renewable ones, the ultimate force behind this trend is the world's need to move away from using sources of energy that create, accelerate, and exacerbate damaging trends such as climate change and **Air Pollution**, with their associated economic, environmental, and societal impacts, to cleaner, greener, zero emission ones.

While there are many impacts of this trend, such as the collapse in funding for new oil and gas projects from $750 Bn in 2014 to just $250 Bn in 2020 as well as the removal of oil and gas stocks from popular investment portfolios, the greatest impact of this trend will be to help create a healthier and more sustainable society. It will also have an impact on global geopolitics by, to a degree, eliminating some governments ability to weaponise energy supplies.

Asides from these though, other equally significant impacts include the scale of the industry's herculean transition, and ultimately the intended elimination of over 35 billion tonnes of CO2 in annual energy related emissions per year.

EXAMPLES

Step back a decade or so ago and you would have found numerous examples of organisations developing and switching to green energy sources, but today we're seeing a veritable explosion of activity and investment that is unparalleled in history.

In 2020 renewable capacity additions increased 45% year on year to 280Gw, the highest year on year increase since1999, with investment in new fossil fuel projects collapsing, and in 2021 and 2022 they accounted for over 90% of the global power capacity increase.

Despite these staggering figures though it is still estimated that the rate of green energy deployment needs to double if the world wants to hit its 2050 climate pledges, especially as the world's energy consumption continues to climb, with several international bodies calling for an end to new fossil fuel projects.

While the significant majority of these new projects are hydro, wind, and solar, accounting for more than 90% of all new green energy projects, there have also been significant investments in new Ammonia, biofuels, biomass, Hydrogen, geothermal, and tidal capacity as well.

ACT NOW

Spurred on by new policies, the need for greater energy security, and in an attempt to stave off the worst of climate change and other damaging trends it is clear that the world is embracing green energy with gusto. But there is alot still to be done and this is a marathon not a sprint.

EXPLORE:

- Business and impact assessments
- Best practises and case studies
- Emerging technologies and technology roadmaps
- Future of Artificial Intelligence, Energy, and Materials
- New business and operating models
- Partner ecosystems and solutions
- Policy and regulation reform

GRID SCALE ENERGY STORAGE SYSTEMS

2ND YEAR ON THE LIST

QUICK TAKE

Grid Scale Energy Storage Systems, which have been around for decades, are increasingly seen as one of the most important pieces of the jigsaw puzzle as countries around the world try to realise their **Net Zero Pledges** and accelerate their **Green Energy Transition**.

As the world switches from a polluting finite oil and gas energy system to a cleaner, greener, renewable energy system that in many cases is intermittent this trend is accelerating as governments and organisations alike seek to improve grid reliability and stability.

Data sources: IRENA, NREL, and various.

IMPACT

The intermittent nature of certain renewable energy sources such as solar and wind have always been the sector's greatest Achilles heel, and while we have new photovoltaic materials and technologies that will let solar generate electricity in all weather conditions, day and night 24/7, until they commercialise and mature we must rely on grid scale storage to ensure grid reliability and stability.

While the cost of grid scale storage has been falling for decades in 2019 the Levelised Cost of Discharge and Electricity (LCoD and LCoE) for Lithium Ion (LiON) batteries which are this trends main workhorse dropped below the LCoE equivalents for oil and gas, hitting $187 per MWh. And since then costs have fallen more and will continue to fall further into the far future.

It's the result of this, and other factors, why states such as California have invested in new grid scale storage capacity rather than new gas peaker plants that would have traditionally been used to boost the grid in times of high demand. All of which simply serves to hasten the demise of fossil fuel based energy generation plants and systems.

EXAMPLES

The biggest impediments of this trend at the moment relate to investment, the speed of deployment, and the cost of energy storage per MWh, but all are coming down at an accelerating rate as projects and economies of scale get bigger and as new technologies drop the cost of storing and releasing energy. Furthermore, as a result of increasing expenditure on new green energy projects it is clear for all to see that more R&D effort is being spent on improving the commercial viability of these systems which, in turn, will help accelerate their deployment thereby creating a virtuous cycle that helps accelerate the world's energy transition.

While many organisations are experimenting with alternative energy storage systems that include everything from so called Gravity Power Plants and more traditional large scale pumped hydro systems, as well as flywheels, Metal-Air batteries, molten salt, water, and new **Undersea Energy Infrastructure** formats, unsurprisingly LiON battery systems still represent over 95% of deployed systems. However it is inevitable that while LiON installations by MWh will still increase that in time this ratio will change.

ACT NOW

While renewable energy has many benefits, especially when it comes to its eco credentials, sources like wind and solar are intermittent and only produce energy when the conditions are right. As a result consumers have to rely on grid scale energy storage systems to boost the grid when energy demand is higher than the grids supply. However, while it's likely that these systems will always have a place in the global energy portfolio as the intermittency of renewables is eliminated this trend will likely decline.

EXPLORE:

- Emerging technologies and technology roadmaps
- Future of Energy and Materials
- Partner ecosystems and solutions

SUPERGRIDS

2ND YEAR ON THE LIST

World's first 1,100 kV HVDC transformer, Siemens

QUICK TAKE

As the world's energy consumption and demand continues to soar with no sign of abating, and as the world accelerates its **Green Energy Transition** more countries are exploring ways to export and distribute the energy they produce to other regions of the world, and while some countries are focused on creating **Energy Islands** others have their sights on connecting together the global energy grids using combinations of trans-continental and submarine Ultra High Voltage Direct Current (UHVDC) grid, converter, and transformer systems that can carry and distribute loads in excess of 10GW with ease.

IMPACT

Supergrids are nothing new, after all countries have been using them to import and export energy for decades, but as the world transitions from one energy system, namely a fossil fuel based one, to a new one, namely green energy, it is giving governments the opportunity to re-think their regional and global energy strategies.

That said though, while this transition poses a threat for countries who are used to weaponising energy supplies in disputes, it gives others a new opportunity to exert and extend their influence in new ways. One example of this is China, a leader in UHVDC systems, who many are now thinking are promoting a supergrid agenda to both extend their influence and to win the **Shadow Standards War**. The net result of which is, as ever in our world, governments need to choose their friends wisely and develop their strategies with their eyes wide open.

On a brighter note though this trend could ultimately help accelerate the world's transition to green energy, by connecting generation centers with demand centers, lower energy costs, and help eliminate **Energy Poverty**.

EXAMPLES

Today there are almost no governments that aren't considering creating or extending supergrid networks, but it generally shouldn't come as a surprise that China and Germany are considered the leaders in the field, and as every project often comes with a multi-billion dollar price tag progress is often a lot slower than it could or should be.

That said though while projects such as the $44 Bn SuperNode European supergrid project and the national US supergrid project stall in endless cycles of debate and become the victims of political wrangling, other projects such as China's national supergrid project which would connect all its provinces and be the world's largest supergrid, as well as the Asian Supergrid project, are making steady, if staggered, progress.

However, while they are making progress China's grand ambition of creating a centrally managed world spanning supergrid, the Global Energy Interconnection (GEI) project which aims to connect 80 countries together by 2070 and forms part of China's multi-trillion dollar Belt and Road initiative, is stalling as countries become suspicious of their movitations.

ACT NOW

Supergrids can both accelerate the world's transition to green energy and reduce the cost of energy for everyone on the planet, and as the world's thirst for energy increases ultimately the winners in this space will be those who take action.

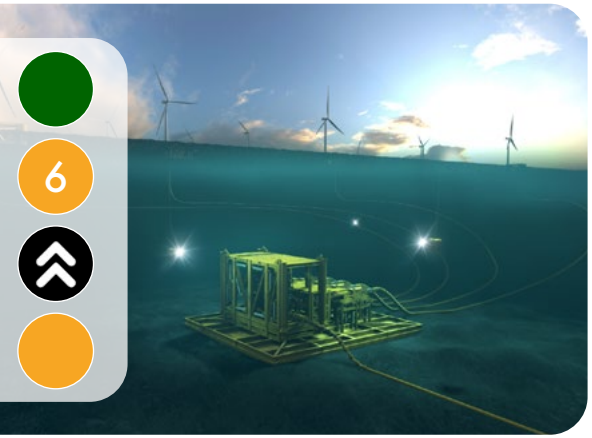
EXPLORE:

- Best practise and case studies
- Business and impact assessments
- Emerging technologies and technology roadmaps
- Future of Energy and Materials
- New business and operating models
- Partner ecosystems and solutions
- Policy and regulation reform

Data sources: Harvard University, IEEE, Siemens, US Department of Energy, and various.

UNDERSEA ENERGY INFRASTRUCTURE

2ND YEAR ON THE LIST



Undersea substations, Aker

QUICK TAKE

As the **Green Energy Transition** takes the world by storm the investment in new offshore energy generation capacity, especially in the deep sea where the winds and tides are the strongest and most reliable, is accelerating at an increasingly rapid rate.

As a result in order to effectively harness these massive wind and tidal energy resources new methods of operation and new forms of infrastructure are required to make them commercially viable so organisations are developing all manner of undersea energy infrastructure.

Data sources: Aker, Bloomberg, IEA, and various.

IMPACT

Today over 80 percent of the world's wind resources are located in deep water reaching over 196 feet (60 meters) below sea level which means that they aren't suitable for fixed foundation wind farms or other infrastructure, such as **Grid Scale Storage Systems**. This is one reason, for example, why organisations such as GE have developed floating deep sea wind turbines and systems, and others are developing **Energy Islands**.

Not only does undersea energy infrastructure, which is often anchored on the sea bed, make these resources viable but they have other benefits as well including improving the cost and reliability of offshore wind.

Because they have fewer moving parts, and in the case of undersea grid scale storage systems and substations, harness seawater cooling, they are not only easier and cheaper to maintain but importantly are also more reliable. All of which ultimately helps improve the commercial attractiveness of offshore power which for some countries now represents over 25 percent of their energy generation capabilities, and growing.

EXAMPLES

Bearing in mind that the explosion in offshore energy investment is only really a recent phenomenon it shouldn't be surprising that this trend is relatively nascent and that it will continue to mature and develop in the coming years.

At the moment there are two main threads to this trend, namely the development of undersea grid scale energy storage systems, some of which operate in a similar way to terrestrial pumped hydro systems, that store energy until it's transferred either to the terrestrial grid or back to the wind turbines to use, and the development of undersea substations.

While both these help improve the cost and reliability of offshore energy projects, and help secure their place in the global energy mix, another interesting benefit is their ability to improve local marine bio-diversity which, as we continue to face of **Bio-Diversity Collapse**, could provide organisations with new revenue streams as well as help them create more sustainable and eco-friendly businesses.

ACT NOW

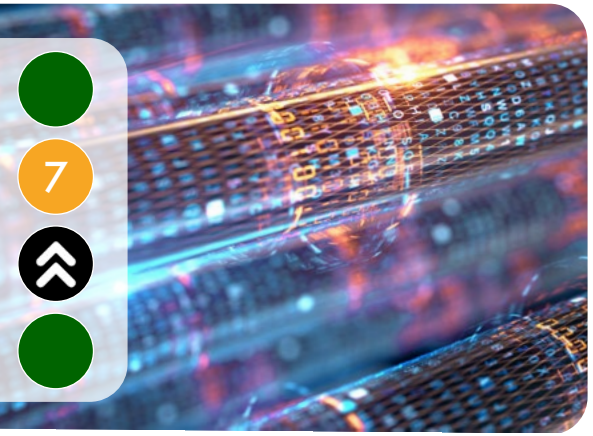
The evolution of the global energy mix presents organisations with new opportunities to create and dominate new market segments and this is a classic example of innovation in action. While this trend has important commercial and operational benefits it is also an interesting example of how organisations, with a little thought, can help regenerate areas potentially damaged by anthropogenic activity.

EXPLORE:

- Emerging technologies and technology roadmaps
- Future of Energy
- Infrastructure investment
- New business and operating models

VIRTUAL POWER PLANTS

2ND YEAR ON THE LIST



QUICK TAKE

Virtual Power Plants (VPPs) are often **Blockchain** based, distributed, **Cloud Computing** based power plants that aggregate electricity generation from Distributed Energy Resources (DER), such as renewables. Not only do they improve power generation efficiency, as well as energy supply flexibility and resilience, but they also play an increasingly important role in energy trading. Most countries around the world now have some form of VPPs, and the trend is accelerating as DER like biomass, hydro, hydrogen, solar, tidal, and wind get deployed.

IMPACT

VPPs are doing for the energy industry what virtualisation did for the technology industry - helping operators reduce costs, improve resource efficiency and energy security, and respond faster to changes in demand. Like investments in **Grid Scale Energy Storage Systems** they are also helping them eliminate the need for peaker plants.

However, while all these benefits are important one of their biggest upsides is that they give operators the ability to fully exploit and use all their assets which has significant advantages when it comes to innovation and developing new products that can be used to extend leadership and increase profitability.

As global energy infrastructure continues to show its age, with all the consequences that brings, which include everything from sparking some of the worst wildfires in US history and rolling blackouts, VPPs will play an increasingly important role in helping modernise the grid and stabilising supply in both normal and disaster scenarios. They also, for the first time give operators opportunities to experiment with new business models and B2C partnerships.

EXAMPLES

A term first banded about in the 1990's in the past decade VPPs have really started to take off as different technologies and trends, such as AI, Blockchain, Cloud, and IOT, have matured, and as communities and countries have embraced the concept of renewables, and other DER.

Not only are VPPs playing an increasingly important role in helping utilities reduce or eliminate significant capital expenditures, such as building new power plants and eliminating costly infrastructure upgrades, but they are also helping them move to a model of predictable energy generation costs and end their reliance on fossil fuel generators whose prices fluctuate and that they have to hedge.

In California rather than building three new coal fired power stations Sidewalk Infrastructure Partners (SIP) built North America's largest VPP which in time will have over 5GW of capacity and save the equivalent of burning 3.8 million pounds of coal. Elsewhere companies like Statkraft are using VPPs to aggregate over 1,400 independent power producers to create a VPP with over 10 GW of capacity.

ACT NOW

While there are solid business reasons why organisations should embrace VPPs its important to consider both the direct and indirect benefits of the technology on everything from the environment to product innovation to security of supply. In time the viability of VPPs will also be further helped by the maturation of other complimentary technologies and trends.

EXPLORE:

- Business and impact assessments
- Emerging technologies and technology roadmaps
- GRC and security implications
- New business and operating models
- Partner ecosystems and solutions
- Product innovation initiatives

Data sources: CPUC, GTM, ResearchGate, Statkraft, and various.

FINANCIAL SERVICES TRENDS

CONTENTS

WHAT IF ... BITCOIN BECAME MAINSTREAM?

BITCOIN, ONCE a fringe movement whispered about in cyberpunk forums, has captured the global imagination. Its volatile journey, from basement server rooms to Wall Street headlines, has ignited both fervent belief and deep skepticism. But what if, instead of simmering on the periphery, Bitcoin crossed the Rubicon and became the dominant form of currency?

Imagine a landscape where fiat currencies are relics of a bygone era. Every transaction, from buying groceries to purchasing a dream home, pulsates through the digital veins of the blockchain. Bitcoin, with its decentralised nature and immutable ledger, becomes the lingua franca of global commerce. Governments adapt, issuing their own digital currencies tethered to the mighty Bitcoin, their financial empires morphing into tributaries that feed it.

This tectonic shift wouldn't just rearrange our wallets, it would restructure the very fabric of global power. Central banks, once the gatekeepers of monetary policy, have to loosen their iron grip. Instead, the fate of the global economy rests on the collective actions of tens of millions of individual miners and investors, a democratic - albeit volatile - experiment in financial autonomy. And, imagine the consequences – rising economic equality as individuals hold greater control over their wealth, or conversely, the emergence of crypto-czars, amassing digital fortunes that dwarf the holdings of nations. The ripple effects of Bitcoin's reign extend far beyond financial frontiers. Social contracts will be rewritten.

Imagine paying your taxes anonymously, directly supporting others with micro-tipping, or crowdfunding revolutionary projects instantly. Philanthropy becomes instantaneous and borderless, fueled by a transparent, trustless system. Yet, alongside these utopian possibilities loom dark shadows. Crime takes on a new digital dimension, cybercriminals wielding Bitcoin like invisible weapons. Regulatory quagmires emerge, governments grappling with the specter of an uncontrollable, global monetary system.

STATS THAT MATTER

25%

PCT. OF GLOBAL MALWARE TARGETING FS INDUSTRY

US CONGRESS

235

NUMBER OF NEOBANKS, GLOBAL TOTAL 2023

INSIDER INTELLIGENCE

$2.1 TR

WEALTH HELD BY RICHEST 25 PEOPLE, GLOBAL 2023

FORBES

$14.8 TR

DIGITAL PAYMENTS MARKET, GLOBAL TOTAL 2023

WORLDPAY

$463 TRILLION

FINANCIAL ASSETS, GLOBAL TOTAL 2023

CREDIT SUISSE

1.4 BN

UNBANKED PEOPLE, GLOBAL TOTAL 2023

WORLD BANK

3.6 BN

ONLINE BANKING CUSTOMERS, GLOBAL 2023

MONEY TRANSFERS

FINANCIAL SERVICES

$26 TR

INDUSTRY MARKET WORTH, GLOBAL 2022

RESEARCH & MARKETS

$126 TRILLION AUM

ASSETS UNDER MANAGEMENT, GLOBAL TOTAL 2023

MCKINSEY & CO

62 ML

NUMBER OF MILLIONAIRES, GLOBAL TOTAL 2023

CREDIT SUISSE

BUY NOW PAY LATER

2ND YEAR ON THE LIST

QUICK TAKE

Buy Now Pay Later (BNPL), which can be best described as an unsecured installment loan, divides consumer's purchases into multiple payments with the first due at the checkout.

While BNPL isn't especially novel as a concept it is useful for retailers and can be a convinient way to help consumers retain cash and remain liquid, while at the same time helping them reduce some of the burden associated with buying items on traditional lines of credit or credit cards. Predominantly championed by fintechs BNPL is now mainstream and growing globally as a payment option.

Data sources: Mckinsey, Precedence Research, and various.

IMPACT

There is little doubt in anybody's minds that BNPL has changed consumer behaviours, as well as the landscape of the broader credit and payments ecosystem as more companies pile into the space. However, while BNPL offers consumers a great number of advantages, such as the ability to spread payments, there are a growing number of voices worried about increasing **Household Debt** levels and peoples ability to pay, as well as a worrying increase in the overall number of payment defaults which in some markets is now more than 30%.

That said though it's estimated the market will grow by 44% CAGR to reach $3.268 Trillion in value by 2030, so despite concerns there appears to be very little holding the trend back.

While adoption varies by country globally it's estimated there are over 360 Million BNPL users, with that hitting 900 Million by 2027, and that 75% of those are Gen Z or Millenials. It's also interesting to see that 67% of consumers believe that BNPL might replace traditional credit cards, and that 38% use BNPL more than once a month, predominantly for electronic purchases.

EXAMPLES

Today more than a quarter of small businesses offer BNPL as it becomes easier to integrate into their Point of Sale (POS), with Klarna, Paypal, and Square being among the industry's major incumbents. However, as other companies including Amazon, Apple, Ant Financial, and others continue to pile into the space their ability to maintain their generous market shares will undoubtedly be tested.

While on average retailers estimate that offering BNPL improves conversion rates by at least 2%, with apparel making up over 30% of all purchases, most BNPL providers only offer the service to consumers with credit scores over 700, and as economies tighten it's highly likely that almost all ratios will change.

Having started in the retail industry though BNPL has since expanded into multiple other industry segments and now encompasses both B2B and B2C spending, with the healthcare and insurance industries leading the charge. Furthermore, as **Open Banking** makes affordability and credit risk checks even cheaper and easier its certain that the market will become even more crowded as more banks and providers pile into it.

ACT NOW

While BNPL is responsible for driving a new wave of consumer behaviour and spending its greatest impact might very well end up being helping to trasform the consumer credit and payments markets. However, while BNPL has its benefits companies in this space must ensure they have robust systems in place to monitor fraud, vet consumers ability to pay, and ensure that they don't contribute to increasing **Wealth Inequality**.

EXPLORE:

- Business and impact assessments
- Emerging technologies and technology roadmaps
- Future of Financial Services and Retail
- New business and operating models
- Partner ecosystems and solutions

CRYPTOCURRENCIES

2ND YEAR ON THE LIST

QUICK TAKE

Millennia ago shells were the first currency, then they were superseded by deer hide notes and physical coins, which were then augmented in the 1960's by credit cards and digital payments. And now, thanks to technologies such as **Blockchain**, money as we know it, has evolved again this time into Cryptocurrencies and individuals, organisations, and governments alike are both intrigued and worried by what they enable and represent. So much so that governments, worried about monetary sovereignty, are creating their own **Central Bank Digital Currencies** (CBDC).

IMPACT

Today you can't walk into a bar or a meeting room anywhere in the world without someone talking to you about cryptocurrency, which goes to demonstrate the system level impact this trend's having and will continue to have.

So far it's estimated 4% of people in the world have cryptocurrency stakes with over 300 Million active crypto users worldwide and growing as more global exchanges, currently 18,000 and counting, accept and enable cryptocurrency purchases and trades. While the market statistics are always changing, or volatile as some would say, currencies like the infamous Bitcoin, first created in 2009, have increased in value by over 193,000% since 2012 with users, despite very public issues with some cryptocurrencies including Bitcoin and other alt-coins, expressing an eye brow raising 97% confidence in them.

However, despite also being seen as key enablers of global criminal activity, which is a big issue in itself, such as **Cryptojacking** and **Ransomware**, currently there are over 10,000 cryptocurrencies in existence representing over $3 Trillion in value.

EXAMPLES

There are plenty of examples of cryptocurrencies and what they enable, from the likes of Bitcoin and Dogecoin to others such as Ethereum, Shiba Inu, Solana, Tether, and many more, but outside of the world of **Stablecoins** very few of them are pegged to any store of real value such as gold which only adds to their market volatility since most of them are reliant on network effects to increase in value.

Nonetheless some of the most notable examples of this trend include the use of Bitcoin to help bank the unbanked, and thereby reduce global **Wealth Inequality**, as well as El Salvador's adoption of Bitcoin as a national currency alongside the US Dollar in 2021 which both the IMF and World Bank opposed. Then there's also the ability to use currencies, such as Tangle to support machine based peer to peer **Internet of Things** microtransactions.

Furthermore, the rise of crypocurrencies and **Tokenisation** have also meant that anyone now can create their own coins - money - including organisations such as Decentraland with their **Metaverse** MANA currency, JPMorgan with their JPM Coin, Roblox, and many others.

ACT NOW

For the first time cryptocurrencies give individuals and organisations the ability to create value based monetary networks that sit outside of the traditional centralised core banking infrastructure and as such give them the opportunity not only to create new captive revenue streams but also, in some cases, create parallel shadow economies. As such the impact of this trend on every aspect of global business, culture, and society should not be underestimated.

EXPLORE:

- Business and impact assessments
- Emerging technologies and technology roadmaps
- Future of Artificial Intelligence, Financial Services, Retail, and the Workforce
- New business and operating models
- Partner ecosystems and solutions

Data sources: Binance, Bloomberg, Fortune, IMF, World Bank, and various.

DECENTRALISED FINANCE

2ND YEAR ON THE LIST

QUICK TAKE

Decentralised Finance (DeFi) is an umbrella term for a financial system that functions without third party intermediaries like banks. By taking advantage of Blockchain to decentralise and disintermediate today's incumbents DeFi players are enabling a whole new breed of Peer to Peer financial services.

However, while this is disruptive Defi's digital stack means that in time the entire ecosystem could be fully automated and embedded with intelligence which will further disrupt the status quo. As a consequence this is a powerful trend with alot of runway.

Data sources: Forbes, FT, Investopedia, Wharton, and various.

IMPACT

Needless to say from an impact perspective the ground is always shifting because as with everything that's digital things move fast.

As they say money makes the world go round, but increasingly money, the concept of money, and how we invest, move, and use it are all changing. Today, leveraging many of these associated trends, the DeFi ecosystem is growing strong, albeit from a low base, to the point that the top three players now have over $100 Billion worth of assets, or Total Value Locked (TVL) in DeFi protocols. Furthermore, lured by lucrative returns investors are pouring money into a host of DeFi borrowing, decentralised trading, lending, and synthetic protocol products.

On Ethereum (ETH), for example, there is now double the amount of ETH locked in smart contracts on Decentralised Exchanges (DEXs) than on Centralised Exchanges - another testament to the trends popularity. However, while new DeFi entrants and protocols spring up like weeds DeFi's enduring legacy could be to help bring banking and financial services to the 2 Billion people in the world who are currently unbanked.

EXAMPLES

The DeFi ecosystem is, naturally, exploding as the number of DEXs, Initial DEX Offerings (IDOs), investment, liquidity pools, lending and payment platforms, Non-Fungible Token (NFT) marketplaces, and more all rise in popularity.

This explosion in growth also means that in the medium term the market will be ripe for a shake out as some organisations go to the wall and others consolidate their positions.

In much the same way that Uber connected drivers and passengers DeFi is connecting financial users and the benefits include 24/7 trading, with platforms such as Robinhood, which in 2021 caused huge disruption and panic when traders targeted GameStop, and other stocks, and being able to trade previously untradeable digital assets, such as digital images and works of art, software code, and tweets via NFT marketplaces like OpenSea.

And all ths is before we discuss the literal ocean of DeFi platforms that have sprung up to take a bite out of every other type of financial service imaginable.

ACT NOW

DeFi is likely to have a significant impact on how banks and the financial services sector as a whole operate in the future. Additionally, not only does it have the potential to shift the structure of the entire financial system itself at a macroeconomic level, but it could also play a significant role in helping reduce the impact of global **Wealth Inequality**.

EXPLORE:

- Business and impact assessments
- Emerging technology and technology roadmaps
- Future of Financial Services
- New business models, operating models, and products
- Partner ecosystems and solutions
- Social trends

FRACTIONAL OWNERSHIP

2ND YEAR ON THE LIST

QUICK TAKE

The ability to part own assets alongside other investors and benefit from them either financially or socially has always been possible. Today though this trend is being pushed into the spotlight more because of a convergence of several technologies and trends including **Cryptocurrencies**, **Decentralised Autonomous Organisations** (DAO), **Blockchain**, **Non-Fungible Tokens** (NFT's), and others which make it possible for people to part own and benefit from almost anything and everything. As a result shaking up everything from access rights, IP law, and tax, to asset classes, risk, and more.

Data sources: Coin Telegraph, Fractional, and various.

IMPACT

While many people associate time shares with fractional ownership the greatest difference between the two is that fractional ownership opportunities give shareholders a deed to a fraction of the asset, sometimes called Fractional Interest. This trend is also increasingly being seen by many as a lagging indicator of the growth of the sharing economy as both continue to rise.

Needless to say though there are pros and cons to the trend. Pros such as the expanded opportunity to own and benefit from all kinds of assets and asset classes, lower maintenance burdens and shared upkeep costs, and shared income opportunities. The cons though include fewer financing options, and a general lack of flexibility and freedom when it comes to decision making, usage, and so forth.

A form of collaborative consumption where the cost of buying, operating, and maintaining assets, as well as the benefits or proceeds, are all split between shareholders, the convergence of the aforementioned technologies and trends now mean that this trend is capable of disrupting several areas of the investment industry.

EXAMPLES

Different from crowd funding and traditional time shares, and seen by some as a trendy business model and by others as a growing asset class, fractional ownership is now having its time in the sun as third parties everywhere come together to take stakes in all manner of digital, physical, and virtual assets, from athletes and celebs to clubs, companies, and more.

One of the most interesting examples of this trend was the attempt by a group of investors who formed a DAO, named ConstitutionDAO, in an attempt to buy the original 1787 US Constitution at auction in 2021 and "preserve it for the people." Even though they ultimately failed the group managed to raise over $47 Million in Ethereum crypto and even created governance $PEOPLE Tokens which would have allowed investors to vote on how the document was managed and its future.

Meanwhile other examples include the ability of individuals to fund buying their homes using this model, which could disrupt and replace traditional mortgage lending, and others promoting the idea of Fractional-NFT's or F-NFT's for short, among many other examples.

ACT NOW

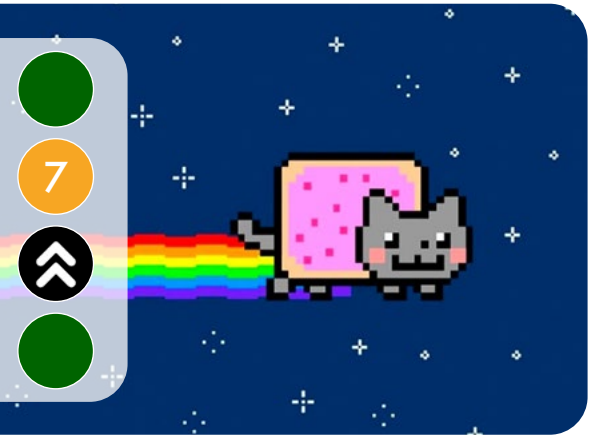
In an era where **Wealth Inequality** is getting greater this trend represents just one interesting way to potentially redress the balance. More than that though it also highlights how people with common interests can now efficiently and effectively come together, under common governance models, to invest in things they have a common interest and protect them, and benefit from them.

EXPLORE:

- Business and impact assessments
- Emerging technologies and technology roadmaps
- Future of Communications, Financial Services, and the Workforce
- New business and operating models

NON-FUNGIBLE TOKENS

2ND YEAR ON THE LIST



Nyan Cat

QUICK TAKE

Non-Fungible Tokens (NFTs) a unit of data stored on a digital ledger, such as a **Blockchain**, that records the purchase, sale, and ownership of digital items of all kinds. As a result it could be argued that for the first time everyone everywhere now has an easy way to buy, sell, and track the provenance of digital assets in a safe and secure way.

The consequence of this is that digital items can now be bought and sold in much the same way as physical items therefore opening the door to a whole new market opportunity.

IMPACT

You always know that a new trend is hot when new words start appearing to support it, and with NFTs one of those is CryptoArt which is now a thing, as well as a new profession. Really.

In a sense NFTs are the result of a combination of a number of different trends and technologies, and while they give everyone a way to trade digital assets they also have a massive carbon footprint because they rely on Blockchain technology.

Today demand for NFTs and Fractional-NFT's, part of the **Fractional Ownership** trend, is surging with the market increasing by 1,785% in just mere months to reach a market capitalisation of over $20 Billion, and while that growth rate isn't sustainable, just like the crypto market it's also clear that this is a trend that's here to stay which means the only way is up.

Additionally, because NFTs are primarily aimed at digital assets it also means that the market has no conceivable top end.

EXAMPLES

From Tim Berners-Lee selling the internets original source code as an NFT for $5.4 Million and Jack Dorsey selling his first Tweet for $2.9 Million, to the original Nyan Cat gif being sold for $590,000 or 300ETH, it's as if all of a sudden the NFT floodgates have opened.

Currently one of the most expensive NFT's ever sold is a digital piece of artwork called "Everydays - The First 5,000 Days" by artist Mike Winkelmann which was sold by Christies for $69,346,250 - a staggering amount of money for something that fundamentally by traditional investment standards at least doesn't exist in physical or material form.

However, while NFTs primarily enable the sale of digital assets elsewhere entrepreneurial individuals have been using them to try and sell physical items too such as was the case in the US where real estate broker Shane Dulgeroff attempted to sell a digital piece of art for $120,000 that came with a "free house." In fact this idea at the time was so novel that noone knew for sure whether regulators would release the deed for the house.

ACT NOW

NFTs literally open up a whole new world of trading but it is a largely unregulated industry and there are significant questions about what happens to people's ownership of assets as and when NFT marketplaces close of go into administration. Nevertheless though it's a trend worth investigating.

EXPLORE:

- Business and impact assessments
- Emerging technologies and technology roadmaps
- Future of Financial Services, Media, and Retail
- Legal and regulatory implications
- New business models, operating models, and products
- Partner ecosystems and solutions

Data sources: Guardian, and various.

OPEN BANKING

2ND YEAR ON THE LIST

QUICK TAKE

Open Banking is a system that gives third parties, whether they be consumers or businesses, controlled and secure access to financial data via the use of APIs. Widely accredited with giving consumers better control over their financial information the trend has also been accredited with facilitating new innovation in the sector and accelerating the growth of industry ecosystems.

With the total number of API calls in the UK alone exceeding over 1 Billion per day it's clear that this trend is not only here to stay, but that it likely has lasting appeal.

Data sources: Experian, FCA, and various.

IMPACT

The impact of Open Banking in the financial services industry has been so positive, from both a consumer and industry innovation perspective, that in Australia and the UK regulators are now actively considering rolling the initiative out to other sectors under the moniker of Open Sectors.

However, while some markets have embraced it whole heartedly, with over 4.5 Million consumers in the UK using open banking services, or more than 10% of all digitally enabled businesses and consumers, other markets such as the EU have seen much slower adoption. Despite this though it's estimated the market will continue to grow by 24% CAGR to reach $43 billion by 2026, and that improved collaboration between providers, who can also use it to counter growing online fraud rates, will act as a tailwind.

While it offers consumers many benefits, including higher acceptance rates, improved customer experience, inclusion, and personalisation, as well as lower fees, the trend is also proving to be a major enabler of the **Buy Now Pay Later** trend, as well as playing a key role in cloud based accounting.

EXAMPLES

From streamlined loan applications to offering more personalised financial and insurance comparisons there are plenty of examples where today this trend is helping remove customer friction, improve financial inclusion, and driving innovation.

With global **Household Debt** now standing at over $200 Trillion, and increasing, perhaps one of this trends greatest impacts has been helping customers manage their finances and investments more effectively using a variety of Open Banking dashboards and Personal Finance Management (PFM) tools. It's also allowed private renters to give mortgage companies, such as the Rental Exchange, access to their rental payment histories, secure mortgages, and get on the property ladder.

However, whether it's helping manage consumer subscriptions, via services such as Bud or Trim, helping businesses simplify their accounting, or regular people file their tax returns faster with the likes of Coconut or Freshbooks, there are no shortage of interesting and noteworthy examples of how this trend is benefiting people.

ACT NOW

Open Banking promised to transform the customer experience and champion innovation, and broadly it has done both of these, with its benefits rippling far afield. With online fraud on the rise though companies nevertheless need to remain vigilent and explore how they can use this trend to benefit themselves and their customers while at the same time keeping the publics trust and ensuring the integrity and security of the systems that enable the seamless interchange of financial information.

EXPLORE:

- Business and impact assessments
- Emerging technologies and technology roadmaps
- Future of Financial Services and Retail
- Legal and regulatory implications
- New business models, operating models, and products
- Partner ecosystems and solutions

REAL TIME PAYMENTS

2ND YEAR ON THE LIST

QUICK TAKE

Real Time Payment (RTP) infrastructure differs from same day ACH because it is separate and many argue exclusively built for the digital age. Unlike same day ACH payments which are often cleared in batches and then settled after the payments clear RTP network payments clear and settle individually in real time with immediate finality.

Consequently, not only does this have a significant impact on the economy, but payees gain certainty of funds and immediate payment finality gives both payees and merchants a continuous, real time view of their cash positions.

Data sources: ACI Worldwide, CEBR, FACT MR, and various.

IMPACT

Unlike many of its peers which only offer end of day or defined period settlements, RTP which are growing at 65% CAGR and are expected to hit $173 Billion by 2026, for the first time enables true 24/7 payments. As a result this trend is now driving changes for other traditional payment types such as checks, credit, debit, prepaid, and the like. However, the benefits of this trend go far beyond the obvious.

Not only does RTP remove friction and help close the gap between companies, customers, and employees, enabling instant pay, for example, as well as instant bill and insurance payments, but it also boosts the **Gig Economy** and P2P trends such as **Decentralised Finance**. In fact, the gains are so significant that countries such as Brazil and India have seen their economies grow by $35 Billion and $46 Billion respectively, and it's expected that by 2032 RTP could add an additional $300 Billion in GDP to the global economy.

In part this is because companies and individuals alike can now better manage their cash flows and cash flow forecasting, credit, liquidity, as well as help both manage payment risks better.

EXAMPLES

The mass adoption of RTP around the world, and the adoption of global standards such as ISO 20022 and SWIFT corporate access, has not only helped banks reduce RTP integration costs, but it's also helped them interact more efficiently with other financial institutions, and more effectively leverage data to run their businesses.

Some of the best known and lauded examples of this trend at the moment include the Faster Payments system in the UK, PIX from Brazil, and the FedNow and RTP Network from The Clearing House in the US, but there are many more.

Furthermore, organisations such as SWIFT, with SWIFT Go, are leveraging this trend to speed up large international business transactions that let banks more effectively compete with fintechs who often use **Blockchain** and other innovations to remove steps from international payment processing, and as a next step the company is working on integrating RTP with multiple **Central Bank Digital Currencies** networks as they try to solve both the standardisation and interoperability challenges associated with this trend.

ACT NOW

As RTP increasingly becomes customers expected norm, as well as the global norm, it is a case of when organisations embrace the trend rather than if, and with so many direct and indirect benefits for everyone involved it's easy to understand why this is a trend to watch and embrace. However, as the world's monetary networks and systems become more complex organisations should act cautiously and explore the challenges associated with embracing this trend including GRC, integration, security, and many others.

EXPLORE:

- Best practises and case studies
- Business and impact assessments
- Future of Financial Services
- GRC and security implications
- New business and operating models
- Partner ecosystems and solutions
- Policy and regulation reform

SOVEREIGN ELECTRONIC PAYMENT NETWORKS

2ND YEAR ON THE LIST

QUICK TAKE

Today companies and consumers alike are used to having a wide variety of payment options, including those that traverse the ACH networks, such as bank transfers, cash, checks, credit and debit cards, digital wallets, direct debits, prepaid cards, money orders, and many others. However, with many electronic payments still transiting networks like those owned by Mastercard and Visa increasingly governments, ranging from China to the EU, are developing and promoting their own alternatives, in part to spur competition and in part to reduce their reliance on foreign organisations.

Data sources: RBR, Visa, WTO, and various.

IMPACT

With almost 4 Billion cards and over 255 Billion transactions a year totalling $14 Trillion spread across more than 200 countries for Visa alone it's not hard to see why governments, as well as other institutions, want a slice of the estimated $22 Trillion global electronic payments pie.

This desire though is further compounded by today's increasingly tense geopolitical situation as different sovereign governments, for a variety of reasons, look to undermine the dominance of traditional providers and become less beholden to their services, as well as eye the ability to use electronic payments as a way to extend their own country's **Soft Power**.

With two US organisations, namely Mastercard and Visa, having a global duopoly it's unsurprising that countries such as China and the EU want to challenge that dominance - an act that will not only affect the politics of local market access, which the WTO has already red flagged in China, but which could also have dramatic consequences on the **Demise of Anonymity and Privacy**, the effectiveness of **Sanctions**, and other trends.

EXAMPLES

While there are a growing number of examples of countries developing their own competing electronic payment networks so far most of the results have been mixed with Europe, for example, with their Electronic Payments Initiative (EPI) scheme experiencing several re-starts and multiple failures to launch as one minute the initiative is in vogue and the next it isn't, and Russia with Mir.

However, while Europe continues to fall at almost every hurdle China on the other hand, with UnionPay, have had considerable success both locally, where over 90% of the Chinese population have a card, and abroad especially in Russia after AMEX, Mastercard, and Visa all "dialled back their services"after the start of the Ukraine War. From a global spending perspective UnionPay now represents over 45% of all global card expenditure, with Visa at 27% and Mastercard at 18%, however if you remove China where UnionPay is dominant then that share drops to just a mere 1%. However, as **E-Commerce** transactions continue to ramp, and as **Super Apps** become more popular it's an understatement to say that this will be a very interesting trend to watch.

ACT NOW

While it would be easy to see this trend as just being yet another area where competing countries are coming together to clash with one another the fact of the matter is that, especially in China's case, the ability to monitor and track payment behaviours and transactions across countries will give them unprecedented insights into the performance of foreign economies, and in a world where information is increasingly being weaponised, in part to promote soft power and as part of the **Psyops Pandemic**, countries should be more wary than they might otherwise be.

EXPLORE:

- Acceptance devices and payment innovations
- Business and impact assessments
- Future of Financial Services
- Policy and regulation reform
- Privacy implications
- Product innovation initiatives

GAMING INDUSTRY TRENDS

CONTENTS

WHAT IF ... GAMING FELT REAL?

IMAGINE A future where the pixelated dragons hiss hot air on your skin, and the metallic tang of alien blood remains a visceral memory clinging to your tongue. Welcome to the era of hyper real gaming, where virtual worlds bleed into the physical, blurring the lines between reality and a million meticulously crafted dreamscapes. The first to succumb are the senses. Sight transcends screens, replaced by haptic suits whispering textures of moss and bark, thermal feedback mimicking the lick of digital flames. Taste buds tingle with the tang of virtual berries, olfactory receptors overwhelmed by the musk of mythical beasts. The boundaries of reality crumble, replaced by a kaleidoscope of sensations so vivid, so visceral, that returning to the mundane feels like waking from a fever dream.

Social landscapes shatter and reform within these new frontiers. Guilds, once pixelated alliances, become tribes, bonded by shared battles and virtual blood oaths. Rivalries forged in digital coliseums spill over into the real world, friendships forged during epic dungeon crawls translate into tangible support networks. Imagine communities built around shared quests, economies thriving on virtual loot traded for real-world currency, a and a new virtual society emerging from the fertile ground of hyper-real gaming. But a darkness lurks in this Eden.

Addiction takes on a terrifying new form, minds trapped in perpetual escapism, unable to distinguish illusion from reality. Lines blur between simulated danger and genuine peril, leading to recklessness and even real death. Imagine games room soldiers returning from virtual war zones with PTSD so real it cripples their lives, or children drowning in the quicksand of unending virtual adventures, and ethics become a Gordian Knot. Is it murder to slay a sentient AI villain? Where do the lines of ownership lie when virtual property translates into real-world wealth? Imagine the legal battles fought over digital dragons and virtual land, governments grappling with the complexities of policing a world without borders. Hyper real gaming isn't just a technological marvel - it's a Pandora's Box, overflowing with both wonder and peril that forces us to confront the fragility of our own reality, the malleability of human perception, and the question of what truly defines our humanity.

STATS THAT MATTER

36

MOBILE GAMERS, AVG. AGE, GLOBAL 2023

TECHCRUNCH

74%

ADULTS BELIEVING GAMES HAVE EDUCATIONAL VALUE

LIQUID WEB

8.4 HRS

TIME PER WEEK GAMING, GLOBAL AVG. 2022

STATISTA

250 ML

AVG. MONTHLY PLAYERS, FORTNITE, 2023

DEMAND SAGE

3.22 BILLION

NUMBER OF GAMERS, GLOBAL TOTAL 2023

STATISTA

540 ML

NUMBER OF E-SPORTS VIEWERS, GLOBAL 2023

DEMAND SAGE

$40 ML

BIGGEST E-SPORTS PRIZE POT, GLOBAL 2023

INTERNATIONAL 10

GAMING

700 K

GAMES IN APP STORES, GLOBAL TOTAL 2023

BUSINESS OF APPS

$233 BILLION

VIDEO GAME MARKET WORTH, GLOBAL TOTAL 2023

STATISTA

30%

IN GAME TRANSACTIONS, PCT. OF GLOBAL MARKET

GAMEFLIP

ARTIFICIAL INTELLIGENCE GAMING COACHES

2ND YEAR ON THE LIST

QUICK TAKE

From the games of Chess and Go, to Dota and Starcraft, we're getting used to seeing **Artificial Intelligence** (AI) not only beat the world's best gamers and Grand Masters, but beat them convincingly and repeatedly. So convincingly in fact that some of AI's human opponents, such as the Korean Go world champion, have retired saying "AI is invincible."

Now though things are coming full circle as AI, the Master, finds a new role - coaching gamers to become better gamers and helping them improve their strategic thinking and skills.

Data sources: Falcon, and various.

IMPACT

A subset of the trend **Artificial Intelligence Coaches** the impact of this trend is especially interesting because overall it not only has the ability to change the way humans gamers learn and play game, but it also has the ability to impact gamer rankings and **E-Sports** competitions.

AI is able to do this because it learns in one way and humans learn in another, and when the two come together interesting things happen. This was exemplified by Google AlphaZero's now infamous "Move 37" during it's match with then world reigning Go champion Lee Sedol which experts initially thought was a mistake but in fact ended up being a master stroke.

Commercially therefore the impact of this trend is difficult to calculate because that would require being able to measure the amount of improvement a gamer made because of this trend, but broadly speaking at the moment studies show that the use of AI coaches is helping improve gamer performance by at least 30%, something with is significant enough to demonstrate the power and potential this trend has.

EXAMPLES

The examples of organisations building and selling AI coaching solutions for the Gaming industry, outside of the Education Industry's own adjacent **Adaptive Learning** trend, is still reasonably slim. But nonetheless in the highly competitive world of E-Sports where players compete for multi-million dollar purses, and where every edge is an advantage the trend's finding its feet with organisations such as Falcon AI and SenpAI now talking using it to revolutionise the gaming world and help gamers climb the ranks faster.

Furthermore, as AI becomes more capable and powerful, and as its ability to analyse player behaviour and game play improves, and as its ability to then coach them also improves this is a trend to watch.

ACT NOW

The impact of changing how humans learn new skills cannot be under estimated which to some degree makes this trend a wolf in sheep's clothing. However, in time significant improvements in AI capability mean this trend will inevitably become the gaming industry's equivalent of a "performance enhancing drug" and be the defacto tool used by gamers everywhere.

EXPLORE:

- Benefits and impact assessments
- Emerging technologies and technology roadmaps
- Future of Artificial Intelligence, Education, and Gaming
- League impact and regulations
- New products
- Partner ecosystems and solutions

CLOUD GAMING

2ND YEAR ON THE LIST

QUICK TAKE

Historically games were only available on physical media, then they were downloaded onto devices and played locally. Today, fuelled by improvements in communications and compute they're run and streamed from the cloud as a service. Not only does this change how we consume and distribute games but it also changes how they're analysed, built, and the gaming experience, as well as the industries economics. Turbo charged by **5G**, **Cloud Computing**, and **Cloud Native Networks**, this trend is the new entertainment battle ground as more corporate giants lay out their visions and pile into the space.

Data sources: Allied Market Research, GM Insights, and various.

IMPACT

This trend has multiple impacts and that's before the commercialisation, integration, and maturation of **Immersive Reality** gaming environments, **Procedural Content Generation**, and other trends.

Today this market is worth an estimated $244 Mn and by 2030 that's estimated to be over $22 Bn. On the one hand this trend brings about new competition for traditional studios as some of the large cloud computing platforms, such as Amazon, Microsoft, and Netflix, build and buy their own studios in an attempt to create vertical stacks, and on the other it completely alters the economics of the industry, the way game data is captured and analysed, the way games are built, designed, and distributed, and in time the entire gaming experience. And those are for starters.

In many respects those in the industry can think of this of this as their "E-Commerce" moment - the point in time when not one thing about the industry but many. Furthermore, the ability to render games in the cloud and then augment them with vast amounts of additional data, experiences, and services will change gaming forever.

EXAMPLES

As well as the aforementioned trends new adaptive codecs and rendering technologies, such as Foveated rendering which reduces data transmission by up to 90%, have also helped move this trend from being a proposition on a presentation to being real. But, even though it might sound straight forwards trying to stream HD or UHD games at 30 , 60, or even 120fps with latencies that meet the demands of even the most intense time-sensitive first person shooters at scale is still hard.

That said though as Gaming as a Service and all manner of subscription models take off with platforms like Amazon Luna, GeForce NOW, Vortex and the on again off again Google Stadia, among others, it's clear that the momentum is building, and there are plenty of AAA studios piling in.

As a consequence at the moment games such as Candy Crush, Destiny, Fortnite, Hunt, Madden, Overwatch, and Showdown dominate the charts and are often updated weekly and sometimes daily with new areas, characters, events, levels, and missions - something that only cloud gaming gives them the opportunity to do cheaply and easily.

ACT NOW

Being able to analyse and change almost every aspect of a game on the fly is one of this trends biggest wins, but ensuring a consistent quality of service and experience is difficult given the ubiquity of different devices, network speeds, and operating systems, so organisations should be careful when embracing it.

EXPLORE:

- Benefits and impact assessments
- Emerging technologies and technology roadmaps
- Future of Communications, Financial Services, Gaming, Marketing, Media and Entertainment, and Retail
- New business and operating models
- Product innovation

E-SPORTS

2ND YEAR ON THE LIST

QUICK TAKE

As a trend E-Sports is coming on strong, especially in Asian and Western cultures, but what is less well known is that it is increasingly eating into the dominance of more traditional established global sports as younger audiences and participants switch allegiances.

As a result sports executives around the world are now thinking much more seriously about the future impact E-Sports will have on the future of their own franchises and sports, and the rise of what many are now referring to as the **Alternative Sports** industry.

IMPACT

E-Sports is defined as playing video games competitively, although definitions vary, and crosses countless genres.

Since 2018 the total number of people watching E-Sports has grown on average by over 12% CAGR to reach over 500 Million by 2020, and it's estimated that by 2023 this figure will be over 700 Million. When broken down, however, around half of these viewers are enthusiasts and the other half are occasional, and globally 90% of them are located in Asia, Europe, and North America - as you perhaps might expect.

As the viewership grows so too do the prize pools with most of them now breaking the $30 Million barrier with winners now regularly banking at least $3 Million per event. And, obviously, the only way is up.

Despite these impressive numbers though E-Sports still has a long way to go before it displaces traditional sports, but nonetheless the market is estimated to grow at 15% CAGR to reach a value of just over $2 Billion by the year 2026.

EXAMPLES

The amount of money given away in prize money so far by the world's largest E-Sports organisations is truly staggering with Dota 2 leading the pack having awarded over $250 Million in prize monies to over 4,000 winners across over 1,500 tournaments, and Counter-Strike, Fortnite, and League of Legends awarding approximately $100 Million each, since their leagues began.

It's also no surprise, therefore, that these organisations are also the most dominant in the industry, and it's also no surprise that those prize pots are continuing to grow as the market gets larger.

However, when we look at the market by hours watched League of Legends tops the charts with over 580 Million hours watcher per year, growing at 21% in 2020, Counter-Strike with 354 Million, and Dota 2 trails with 253 Million. So, as you can see the field, as they say, is still wide open. And, as we continue to see advances in the communications industry, including in speed and ubiquity, all of these numbers will increase.

ACT NOW

While many will see the E-Sports industry as being distinctly separate from the traditional sports industry the viewership and the amount of money it commands will be too big for many to ignore which means that not only will we see increased competition, but that we will also see a plethora of new entrants vying for the crown.

EXPLORE:

- Business and impact assessments
- Emerging technologies and technology roadmaps
- Future of Communications, Entertainment and Gaming
- New business models, operating models, and products
- Partner ecosystems and solutions

Data sources: E-Sports Earnings, Newzoo, Roundhil, Twitch, and various.

GAMETELLING

2ND YEAR ON THE LIST

Gametelling in Minecraft, Evbo

QUICK TAKE

We are all used to the idea of storytelling, but increasingly engaging, interactive, and realistic game environments, that are also helping supercharge the trend of **Virtual Film Production**, have helped fuel the rise of Gametelling - a trend where game players create, record, and stream their own made up adventures and stories to massive online audiences. Enabled by increasingly authentic game platforms and **Over The Top Content** (OTCC) media distribution platforms such as Twitch and YouTube this trend is now replacing some traditional TV viewing, especially for younger audiences.

Data sources: Various.

IMPACT

As we continue to see game engines and the interactive worlds they can be used to create become increasingly life-like and entertaining, as well as advances in **Synthetic Content**, in time the breadth and quality of serialised game content that so called Gaming Influencers create will only increase.

The modern equivalent of children's TV today hundreds of millions of children of all ages spend over 9 Bn hours a year, a 300% increase in just two years, to watch creators that analysts call the "Rockstars of their generation," explore, fight, and socialise their way through different games and worlds, often complete with plot lines and voice overs.

In 2021 an estimated 4 in 10 children globally follow one or more of these influencers so it's no wonder why brands everywhere are trying to find ways to capitalise on the trend - often with little success because it can be argued they don't understand the trend well enough. On that note though, and ironically, with the number of channels also quadrupling in the past few years, to over 12 Mn on Twitch alone this is also why brands should experiment with this trend.

EXAMPLES

Examples of this trend are everywhere, but given the fact it plays off of the OTTC trend many of the channels are concentrated on platforms such Twitch and YouTube. Furthermore, depending on your age there's a good chance you've never watched the episodes and series that creators create.

While this trend has been on the rise for over a decade it's now considered prime viewing for younger audiences between the ages of 6 and above - whether or not adults approve - and in many ways we can now say that it occupies the space in their lives that traditional children's TV used to occupy.

With examples of creators like Evbo, Ninja, PrestonPlayz, and all their other friends who regularly storify games such as Fortnite, Minecraft, and Roblox, and who collectively have hundreds of millions of followers and just about as much money in the bank, and with others such as Element Animation, a more "professional" outfit with a slightly different demographic and USP who also create their own plot lines and add their own twists, there's no shortage of entertaining content for young ones to choose from.

ACT NOW

As the rendering quality of game engines continues to improve in many ways you can think of these game worlds as being giant world-sized **Metaverse** movie studios that are infinitely customisable, enable all kinds of interactions, and where creators have the ability to create any experience they like. It's also no coincidence that this trend and the trend of **Virtual Film Production** are converging. As a consequence this is a trend that's under rated by many and one to take seriously.

EXPLORE:

- Advertising and content policies
- Future of Customer Experience, Gaming, Marketing, Media and Entertainment, and Retail
- Game production
- New business and operating models
- Policy and regulation reform
- Product development

HEALTHCARE INDUSTRY TRENDS

CONTENTS

BOOK AN EXPERT CALL

WHAT IF ... WE WERE BUG FIGHTING COMPUTERS?

IMAGINE A human being with the longevity of a Redwood and the computational power of an Exascale AI supercomputer. This is the future Synthetic Biology enables as humans become biological supercomputers, with cells becoming multi-core computing systems capable of not only detecting disease within our bodies, but also becoming living pharmacies capable of synthesising bespoke cures to defeat it all in vivo.

Old fashioned biopsies, blood tests, scans, and swabs are a thing of the past. Instead, equipped with billions of in vivo bio-sensors that are woven into the very fabric of our cells our bodies can see, sense, and analyse everything that goes on in it and pin point everything that's wrong. Imagine hybrid human immune cells detecting the early stages of Cancer by detecting cancerous DNA biomarkers in the blood, or viruses being analysed in real time by our bodies own biological computing machinary. Early detection, once a whisper, becomes a roar, giving us the power to nip illness in the bud before it takes hold. But the real magic unfolds in the theatre of treatment.

Gone are the generic drugs, pills, and vaccines, replaced instead by the body's own alchemical bio-manufacturing lab. Genetically modified cells, programmed with the blueprints of bespoke cures, and able to compute their own novel treatments, churn out personalised cure alls that are tailored to the unique nuances of each individual illness and person. Imagine cancerous tumors dissolving from within, identified and attacked by modified CAR-T cells that are programmed to target their vulnerabilities, or infections snuffed out by a cocktail of antibodies brewed by the body itself.

This biological renaissance, however, is not without its shadows. Inequality looms. With access to these advanced healthcare technologies potentially becoming the new frontier of wealth and privilege. Imagine a world where the wealthy waltz through life equipped with inate ability to detect and fight off every ailment and pathogen, while the less fortunate remain tethered to the old world of pills and procedures. And who owns the IP for our body's supercomputer - and therefore us?

STATS THAT MATTER

65 ML

HEALTHCARE WORKERS, GLOBAL TOTAL 2023

BMJ

337 ML

YEARS OF LIFE LOST (YLL) DURING COVID-19, 2023

WHO

74 %

(NCD) NON-COMMUNICABLE DISEASE, % GLOBAL DEATHS

WHO

1.6 BN

YEARS OF LIFE LOST TO NCD'S, PER YEAR, 2019

WHO

18 MILLION DEATHS PER YEAR

BIGGEST NON-COMMUNICABLE DISEASE (NCD) KILLER : HEART DISEASE, GLOBAL 2022

WHO

$4.3 TR

USA TOTAL HEALTHCARE SPEND, 2023

AMA

$8 TR

GLOBAL TOTAL HEALTHCARE SPEND, 2023

REPORTLINKER

HEALTHCARE

68 %

UNIVERSAL HEALTHCARE COVERAGE, GLOBAL 2019

WHO

3.2 MILLION DEATHS PER YEAR

BIGGEST COMMUNICABLE DISEASE KILLER : LOWER RESPIRATORY DISEASES, GLOBAL 2022

WHO

73

HUMAN LIFESPAN, GLOBAL AVG., 2023

WHO

PREDICTIVE HEALTHCARE

2ND YEAR ON THE LIST

QUICK TAKE

As the **Quantified Self** trend helps us capture more mental and physical health data organisations around the world are increasingly finding new ways to use this and other data to predict people's future health and wellness, and even life expectancies. Furthermore, as the quality, variety, and volume of alternative biochemical, biomarker, biomechanical, biometric, genetic, and medical datasets increases **Artificial Intelligence** (AI) and other tools are becoming increasingly adept at detecting health clues and patterns, generating insights, and predicting health outcomes.

Data sources: CDC, Europa, and various.

IMPACT

Being able to predict when someone will get ill and what their ailments and conditions will be weeks or even years ahead of time can change lives and save lives - especially when it comes to more serious chronic conditions such as alzheimers, cancer, and heart disease. While this is game changing in itself the power of this trend on improving people's wellness is magnified when it's intelligently complimented by the implementation of **Preventative Healthcare** strategies.

Today in the US alone 7 out of 10 deaths and over $1 Trillion, or 75% of all US healthcare spending, is on what many experts regard as preventable chronic diseases such as diabetes, heart disease, hypertension, and osteoarthritis, with the hidden total economic cost being over $3.7 Trillion.

Needless to say the ability to predict who is at risk, as well as predict the future trajectories of these and other diseases when they do occur within patients so that healthcare professionals, and in the future alternative AI solutions, can make the right interventions as early as possible is transformative.

EXAMPLES

While at a high level this trend has been around for a long time it's only recently that new technologies and tools have given the industry the data and insights it needs to be able to accurately predict the onset and trajectory of all manner of different diseases. As such there are many examples, such as blood sampling techniques which are now so sensitive they can detect the faintest cancer markers in the blood years before the tumours metastasise. Or the use of AI to identify disease, such as heart disease, and then compare it with other datasets to calculate its trajectory and the patients life expectancy.

However, while these examples are interesting better things lie ahead when we combine the **Digitisation** of healthcare with AI. By combining different data sets together including patient CT, MRI, PET, and X-Ray scans along with other medical and quantified self data AI can create **Digital Twins** of patients and compare all manner of clinical observations with other data sets, other patients, and medical baselines to predict how those observations will interact, their likely outcomes and future disease profiles, possible complications and much more.

ACT NOW

The ability to predict someone's future health, whether or not they have any observable conditions at that time, is incredibly powerful. It also means that interventions and treatments can be made years or even decades ahead of time which ultimately means those people will have healthier, longer lives.

EXPLORE:

- Emerging technologies and technology roadmaps
- Future of Artificial Intelligence and Healthcare
- New business and operating models
- Partner ecosystems and solutions

QUANTIFIED SELF

2ND YEAR ON THE LIST

QUICK TAKE

Technology used to be distant to us, then it was near, then with the advent of **Wearable Technology** and Implanted Medical Devices, it was on us and in us.

Over time as the devices around us have gotten smarter, packed with intelligence and sophisticated sensors, their ability to measure, monitor, and track our activities and behaviours, as well as our mental and physical well-being has improved significantly - so much so that now armed with all this data people everywhere can monitor their own health and take control of it in ways that simply wasn't possible before.

Data sources: Clinic Compare, and various.

IMPACT

One of the most understated impacts of this trend is that it democratises access to health and wellness data and gives individuals, as well as organisations and healthcare professionals, access to data that was previously only accessible using professional medical and sports diagnostic equipment that was often only available at specialist centers.

As a result, increasingly it could be said we are putting a hospital, a doctor, and a sports and "wellness" coach at people's fingertips - especially as we see **Artificial Intelligence** (AI) disintermediate all these and take a more dominant role in diagnosing and communicating health data and outcomes to people.

One of the greatest benefits of this trend is that, with the right data privacy and regulations in place, it gives organisations the ability to monitor and track the mental and physical wellness of their citizens and customers at a granular level at scale which could then be used to create real time healthcare initiatives that have an impact at the national and regional level. A downside though is the potential negative psychological impact of self-tracking.

EXAMPLES

While this trend is transformative in itself it becomes even more impactful when we combine data captured from human biochemical, biomarker, biomechanical, and biometric sources with other data sources.

A good example of this being Nitanic's ability to quantify the impact of Pokemon Go on people's health. By using GPS tracking data they were able to calculate that on average people who catch 100 Pokemon a day shed a pound roughly every three days. Now combine this data with some of the other sources mentioned above and you could calculate improvements in blood pressure, cardio vascular health, and all manner of other metrics at both an individual and societal level then make the necessary interventions.

At a more personal level this trend lets individuals track wellness and performance over time, surface undiagnosed diseases such as Lyme Disease, as happened recently to a man in the US, predict epileptic fits and the onset of illness such as flu, detect and diagnose everything from cancer to diabetes, to dementia, depression, and PTSD, and much more.

ACT NOW

Our ability to monitor and track our wellness is only limited by the **Sensor Technologies** we have available to us, and as these become more sensitive and sophisticated it's only a matter of time before even the hardest to capture data - such as the ability to non-invasively analyse people's genomes and changes over time - is within reach. Not only does this trend help democratise healthcare at global scale but the insights it gathers is already changing lives and preventing deaths.

EXPLORE:

- Best practises and case studies
- Data privacy and policies
- Emerging technologies and technology roadmaps
- Future of Artificial Intelligence, Devices, Healthcare, Insurance, and Sensors
- New business and operating models
- Partner ecosystems and solutions

REMOTE SURGERIES

2ND YEAR ON THE LIST

QUICK TAKE

Resourcing and resource availability are arguably two of healthcare's greatest challenges, and if there is a mismatch then it can have dire or even fatal consequences.

Nowhere is this more prevalent than in the surgical field where specialists are available in one region but not another, and up until recently that has been a problem that could only be solved by moving people around. However, thanks to advances in telecommunications and robotics now healthcare professionals and surgeons in one region can operate on patients hundreds of miles away.

Data sources: King's College, The Lancet, and various.

IMPACT

Every year it's estimated that 17 Million people in low to middle income countries die because they don't have access to safe surgical healthcare services, and that all of these deaths are preventable. It's also estimated that in these same countries a further 143 Million people need additional life-saving surgeries.

In order to rectify this situation it's estimated that countries need to make investments of at least $420 Billion to increase their operative volumes to a minimum level of 5,000 per 100,000 surgeries and that if this is not done then globally in the next decade over $12 Trillion worth of economic productivity will be lost.

In addition to these figures it's also estimated that a further 4 Million people die within 30 days of surgery with, again, half of those deaths being in low to middle income countries - but not exclusively.

Needless to say remote surgeries, where surgeons and healthcare professionals can be based in one location and operate on people in another, would be of great benefit.

EXAMPLES

Remote surgeries are perhaps the epitome of how emerging technologies are helping decentralise all manner of services for the benefit of people everywhere, and while the trend shows great promise - and is already delivering on some of that promise - there is still a long way to go before all the services that people find in a traditional theatre are available in this way.

Our ability to offer remote surgeries relies on organisations being able to combine together a variety of different emerging technologies, from 5G and AI to robotics and more, so this is still a relatively nascent space.

That said though in China and India surgeons performed brain and heart surgery on patients who were hundreds of miles from their location, and in the USA surgeons used them to surgically implant stents in patients remotely. And, unsurprisingly the world's military, who sees great potential in the trend, are also investing substantial energy, time, and resources to develop solutions that allow them to preform remote surgeries on soldiers injured in battle - all of which will inevitably, in time, filter down into the commercial sector.

ACT NOW

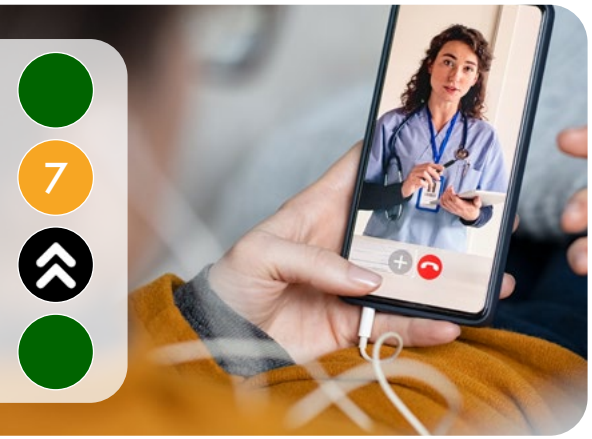
Remote surgeries greatly improve the accessibility of surgeons and surgical procedures to those who need it the most, and it does so affordably. It also marks the beginning of Surgery as a Service. As a result it is our advice that you evaluate and experiment with the trend.

EXPLORE:

- Benefits and impact assessment
- Emerging technology and technology roadmaps
- Future of Communications, Healthcare and Robotics
- New business models, operating models, and products
- Societal trends

TELE-HEALTH

2ND YEAR ON THE LIST



QUICK TAKE

When stakeholders talk about the Tele-Health trend, that uses a mix of electronic and telecommunications technologies, and which can also include **Wearable Technology**, to deliver a variety of healthcare services remotely, they often think of it as just a modern alternative to traditional Doctor-Patient interactions. Today though as the devices at the edge become increasingly capable and smart healthcare professionals will soon be able to do much more and use them to predict, diagnose, monitor, and treat all manner of conditions cheaper, easier, and faster than ever.

Data sources: Forbes, McKinsey, and various.

IMPACT

While tele-health was already a growing and accelerating global trend during COVID-19 pandemic its use increased by 38 fold from the pre-COVID baseline as people everywhere sought new ways to safely access and deliver healthcare services.

As a result it is now estimated that up to $250 Billion of US healthcare spend alone could be shifted to virtual or virtually enabled care, and that with up to 60% of people saying they want to continue using it that the overall market could be worth upwards of $600 Billion by 2027. Furthermore, with every tele-health consultation saving people an estimated 100 minutes in associated travel and wait time the ancillary benefits, such as the impact on the environment, healthcare premiums, people's productivity, and so on are also notable and significant.

Additionally, as our smart devices on board AI, cameras, and sensors become increasingly powerful in time healthcare professionals will be able to use these to capture and analyse even more valuable patient biomarker and biometric data and provide an even better, and more granular, service.

EXAMPLES

Largely the capabilities of tele-health solutions are only limited by the technologies of the time, and as **Artificial Intelligence** (AI), **Machine Vision**, sensors, and smart device technologies all improve so too does our ability to capture and analyse more valuable patient data in line with the **Quantified Self** and **Predictive Healthcare** trends.

Today smart devices can analyse vocal biomarkers to quantify people's levels of anxiety, dementia, and depression, as well as diagnose conditions including the flu, epilepsy, heart disease, PTSD, and much more, as well as use their cameras to determine whether they have cancer, including pancreatic and skin cancer, genetic abnormalities, and many other conditions. And this is just the beginning as we continue to see our devices morph into futuristic tricorders, and new services such as genomics being included in the mix.

While the space is still expanding there are an increasing number of providers leveraging this trend and developing a wide range of tele-health services including organisations such as 23andMe, 98point6, Liviongo, TeleDoc.

ACT NOW

While tele-health has significant benefits it still has its limitations that in time new technology developments will help overcome as the breadth of services that can be offered continues to expand.

EXPLORE:

- Business and impact assessments
- Emerging technologies and technology roadmaps
- Future of Artificial Intelligence, Healthcare, and Insurance
- Lower health insurance premiums
- Quantified self and wearable technology innovations
- New business models, operating models, and products

INSURANCE INDUSTRY TRENDS

CONTENTS

BOOK AN EXPERT CALL

WHAT IF ... WE COULD PREDICT EVERY RISK?

IN A world where insurance companies have unparalleled predictive capabilities a seismic shift in risk management emerges. Picture a future where insurers not only anticipate risks but also are able to predict and proactively prevent them, revolutionising the conventional insurance model. This transformative approach, fuelled by advanced technologies like AI Internet of Things, and sensing systems empower insurers to analyse vast datasets and identify potential risks before they materialise.

The implications of this proactive risk prevention model are profound. Individuals and businesses would benefit from enhanced security and stability in their daily lives and operations. Imagine, for example, receiving predictive tailored recommendations and interventions about your cyber security posture, your health and home, or even the environment around you. Furthermore, by preventing losses before they occur insurers can reduce claims payouts and operational costs, leading to lower premiums and improved affordability for policyholders which, in turn would increase the amount of disposable income they have to spend on other goods and services in the economy.

This shift towards proactive risk management not only promises financial benefits but also fosters a culture of safety and resilience. By leveraging technology to anticipate and mitigate risks, insurers could play a pivotal role in promoting a safer society for all. However, as with any transformative innovation, ethical considerations surrounding privacy and individual autonomy must be carefully navigated to ensure widespread acceptance and trust.

In conclusion, the prospect of insurance companies predicting and preventing all manner of risks signifies a paradigm shift in risk management and completely changes the customer experience for the better. By harnessing the power of technology, insurers offer proactive solutions that not only protect individuals and businesses from potential harm but also foster a culture of prevention and resilience. This visionary approach has the potential to reshape the insurance industry and create a safer, more secure future for generations to come.

STATS THAT MATTER

INSURANCE

$8.4 BN

INSURETECH INVESTMENT, GLOBAL TOTAL 2022

CB INSIGHTS

$10 BN

EST. CYBERCRIME PAYOUTS, GLOBAL TOTAL 2022

FORTUNE

$2 TR

P&C INSURANCE MARKET, GLOBAL TOTAL 2022

ALLIANZ

$2.8 TR

LIFE INSURANCE MARKET, GLOBAL TOTAL 2022

ALLIANZ

$6.17 TRLLION

INSURANCE PREMIUM INCOME, GLOBAL TOTAL 2022

ALLIANZ

$638 BN

REINSURANCE CAPITAL ALLOCATION, GLOBAL 2022

GALLAGHER & CO

$5.5 TR

EST. INSURANCE PAYOUTS, GLOBAL TOTAL 2022

BUSINESS RESEARCH

7.7 %

LIFE PREMIUMS, AVG. INCREASE, GLOBAL 2022

OECD

$125 BILLION

NATURAL DISASTER PAYOUTS, GLOBAL TOTAL 2022

SWISS RE

45 %

NATURAL DISASTER LOSSES INSURED, GLOBAL 2022

AON

ON DEMAND INSURANCE

2ND YEAR ON THE LIST

QUICK TAKE

Noone ever uses everything all of the time - not even their smartphones. But despite this, along with the fact that we use different things in different ways throughout the day, and the fact that many of our things just sit around doing nothing all day, we still pay to insure them against the worst case scenarios just in case they happen 24/7/365.

In today's on demand world though it's now easier than ever before for insurers to calculate risk, calculate premiums, and provide on demand insurance when policy holders need it, but despite this most don't still.

Data sources: Allied Market Research, KPMG, NAIC, and various.

IMPACT

Today On Demand Insurance (ODI) is a growing market segment, but it accounts for less than 1% of the global insurance market with most of the organisations who offer it being challengers rather than incumbents. However, that said as these challengers attract hefty investments and as 93% of Millennials say they'd be willing to buy ODI, provided prices don't go up, it's clear that there's a market opportunity to exploit - especially as **Digitisation** and new technologies make it increasingly feasible for organisations to offer it.

However, while this trend lets customers buy the protection they need while only paying for it when they need it it could be a long time before this trend becomes mainstream. Furthermore, the nature of it also means that customers often end up paying significantly higher premiums, albeit for a much shorter period of time, because of the higher fraud and risk profiles associated with it, and ultimately unless insurers can get the economics of this trend correct then their incentives to offer it will remain limited. But, that said though it could easily be argued that these are simply ICT and technology issues which are increasingly easy to solve and scale.

EXAMPLES

While this trend also plays into the **Predictive Insurance** and **Vehicle Telematics** trends it's clear that insurers ability to offer ODI, with just a single swipe of a smartphone screen, is becoming more feasible as different operating models and technologies mature, and while we might not see this trend become the default offering for all insurance types it looks certain that it will play a more important role - provided incumbents don't try to kill it.

The use are obvious, from being able to just turn on insurance cover for your expensive gadgets when you go out of the house, or abroad, to just being able to turn on cover for an item you've just bought from a shop by scanning the receipt, or just turning on cover for the next hour when you take your - or someone else's - car for a wild joyride.

While many challengers are finding it difficult to get traction some of the more successful ones include Sure and Travelers, who through their acquisition of Trov can now offer all manner of different on demand single item insurance propositions, including on demand trip insurance for passengers of Google's self-driving car unit Waymo.

ACT NOW

Today an organisations ability to perform micro risk assessments on customers and situations, which is a Big Data issue, in order to offer customers policies that they can turn on and off with the flick of a metaphorical button is largely a technological problem, but if organisations did want to offer it in a meaningful way and take this trend from niche to mainstream then there's no reason why they couldn't.

EXPLORE:

- Business and impact assessments
- Emerging technologies and technology roadmaps
- Future of Artificial Intelligence, Computing, and Insurance
- New business models, operating models, and products

PREDICTIVE INSURANCE

2ND YEAR ON THE LIST

QUICK TAKE

As we've seen with the **Predictive Healthcare** trend it's often cheaper to predict and prevent incidents from happening in the first place - whether it's a heart attack, a burst water pipe, or a car accident. And, with the rise of **Internet of Things** (IoT), **Smart Cities**, **Smart Homes**, **Vehicle Telematics**, and other trends like **Artificial Intelligence** (AI) and **Machine Vision**, to name but a few, the ability to predict incidents before they occur is now easier than ever before, meaning that rather than having to pay out after the worst happens insurers can now pay less to prevent it.

Data sources: ABI, McKinsey, Willis Towers Watson, and various.

IMPACT

The move from reactively paying policy holders after they have had an incident to pro actively predicting it before it happens so that it can be prevented is a cultural paradigm shift for the industry that at a high level allows insurers to not only significantly improve the quality of the **Customer Experience** and reduce claim values, but also simplify claims handling and evaluation. All of which must be seen as a Win Win for everyone involved.

While this is a large trend covering a large topic area today over 65% of insurers credit predictive analytics with reducing issues and underwriting expenses, with a further 60% saying it's also helped them increase sales and profitability.

However, while these figures will undoubtedly also include back office functions such as the claims process, fraud, preventing customer churn, risk modelling, and so on, when we look at the impact of this trend on actual claim values so far it's helped reduce fleet claims by 80%, accident claim costs by 50%, and the cost of overall claims by over 30%. None of which are insignificant numbers.

EXAMPLES

While there are multiple examples of how this trend is being applied today, from health and vehicle monitoring to natural disaster preparedness and beyond, we could argue that given the market opportunity and benefits there should be many more.

At the moment notable examples of how insurers are embracing this trend include Vitality who are using **Wearable Technology** to monitor and predict people's health, and Withings whose smart home air quality monitors are helping insurers make health interventions and provide emergency intervention services before toxic gases like Carbon Monoxide reach dangerous levels in homes.

Elsewhere, other examples include home heat and humidity data to predict mould growth within homes which, asides from having an impact on their liveability and structure can also have a serious impact on health. Then there's the use of AI and other sensors, including acoustic sensors to detect the early warning signs of electrical, plumbing, and structural problems within buildings - which can be fixed before they become a real issue.

ACT NOW

The ability to predict incidents that would produce a claim before they happen and make interventions that ensure they don't happen in the first place is a game changer for the industry that has significant benefits for insurers and policy holders alike. As a consequence insurers should explore this trend further and experiment with it.

EXPLORE:

- Benefits and impact assessments
- Data analytics, capture, and modelling strategies
- Emerging technologies and technology roadmaps
- Future of Artificial Intelligence, Computing, Healthcare, Insurance, and Transportation
- New business models, operating models, and products
- Partner ecosystems and solutions

SELF-INSURED ORGANISATIONS

2ND YEAR ON THE LIST

QUICK TAKE

Organisations that insure different parts of their businesses or operations themselves are nothing new, but with insurance premiums for the vast majority of businesses at all time highs, especially in the USA, and the emergence of new technologies and technology paradigms, including **Predictive Insurance**, more organisations than ever before have both the data they need and the reasons to take the leap to self-insure. From the UAE in the 1970's who insured airlines and shipping during the Iran Iraq war to Tesla, and others, this is an up ticking trend to keep on your radar.

Data sources: EBRI, Kaiser, and various.

IMPACT

While the obvious benefit of self-insuring is saving money and avoiding paying third party premiums as with everything in the insurance sector it all comes down to an organisations ability and willingness to calculate and play the odds. Get it right and there can be significant cost benefits, but miscalculate the risk and it can be catastrophic - which is where underwriting comes in. This trend is literally the concept of Risk-Return incarnate, and as more organisations own their data and offer more of their products as a service this trend will likely increase in popularity.

That said though while the concept is appealing many organisations lack the skills and tools to help them assess their risk exposure, and often under estimate the cost and effort involved in running their own programs.

Nevertheless, today it's estimated 82% of employees working for America's largest organisations, and 94 million Americans, have health insurance plans partially or fully funded by their employers - all of which is just the tip of the iceberg as organisations become increasingly data rich and open to the concept.

EXAMPLES

Today there aren't that many examples of organisations who self-insure, but the organisations who do tend to be confident in their products, data rich, tech savvy, and highly capitalised. It could also be argued that their boards favour disrupting the status quo rather than being a part of it - which then says alot about the organisations overall culture.

While countries like the UAE used the concept of self-insurance as a means to help their country prosper during the Iran Iraq war today organisations like Tesla are capturing and analysing all manner of different data sets, about their customers and products, which are so granular and detailed that it's letting them undercut traditional General Insurers motor premiums by at least 20%.

However, not just content with self-insuring their customers and products Tesla has now extended this concept further and are now providing their own Directors and Officers (D&O) liability insurance to their board members.

ACT NOW

As we enter an age where anonymity and privacy are a thing of the past, and where everything is smart and connected, and captures and streams data that can be analysed in real time by increasingly sophisticated algorithms, more organisations will have the opportunity to self-insure, but doing so will require the right mix of culture, risk appetite, and technology. However, if all these align then in time there is no reason why organisations couldn't insure themselves against any form of liability or risk.

EXPLORE:

- Business and impact assessments
- Data analytics, capture, and modelling strategies
- Emerging technologies and technology roadmaps
- Future of Insurance
- New business models, operating models, and products
- Predictive insurance models

VEHICLE TELEMATICS

2ND YEAR ON THE LIST

QUICK TAKE

Telematics, or Usage Based Insurance (UBI), is where your car insurance provider monitors your driving habits and adjusts your car insurance premiums based on how you drive, hence the term "Pay how you drive," and it's been around since 2009 with the vast majority of insurers offering it as a Black Box installation in your vehicle or via an app on your smartphone. While telematics has been around for over a decade now though overall adoption in the top five markets remains very low at between 4% to 20% with most customers either being younger drivers, high risk groups, or fleet customers.

Data sources: ABI, GSMA, McKinsey, and various.

IMPACT

By 2030 it's estimated that the global telematics value pool could be $750 Billion even though overall market adoption rates remain low at, in most cases, well below 20%, with some of this value coming from governments increasing willingness to mandate specific telematics services such as emergency call capabilities, as we're already seeing in both the EU and Russia.

However, while telematics adoption remains low, which will have an impact on insurers overall ability to play a significant role in helping influence and optimise traffic flows within Smart Cities, the trend offers insurers the ability to reduce the number of fraudulent claims, as well as offer Usage Based Insurance (UBI) policies, micro policies, real time dynamic pricing, and other complimentary services for both regular consumers and fleet customers.

Done right though telematics offers insurers a unique opportunity to extend the services they offer their customers and capture more hare of wallet outside of their traditional core business areas.

EXAMPLES

Using even the most basic of connectivity and data collection technologies there is a huge amount of valuable data and insights that organisations can pull from a telematics service which can then be used to influence driver behaviours, improve productivity and safety, and reduce costs, criminality, fraud, pollution, and the risk of reputational damage.

While there are many examples, such as LV= and MoreThan who offer telematics solutions in the UK, and Carrot's rewards based telematics solutions, some of the more disruptive and interesting - from a traditional standpoint at least - are organisations such as ByMiles who offer Pay as you Drive (PAYD) policies that only charge customers for the miles they drive - bearing in mind that for over 95% of the time most consumer vehicles are on the driveway anyway.

However, while we could fill a codex all by itself of the organisations offering some kind of telematics product very few have ventured out of their comfort zone to offer truly valuable or complimentary services that help them take a greater share of customer wallet.

ACT NOW

While telematics has a variety of benefits, for both customers and insurers, the real benefit, which most insurers aren't capitalising on, is the ability to use it as a platform to engage with and learn more about their customers, sell them more, and therefore play a more central role in their lives - thereby moving away from the industry's perception of being little more than a have-to-have grudge purchase.

EXPLORE:

- Business and impact assessments
- Data analytics, capture, and modelling strategies
- Emerging technologies and technology roadmaps
- Future of Insurance
- New business models, operating models, and products
- Partner ecosystems and solutions

LOGISTICS INDUSTRY TRENDS

CONTENTS

BOOK AN EXPERT CALL

WHAT IF ... OUR DELIVERIES ARRIVED IN MINUTES?

IN THE world of logistics envisioning a future where everything is delivered efficiently and cheaply within minutes of being ordered is nothing short of revolutionary. Picture a world where drones zip through the skies like clockwork, dropping off packages at your doorstep mere minutes after you place an order. At the core of this vision are cutting-edge technologies like drones and autonomous robotic warehouse systems.

Equipped with advanced sensors and navigation capabilities, drones navigate bustling city streets and suburban neighbourhoods with ease, delivering goods at lightning speed. Meanwhile, inside dark warehouses, robotic picking and fulfillment systems work tirelessly to locate, pack, and prepare orders for delivery in record time.

The implications of this rapid delivery revolution are immense. Businesses gain a competitive edge by offering lightning-fast shipping options, meeting consumer expectations for instant gratification and convenience. With reduced transit times and overhead costs, companies can operate more efficiently, ultimately passing on the savings to customers.

However, this future isn't without its challenges. Regulatory hurdles, safety concerns, and airspace management are all significant obstacles that must be overcome. Yet, the potential benefits of ultra-fast and affordable local delivery are too great to ignore. From revolutionising E-Commerce to streamlining last-mile logistics, this future scenario promises to reshape the way we move goods around urban and suburban areas.

In conclusion, the dream of near-instantaneous and cost-effective local delivery is within reach. By harnessing the power of emerging technologies like drones and autonomous robotic warehouse systems we can create a future where speed and efficiency are the norm, and the possibilities are limitless. It's time to embrace the future of local logistics and unlock a new era of convenience and accessibility for all.

STATS THAT MATTER

LOGISTICS

2.4 DAYS

GOODS DWELL TIME, AVG. AIRPORT, GLOBAL 2023

CARGOIQ

4.8 DAYS

CONTAINER DWELL TIME, AVG. PORT, GLOBAL 2023

WORLD BANK

68 ML

AIR CARGO VOLUME, TONNES, GLOBAL 2022

STATISTA

10.8 BN

SHIP CARGO VOLUMES, TONNES, GLOBAL 2022

RESEARCH & MARKETS

25 BILLION SQ FT

WAREHOUSE CAPACITY, GLOBAL TOTAL 2023

AJOT

$10.6 TR

INDUSTRY MARKET SIZE, GLOBAL TOTAL 2022

RESEARCH & MARKETS

70 %

PORT DIGITISATION, AVG. REDUCTION IN DELAYS

WORLD BANK

$3.4 KG

AIR FREIGHT COST PER KG, GLOBAL AVG. 2022

WORLD BANK

185 BILLION

PARCEL SHIPPING VOLUME, GLOBAL TOTAL 2023

STATISTA

44 DAYS

CONTAINER TRANSIT TIME, GLOBAL AVG. 2023

WORLD BANK

AUTONOMOUS LAST MILE DELIVERIES

2ND YEAR ON THE LIST

Continental's curbside Robo-Dogs

QUICK TAKE

In order to reduce costs and improve efficiencies the logistics industry have been deploying and experimenting with **Autonomous Vehicles** for some time now. But, in order to realise their ambitions of a fully autonomous logistics chain one major obstacle remains - how to conquer the problem of getting goods the last mile to the customer. Whether they're in suburbia or on the 80th floor of a tower block. **Drone Deliveries**, where the drones are embedded into the structure of the delivery vehicles, is one way to solve the problem. But there are other innovative approaches being developed too - such as Robo-Dogs.

Data sources: SOTI, and various.

IMPACT

With consumers all around the world buying trillions of dollars worth of goods from E-Commerce marketplaces and **Gig Economy** platforms every year, and with there being no signs of this trend slowing down - especially after a 40% increase during the 2020 Global Pandemic - 61% of logistics organisations agree that last mile delivery is the most inefficient process in the entire supply chain.

Furthermore, with 56% of US shoppers, for example, saying they wouldn't buy from a store again if they were unsatisfied with the delivery experience, and 37% going as far as blaming the stores themselves for tardy deliveries, it's easy to see how getting the accuracy and timeliness of this crucial service right.

From an operators perspective up to 28% of the delivery cost can be associated with the last mile which is why trying to optimise it is of such importance, and with new autonomous and robotic technologies coming online, as well as **Artificial Intelligence** (AI) and **Quantum Technologies** which can be used to optimise it, there's a chance they might just move the dial.

EXAMPLES

One of the greatest challenges, arguably, of automating the last mile is the fact that solutions must be able to handle a variety of different tasks and environments, from being able to deliver a large odd shaped package to a residential neighbourhood, as well as groceries and a Pizza to the 80th floor of a high rise - which is a problem for operators in cities such as Dubai, Hong Kong, London, and New York.

From Starship's autonomous trundling boxes on wheels that use LiDAR to weave their way through busy streets to deliver pizza to hungry workers though to UPS's van integrated Workhorse Drones that let drivers deliver packages in one place while the drones deliver packages in another, there are solutions.

Then, we have the likes of 7Eleven, Amazon, and Zipline who are also leaning heavily on drones with the first two using them to deliver groceries, and the latter using them to deliver vital medical supplies across Africa. And then, of course, there are stair climbing street strutting Robo-Dogs which are perhaps the coolest of them all ...

ACT NOW

It will take a long time before everything we order online is delivered by some form of autonomous delivery system because organisations are still trying to find that magic formula which less them balance accuracy, cost, and timeliness with the real world of affordability, liability, and simplicity. After all, no customer wants a drone in the face, or to have their neighbourhood power grid taken out by a drone that carelessly flew into a pylon. That said though as the technologies improve the day will come.

EXPLORE:

- Business and impact assessments
- Emerging technologies and technology roadmaps
- Future of Artificial Intelligence, Communications, Energy, Retail, Sensors, and Transportation
- Legal, liability, and risk due diligence
- Partner ecosystems and solutions
- Urban planning

CONTROL TOWERS

2ND YEAR ON THE LIST

QUICK TAKE

A connected, personalised dashboard of data, key business metrics, and events across a logistics network Control Towers offer organisations a way to see, analyse, and respond to critical issues and events that can affect their business and their customers businesses. When combined with other trends such as **Artificial Intelligence** (AI), **Blockchain**, **Digital Twins**, **Internet of Things** (IoT), and **Robotic Process Automation** (RPA), among others, they help organisations improve collaboration, communications, costs, customer expectations, efficiency, resilience, and sustainability metrics.

Data sources: Accenture, IBM, SupplyOn, Xometry, and various.

IMPACT

It can be argued that ultimately the end goal of this trend is to first help organisations gain accurate, real time end to end visibility of their logistics, then eventually automate them and enable continuous, autonomous, intelligent optimisation.

While there are many benefits, such as real time order planning and being able to notify customers in advance about delays or spikes in demand, studies have shown that organisations who've embraced this trend have reduced their overall logistics operating costs by as much as 15% while at the same time growing revenues and realising greater operational efficiency and flexibility.

All of which is before we discuss the impact this trend has on asset and inventory management and tracking, product costs and sourcing, sustainability, and other metrics including the benefit of having a single source of the truth and the data to allow stakeholders to conduct real time risk and scenario modelling and therefore make better informed decisions, which can then have a big impact on the organisations overall financial performance and customer satisfaction.

EXAMPLES

One of the most notable examples is Bosch who, by incorporating governance and flexible technology architectures into one unified cloud platform, are now using just a single control tower to manage the logistics for more than 85% of their $40 Bn global supply chain volumes, which equates to over 300 Million components a day shipping to more than 270 manufacturing facilities around the world. Furthermore, with over 37,000 staff accessing the system not only does Bosch believe it gives them a strategic advantage in the market, but they're now planning the next step which will be to extend access to the platform to their key suppliers so they can see the organisations manufacturing needs in real time - thereby further optimising their logistics networks and lowering acquisition and shipping costs and emissions.

Elsewhere another notable example is Airbus who interestingly call this trend the "Heartbeat of their operation" and who use it co-ordinate the logistics of more than 24,000 suppliers from over 100 countries, and who so far have used it to save themselves over 357 Million kilometers of transport.

ACT NOW

The ability to digitise and then visualise and intelligently and autonomously analyse every aspect of a logistics operation gives organisations a strategic advantage over their peers, but it's a difficult and expensive undertaking which needs approval from multiple stakeholders and this is where most of these initiatives either fall flat or end up only partly implemented with the result being that they sometimes fail to live up to their promise. As a result it's important to realise that if you embrace this trend you need to go all in.

EXPLORE:

- Business and impact assessments
- Emerging technologies and technology roadmaps
- Future of Artificial Intelligence, Logistics, Manufacturing, Supply Chains, Retail, Transportation, and Work
- New business and operating models
- Partner ecosystems and solutions

DARK WAREHOUSES

2ND YEAR ON THE LIST

QUICK TAKE

Dark Warehouses, like **Dark Factories**, **Dark Stores**, and **Dark Restaurants**, are fully automated warehouses that operate 24/7 without the need for heat or people, or the need for any human involvement whatsoever. They're also becoming increasingly common and sophisticated as **E-Commerce**, **Just In Time Manufacturing**, and other trends become increasingly popular and as operators everywhere look for new ways to improve inventory management and fulfilment, and reduce costs, while at the same time improving operational agility and flexibility.

IMPACT

In today's world dark warehouses have a lot of advantages over traditional ones, especially given the fact that in time they'll compliment the **Autonomous Vehicles** and **Autonomous Last Mile Delivery** trends, among others. Not only do they occupy up to 50% less space because they don't need wide aisles for human-driven forklifts or break out rooms, or require expensive HVAC systems, but the warehouse robots they rely on generate fewer errors and can also use retrieval systems with bins stacked much higher than typical fulfilment centers.

Furthermore, using advanced **Artificial Intelligence** (AI) and **Machine Vision** these robots can also unload pallets, pick items, and place them on high speed conveyor belt systems at least 30% faster than human workers - and that rate is increasing. Collectively not only does this mean that the cost of operation can be up to 50% less than traditional warehouses, but it also means that their overall output is much higher. However, all that said the cost of the technology required to operate them, such as expensive ASRS and WMS systems is still high, but in time those costs will decrease.

EXAMPLES

Today it's easy to argue that every organisation is a technology company, and increasingly these organisations are all trying to develop their own technology stacks and platforms that they can sell to other operators.

A good example of this is Ocado, a UK based grocery retailer who through the years have worked hard to build "The Grid" - a giant chessboard like warehouse structure populated entirely by robots that scuttle backwards and forwards night and day autonomously picking groceries. Processing over 3.5 Million items and over 65,000 orders a week this single grid is seen by many as the future of dark warehouses, and organisations like Coles, Kroger, Morrisons, and others are buying in.

Elsewhere ever the innovator Amazon has also been busy developing its own dark warehouses, but in their case they believe that it will take them ten years to create fully automated warehouses that don't have any people present, which in part is because of the massive variety of stock they have to handle and ship and the volumes they need to manage.

ACT NOW

As a trend we can argue that dark warehouses are still in their infancy, but the momentum is accelerating as the technologies they're based on improve rapidly and as costs fall, all of which means that it won't be long until more organisations start experimenting with the trend and deploying them at scale.

EXPLORE:

- Business and impact assessments
- Best practises and case studies
- Emerging technologies and technology roadmaps
- Future of Artificial Intelligence, Manufacturing, Logistics, Retail, Robotics, and the Workforce
- Partner ecosystems and solutions
- New business and operating models

Data sources: Amazon, Kion, Ocado, Toyota, and various.

DRONE DELIVERIES

2ND YEAR ON THE LIST

QUICK TAKE

Many organisations have been trialling Drone Deliveries as a way to improve the cost and efficiency of their supply chain operations, and as part of their **Autonomous Last Mile Deliveries** initiatives. And in some cases they've worked and in others they've flopped. But the deployments and experiments continue.

In some respects drone deliveries are technologically premature - after all most drones have small load carrying capabilities, range issues, short flight times, and are still rather "dumb." But, solutions are coming.

Data sources: R&M, UPS, and various.

IMPACT

While drone delivery services can have a dramatic impact on delivery times as well as the sustainability of those deliveries today they represent a very small percentage of deliveries. So small in fact that it looks like a rounding error.

However, by 2025 the market is expected to reach $4.4 Billion and grow at 45% CAGR. And, while this might at first look promising, it's worth noting that a lot of this growth will be from organisations who are using drones to deliver goods to hard to reach locations where traditional last mile delivery options are either non existent or expensive.

When we look at the use of drones in more suburban or urban use cases today it costs UPS an estimated $12.92 per drone delivery versus a traditional cost of just $2, and while this will fall exponentially as drone technologies improve and as operators find optimal ways to integrate them into their operations it is clear that there is still work to be done. And that's before we discuss the city or country level need for new micro **Urban Airspace Management Systems** and associated regulations.

EXAMPLES

When it comes to trying to make drone delivery a viable and, just as importantly, a liability free reality operators need to rely on a range of technological innovations. These include, but are not limited to, more energy dense power systems, such as Hydrogen, or LiON batteries that can be wirelessly charged, and they also need upgrades in the **Artificial Intelligence** (AI), **Machine Vision**, and sensing departments that let them see and autonomously avoid and manoeuvre around any and all obstacles - including balconies, porches, power lines, and washing lines. Get these right and then the problems the industry face are more operational than technological.

While many organisations have trialled drone deliveries most of the suburban and urban experiments so far have been just that and have mostly been wrapped up. So far the best results have been from organisations using drones to deliver goods to hard to reach rural locations, or in urban locations where the delivery of goods, such as heart defibrillators or supplies of human blood, are time critical. That said there's no doubt drones will have their day ...

ACT NOW

While the drone delivery industry is still young technological advances in the coming years will make it a much more attractive and viable commercial proposition, and in the short to medium term drones will be best suited to fulfilling niche delivery roles and complimenting existing operational strategies.

EXPLORE:

- Business and impact assessments
- Emerging technologies and technology roadmaps
- Future of Communications, Drones, and Energy
- Partner ecosystems and solutions
- Urban airspace management

MANUFACTURING INDUSTRY TRENDS

CONTENTS

BOOK AN EXPERT CALL

WHAT IF ... FACTORIES WERE FULLY AUTOMATED?

IN THE world of manufacturing full automation has been a long term goal for many decades and now it's a reality, and at its core the shift towards automation represents a fundamental redefinition of the manufacturing landscape. By leveraging advanced technologies such as AI and robotics companies are now transforming traditional production methods, driving efficiency and productivity to unprecedented heights.

One of the key drivers behind the push for automation is the potential to streamline operations and reduce costs. By replacing manual labour with automated systems, manufacturers can minimise human error, optimise production schedules, and ultimately enhance their competitiveness in the global market.

Furthermore, automation holds the promise of fostering sustainability within the manufacturing sector. Automated processes are inherently more resource-efficient, leading to reductions in waste, energy consumption, and environmental impact. As the world grapples with pressing environmental challenges, such as climate change and resource depletion, the adoption of automated manufacturing technologies offers a compelling path towards a more sustainable future.

However, realising the full potential of automated manufacturing requires strategic investments in technology, education, and workforce development. Policymakers must also play a crucial role in creating an enabling regulatory environment that encourages innovation while safeguarding workers' rights and promoting equitable access to opportunities.

In conclusion, the transition towards fully automated manufacturing represents a transformative opportunity for the industry. By embracing automation, companies can unlock new levels of efficiency, productivity, and sustainability, paving the way for a brighter and more prosperous future.

STATS THAT MATTER

MANUFACTURING

7 %

PCT. OF MANUFACTURING THAT'S LABOUR INTENSIVE

MCKINSEY & CO

22 %

PCT. OF MANUFACTURING THAT'S ENERGY INTENSIVE

MCKINSEY & CO

106

CARS MADE PER MINUTE, GLOBAL AVG. 2023

AUTO DEALER

70 ML

WORLDS BIGGEST FACTORY, SQ FT, VW GERMANY

VW

$16.3 TRILLION

VALUE ADDED MANUFACTURING OUTPUT, GLOBAL TOTAL 2022

AJOT

28 %

CHINA, PCT. OF TOTAL GLOBAL OUTPUT, 2022

WORLD BANK

570 K

INDUSTRIAL ROBOTS SOLD, GLOBAL TOTAL 2022

IFR

42 %

ENERGY USE, PCT. OF GLOBAL TOTAL 2022

IEA

464 MILLION

PEOPLE EMPLOYED IN SECTOR, GLOBAL 2022

MCKINZIE & CO

60 %

SECTOR R&D ACTIVITY, PCT. GLOBAL TOTAL, 2022

WORLD BANK

ADDITIVE MANUFACTURING

2ND YEAR ON THE LIST

Designed by AI and 3D Printed, Under Armour

QUICK TAKE

Additive Manufacturing, which has many alternative names including, but not limited to, 3D or 4D Printing - both of which then have their own distinct subsets - has been around since the 1980's but it's only, thanks to technology advances, that it's starting to make its mark on the world.

By giving people the ability to print all kinds of products on demand - from aircraft engines and human organs to clothing and electronics - this trend is altering global politics, disrupting global supply chains, and giving organisations new sustainable business opportunities.

Data sources: Carbon, United Nations, Stratasys, and various.

IMPACT

In time this trend will dominate the global manufacturing landscape and it's difficult to see why the vast majority of products won't be manufactured in this way - especially as we continue to see significant technological progress being made in the field. The ability to print products on demand has wide ranging consequences.

Organisations can print products locally on demand after they've been purchased thus eliminating the need to predict and hold inventory, and because products can be manufactured locally complex global supply chains and logistics can be collapsed or eliminated altogether. And then there's the ability to produce tailored goods in small batches which would have been previously uneconomically viable. Furthermore, materials use and wastage can be reduced by upto 80%.

However, with over 28% of all goods being made in China and 16% in the USA this trend also has the opportunity to shift the balance of global power, impact GDP and re-distribute wealth, and exponentially accelerate product prototyping and development - all for starters.

EXAMPLES

Today there are plenty of examples of Additive Manufacturing in action - whether it's fashion designers in Miami 3D printing distinctive fashion lines, or Adidas and Under Armour printing off tens of millions of sneakers in the backs of their stores - which no longer need to be made or imported from China. Or held in inventory ...

But that's just part of the story. As the trend has matured and as investment and R&D continues to pour in it's now possible to print enterprise grade products on demand, such as aerospace components and aircraft and rocket engines.

In short, in time, if it can be manufactured it'll likely be 3D or 4D printed - whether that's your gadgets and smart devices, the products you buy on a daily basis, your food, your furniture, your vehicles, or a million other things besides. Even human organs are being printed today - from bone and cartilage to hearts and kidneys ... This is a trend that knows no bounds.

ACT NOW

Once you've printed a product on demand you'll never go back, and you'll be hard pressed not to realise the benefits this trend has on your organisations business models, ESG metrics, finances, operations, and profits. However, there is still some way to go before this trend is fully commercialised, mature, and scalable.

EXPLORE:

- Business and impact assessments
- Emerging technologies and technology roadmaps
- Future of Manufacturing and Materials
- New business models, operating models, and products
- Partner ecosystems and solutions

CUSTOMISATION

2ND YEAR ON THE LIST

QUICK TAKE

With more than 70% of consumers wanting personalised products, and with the trend commanding a premium in the market, Customisation is arguably one of the hottest **E-Commerce** and manufacturing trends. Furthermore, with technologies such as **5G**, **Additive Manufacturing**, **Artificial Intelligence** (AI), **Internet of Things** (IoT), networked production, and **Robotics**, it's becoming increasingly feasible and economically viable for factories to handle customisation requests quickly and efficiently at scale without the need to constantly reconfigure their systems.

Data sources: Deloitte, McKinsey, and various.

IMPACT

The ability for customers to literally break the mould and create and design their own personalised products is arguably the pinnacle of manufacturing but up until recently doing small customised runs of tailored products has been difficult and expensive for manufacturers to do. So much so that in many cases it's just not on the table as an option. Today though new Industry 4.0 technologies not just make this service increasingly feasible but they also make it economically attractive and viable.

Across all sectors it's estimated that customisation could add at least an extra $1 Trillion in revenues in the US alone, with that impact obviously multiplied globally, and that organisations that do customisation well generate 40 % more revenues from it than their peers. Also, at a high level it's an increasingly attractive way for brands to improve the Customer Experience and build brand loyalty with 76% of customers more likely to buy from a brand that offers customisation and over 80% of them likely to repurchase and recommend family and friends - provided of course that their experience is a good one.

EXAMPLES

New examples are emerging all the time as organisations across sectors embrace this trends potential, from brands such as Oreo who let consumers customise and create their own cookies, to the likes of the NFL who offer tailored 3D printed football helmets, to Nike who via their NikeiD service offer customers the opportunity to personalise their shoes in lots of different ways.

At the more niche end of the customisation market we also see organisations like MINI offering all manner of customisation options for their cars, and brands such as Sculpteo and Sonova using 3D printing and the trend to let customers create their own custom earbuds and hearing aids fitted to their exact ear shape and size.

However, we also see others such as Amazon and JD.com in the E-Commerce space, investing heavily in the technologies in this field and it's also increasingly likely that in time they will leverage this trend, along with the **Autonomous Retailers** and **Digitisation** trends, to disrupt the retail market all over again while, in their case, offering goods on demand and reaping higher profits.

ACT NOW

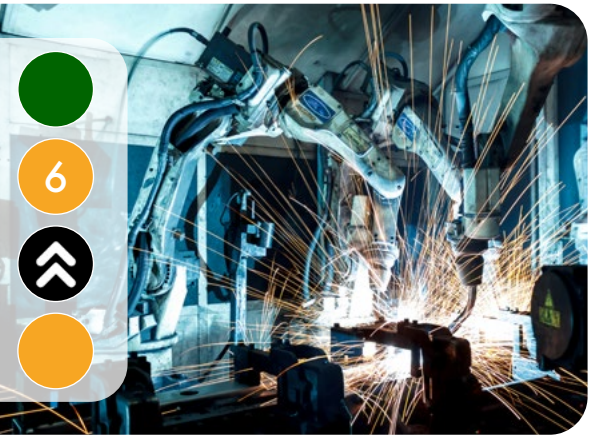
Customisation at speed and scale has always been difficult but now new manufacturing processes and technologies are making it more viable than ever. As a result not only can organisations use this trend to improve the customer experience and increase customer loyalty but, in a rare triple win, they can also use it to command premiums in the market and realise higher profit margins.

EXPLORE:

- Business and impact assessments
- Emerging technologies and technology roadmaps
- Future of Artificial Intelligence, Communications, Manufacturing, and Robotics
- New business models, operating models, and products
- Product development and innovation

DARK FACTORIES

2ND YEAR ON THE LIST



QUICK TAKE

Developing **Dark Factories**, where fully automated factories manufacture products without any human involvement, have been an ambition of the sector for quite some time now especially for organisations based out of Asia where the competition to manufacture products for the lowest cost is both intense and a competitive advantage.

Despite this though so far even some of the world's largest manufacturers have struggled to create dark factories which, while being a benefit for them, has serious implications for the workforce.

Data sources: McKinsey, Odgers, Siemens, WEF, and various.

IMPACT

While many organisations have been pinning their hopes on Industry 4.0 to help them develop dark factories the fact of the matter is that we need several technological leaps in **Additive Manufacturing**, **Artificial Intelligence** (AI), control systems, **Factory Digital Twins**, **Machine Vision**, networks, **Robotic Process Automation** (RPA) and **Robotics**, and others to make them happen - leaps that are now happening.

While it might seem like most manufacturing has already been automated the actual global robot to human worker ratio is very low even in China where it's just 30 robots per10,000 workers. However, with many in the sector citing their ability to hire workers as a major concern, with over 2.5 Million jobs going unfilled in the last decade with an economic impact of more than $2.5 Trillion, it's inevitable this ratio will increase as technologies mature. Despite their challenges though the appeal of dark factories to improve product quality and inventory cycle time, increase productivity and reliability, and reduce production costs, mean that this trend is on the ascent.

EXAMPLES

While there have been many attempts in the past to create dark factories, with the first proof of concept being run in a flour mill in the US in 1784, the majority have failed, and while there are many reasons for this, such as costs and maintenance issues, many of the organisations trying to shift to this new operating model keep coming to two main conclusions - that manufacturing is complex, and automation is inflexible.

Even though many people believe manufacturing is dull and repetitive in reality manual assembly especially requires an enormous amount of precision and skill that up until recently even the most sophisticated algorithms and robots couldn't match.

Despite this though there are examples such as FANUC, a Japanese robotics company where robots build new robots in lights out mode for up to 600 hours at a time with no humans involved, and then there's Philips in Denmark who are using dark factories to manufacture their electric razors. Then, at the top of the pile there's manufacturing giant Foxconn with more than 40,000 "Foxbots" operating in lights out mode to produce more than 10,000 new robots a year.

ACT NOW

With double digit improvements in inventory cycle times, cost-productivity, and reliability, there are clearly many reasons why organisations should be interested in this trend, and when one manufacturer manages to completely automate factories that were hitherto too difficult to automate at scale then the flood gates will open and the transition will begin. It's also likely that the adoption of this trend could be accelerated by **Flattening Supply Chains**, the trend of making products simpler and with fewer components.

EXPLORE:

- Business and impact assessments
- Emerging technologies and technology roadmaps
- Future of Artificial Intelligence, Communications, Manufacturing, Materials, Robotics, and Work
- New business and operating models
- Partner ecosystems and solutions

FACTORY DIGITAL TWINS

2ND YEAR ON THE LIST

A Factory Digital Twin, BMW

QUICK TAKE

Factory Digital Twins are near prefect digital replicas of factories that have either already been built, or are yet to be built.

As the technologies used to create them become increasingly powerful these twins are able to replicate and simulate every conceivable factory detail - from the laws of nature and physics, to the factory's assets, equipment, machines, and processes, right through to the actions and behaviours of the human workers themselves. They also play an integral role in enabling the **Continuous Innovation** trend.

Data sources: Deloitte, Gartner, PTC, Siemens, and various.

IMPACT

Factory digital twins give organisations the ability to model, analyse, test, and predict every aspect of a factory's operations in granular detail - even before they've been built - and this has many commercial, operational, and procedural benefits.

However, while there are obvious advantages to being able to analyse how a factory is operating, or will operate in the future, so that its operations can be optimised there are many other benefits too.

Benefits that include everything from the factory's ability to predict and fix failures autonomously, all the way through their ability to intelligently simulate the optimal way to manufacture new product concepts before they're made for real. And that's before we discuss the usefulness of being able to analyse and extrapolate factory trends, or quiz it using nothing more than natural language.

As a result of these and other benefits this trend is estimated to grow at 16% CAGR and reach a market size of over $1.3 Trillion by 2030.

EXAMPLES

While many organisations talk about the benefits of Industry 4.0 it can be argued that factory digital twins are the next evolutionary step of that trend. But, building twins that can simulate everything found in a physical factory - from the effect of gravity on the machines and the arcs of the robots to the workflows and beyond - is incredibly difficult. Yet, despite this, several organisations have achieved it and reaping the benefits.

This includes BMW who partnered with Nvidia and Siemens and built a digital twin of a new factory before it was built so they could test every aspect of it, right down to how the human employees would interact with the machines, before they finally sent in the construction crews to break ground.

As twins technologies improve it won't be long until they're accurate down to the photon level - as we've already seen with Nvidia's own Virtual Reality HQ in the USA - and in time they will become an increasingly important tool used by Artificial Intelligence (AI) itself which, as people do today, will use them to analyse, automate, monitor, and optimise factory operations in real time.

ACT NOW

Factory digital twins have benefits that go far beyond the obvious, and they will play an increasingly important role in the future of the industry - whether it's increasing manufacturing profitability and speed or accelerating the industry's overall rate of innovation.

EXPLORE:

- Business and impact assessments
- Data ownership strategies
- Emerging technologies and technology roadmaps
- Future of Manufacturing
- New business models, operating models, and products
- Partner ecosystems and solutions

MARITIME INDUSTRY TRENDS

CONTENTS

BOOK AN EXPERT CALL

WHAT IF ... DRONE CARGO FLEETS WERE THE NORM?

IN THE ever-evolving landscape of global shipping, a new chapter is unfolding with the rise of autonomous drone fleets. Backed by cutting-edge technology and recent research breakthroughs, these unmanned vessels are poised to revolutionise the maritime industry and global supply chains in unprecedented ways with recent studies indicating that autonomous drone fleets have the potential to significantly enhance efficiency and cost-effectiveness in global shipping. According to industry experts, the implementation of drone fleets could reduce transportation costs by up to 20%, leading to savings of billions of dollars annually.

Moreover, autonomous drones offer unparalleled speed and reliability in cargo transportation. Research findings suggest that these unmanned vessels can navigate shipping routes up to 30% faster than traditional vessels, resulting in quicker delivery times and improved customer satisfaction.

Furthermore, the environmental benefits of autonomous drone fleets cannot be overstated. With reduced fuel consumption and emissions, these vessels contribute to a more sustainable shipping industry, aligning with global efforts to combat climate change and reduce carbon footprints.

As research continues to advance, the potential applications of autonomous drone fleets in global shipping are limitless. From optimising supply chain logistics to aiding just in time delivery and better inventory management, these unmanned vessels represent a paradigm shift towards a more efficient, sustainable, and interconnected global shipping network.

In conclusion, the advent of autonomous drone fleets heralds a new era in global shipping. With their unprecedented speed, efficiency, and environmental benefits, these unmanned vessels are poised to redefine the future of maritime transportation, driving innovation and progress on a global scale.

STATS THAT MATTER

90 %

SHIPS BUILT IN ASIA, PCT. GLOBAL TOTAL 2022

CLARKSONS

230

SHIPS SCRAPPED, GLOBAL TOTAL 2019

HELLENIC

1,031

NEW CONTAINER SHIP ORDERS, GLOBAL 2022

STATISTA

40 ML TEU

BUSIEST PORT BY CAPACITY, SHANGHAI

WSC

1.95 BILLION TONNES

SHIPPING VOLUME, GLOBAL TOTAL 2022

STATISTA

$1.3 TR

VALUE OF THE GLOBAL SHIPPING FLEET, 2022

CLARKSONS

2.3 BN

DWT OF THE GLOBAL SHIPPING FLEET, 2022

CLARKSONS

MARITIME

30 ML

CRUISE PASSENGERS, GLOBAL TOTAL 2022

CLIA

50,000

SIZE OF MERCHANT FLEET, GLOBAL TOTAL 2023

UNCTAD

21

SHIP AGE, ALL SHIPS, GLOBAL AVG. 2022

UNCTAD

AUTONOMOUS SHIPS

2ND YEAR ON THE LIST

QUICK TAKE

While many in the industry are looking to an era where the seas are ploughed by platoons of Autonomous Ships the reality is we'll first have to endure a transition phase - first to drone or tele-operated shipping, and then to autonomous shipping. Not only will this transition take at least a decade or more, even though the world's first autonomous ships have already arrived, but it will require a fundamental re-writing of maritime legislation, and bring with it both benefits and dangers that include everything from improved operating efficiency to the threat of damaging cyber attacks.

Data sources: Various.

IMPACT

Just as we have seen elsewhere the impact of autonomous ships will be both broad and varied. While it is expected that the market will be worth $166 Billion by 2030, and that by 2040 50% of ships will be autonomous, it's also expected that they will be able to reduce the overall operator costs by at least 30% - through the combination of reducing fuel use and the elimination of crews - and that they could increase global shipping volumes by at least 30%, as well as allow fleets to be made up of smaller, lighter, more energy efficient vessels.

There will be a human cost though. On the one hand these ships will no longer need crews, which will both eliminate human error which accounts for 70% of all accidents, as well as Health and Safety liabilities, but on the other at any one point in time there are over 100,000 manned ships ploughing the seas and automation will have a devastating impact on the people who rely on the industry for their income and livelihoods. However, while there will undoubtedly be redundancies there will also be the opportunity for some crew members to re-trained to fulfil higher duty roles, such as tele-operator roles.

EXAMPLES

Following on from developments in the **Autonomous Vehicles** space autonomous vessels have been on the radar of shipping companies for some time now with the International Maritime Organization (IMO) working diligently since 2017 to ensure the safe and clean transition to what they call Maritime Autonomous Surface Ships (MASS), with some of their first frameworks being published in 2018.

While organisations such as Rolls Royce have been working on autonomous control, remote command, and intelligent crew systems for several years now, with an eye on full automation in the near future, elsewhere organisations such as Yara, in Norway, and Nippon, in Japan, have gone several steps further and already performed the first commercial sea trials of autonomous cargo ships with the first deployments slated for 2025.

ACT NOW

The automation of the industry is a matter of when, not if, and as a consequence owners and operators should be prepared as autonomous ships and **Autonomous Ports** become more commonplace over time.

EXPLORE:

- Autonomous operations and new business models
- Business, cyber, and assessments
- Emerging technologies and technology roadmaps
- Future of Artificial Intelligence, Maritime, Security, Transport, and the Workplace and Workforce
- IMO MASS Regulations
- Policy and regulation reform
- Re-education and re-training initiatives

SHIP SCRAPPING

2ND YEAR ON THE LIST

QUICK TAKE

Ships are always being scrapped as new more cost effective ones enter service, but during the global pandemic we saw a rapid rise in the number of ships being scrapped with many breakers yards in Greece, India, and Turkey filling up quickly.

We also saw a dramatic decrease in ships scrap value which saw some breakers rates, which are normally in the $280 to $400 range, drop as low as $80 per ton - especially in the case of ships registered in the EU and at yards subject to stringent EU regulations. Post pandemic, however, prices rebounded.

IMPACT

Since 2016 the average age at which a ship is scrapped has increased from 23 to 27 years, and now that de-carbonising the global shipping fleet by at least 40% by 2030, and then by 70% or more by 2050, is one of the industry's top priorities it's estimated that by 2026 the industry will have to spend over $317 Billion to green the fleet - $235 Billion to build new ships and $114 Billion to retrofit existing ships.

As a consequence, and with the cost of retrofitting some ships, such as a 24,000 TEU cargo ship, costing upwards of $25 Million to convert to LNG fuel, for example, scrappage could become a more attractive commercial proposition in the years ahead - especially as governments, such as the EU, take a tougher stance against "polluters."

While 2020 itself was an exceptional year, with a 33% increase on 2019, in 2021 there was a further 40% increase in the number of scrapped ships, with over 630, amounting to 17.4 Million DWT, going to the breakers. However, while some of this increase was due to the pandemic some of it was also due to record high steel prices which surpassed $754 per lightweight tonne.

EXAMPLES

In order to meet the International Maritime Organization (IMO) and the industry's **Net Zero Pledges** by 2050 it's imperative that new net zero emissions ships start entering the fleet from 2030 at the latest. But, while achieving the IMO's emissions goals is one thing, there are many that continue to question the environmental and social cost of organisations using beaching yards, such as those in Bangladesh, India, and Pakistan, which on average still dismantle an estimated 90% of all the world's ships in what many describe as deadly, dire, and toxic conditions.

On average a typical 5,000 ton ship can be dismantled in a month - with larger ships taking up to a year or more - with subcontractors first stripping out all the loose and flammable items. After that cutting crews start dismantling the hull, stern first, while other crews remove everything else, including heavy metals, toxic materials, and other materials.

ACT NOW

Over the next decade almost all the world's ships will have to either be scrapped or retrofitted, and with 90% of that likely to be done by beaching yards it could be argued that the cure might be worse than the disease. As a result, ship designers should give more thought to the recyclability of their ships, and owners should do their utmost to limit the damage that scrapping ships can cause.

EXPLORE:

- Emerging technologies and technology roadmaps
- Hong Kong Convention
- Future of Energy and Manufacturing
- Sustainable ship design
- Unilateral global accords and coordinated global action

Data sources: BIMCO, GMS Leadership, IMO, MDPI, UNCTAD, and various.

MEDIA AND ENTERTAINMENT TRENDS

CONTENTS

BOOK AN EXPERT CALL

WHAT IF ... ALL CONTENT WAS AI GENERATED?

IN A a future where AI becomes the primary creator of content, the emergence of procedural AI-generated content stands out as a transformative force. With algorithms capable of generating vast volumes of content at unprecedented speeds, the potential benefits and challenges are vast.

On the positive side, procedural AI-generated content offers unparalleled scalability and efficiency. By automating the content creation process individuals and organisations alike can produce immense volumes of tailored content across various platforms, catering to diverse audiences with personalised experiences. And this scalability extends to industries such as entertainment, journalism, and marketing where content can be rapidly generated to meet rapidly evolving demands.

However, the sheer volume of AI generated content also poses significant challenges. With algorithms churning out content at a rapid pace, the risk of bias, low quality content, and disinformation and misinformation looms large, and without human oversight and ethical guidelines there's a potential for AI generated content to propagate falsehoods, reinforce biases, and undermining peoples trust in information.

Navigating this landscape also requires a multifaceted approach. Ethical guidelines and regulatory frameworks must be developed to ensure the integrity and accuracy of AI generated content. Additionally, investments in media literacy and critical thinking skills are essential to empower consumers to discern between authentic and synthetic content.

In conclusion, while procedural AI-generated content offers immense potential for innovation and efficiency, it also presents significant challenges. By addressing these challenges proactively and collaboratively, we can harness the power of AI to enhance content creation while upholding ethical standards and preserving the integrity of information in an AI-driven world.

STATS THAT MATTER

$2.4 ML

$ PER SPONSORED POST, CRISTIANO RONALDO

IMH

$92 ML

#1 CELEBRITY EARNER, TAYLOR SWIFT, 2022

FORBES

416 BN

LONG FORM VIDEO STREAMS, GLOBAL 2022

LUMINATE

3.4 TR

MUSIC STREAMS, GLOBAL 2022

LUMINATE

787 MILLION

#1 INFLUENCER, CRISTIANO RONALDO, FOLLOWERS 2023

STATISTA

3 BN

FACEBOOK, MONTHLY USERS 2023

DEMAND SAGE

2.7 BN

YOUTUBE, MONTHLY USERS 2023

GMI

MEDIA & ENTERTAINMENT

$1.1 BN

#1 BLOCKBUSTER, BARBIE, 2023

BOX OFFICE MOJO

231 MILLION

NETFLIX SUBSCRIBERS, GLOBAL TOTAL 2023

NETFLIX

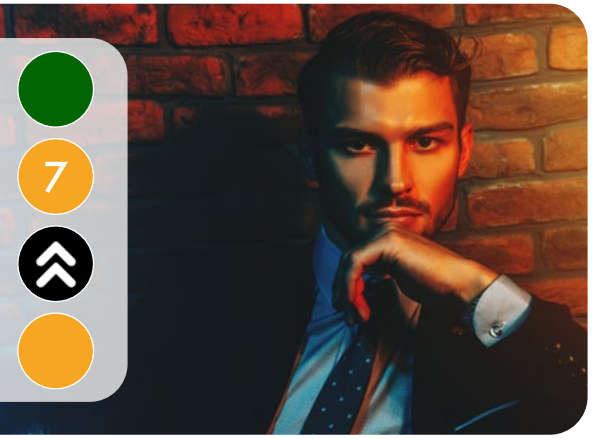
1.2 BN

#1 STREAMED SONG, FLOWERS BY CYRUS, 2023

LUMINATE

DIGITAL HUMANS

2ND YEAR ON THE LIST



QUICK TAKE

In a nutshell Digital Humans, which while being their own trend can also be a subset of the **Synthetic Content** trend, can be used to replace any real person we watch or interact with via a screen. And if that sounds an odd way to frame it then it's also the most accurate - literally.

Digital humans recreate the human experience at internet scale. A single digital human, for example, could have millions of different conversations or interactions with millions of real people in parallel. And whatever a real human can do they'll be able to do to.

Data sources: Various.

IMPACT

If you think about all of the content you consume and interact with on a daily basis through a screen - whether it's an advert, a lecture, a music concert, a video, a Zoom call, and so on - the fact is that you only know you're interacting with a living person because of the way they act, move, and talk. And once machines are capable of re-creating this and overcoming the phenomenon called "Uncanny Valley" you won't be able to tell a real human from a digital one.

Ultimately this means that real humans, for example your favourite actor, influencer, pop star, and so on, could be replaced with digital ones and noone will be able to tell the difference - or care. The impact of this, especially in our digital age, is not only significant it's society changing in many ways - from its impact on jobs and livelihoods, to its impact on company operations, customer engagement, diversity and inclusion, hiring, image rights, industry economics, marketing, productivity, and the very fabric of society itself.

And that's all before we discuss what happens when digital humans are weaponised to spread disinformation.

EXAMPLES

We're all used to the CGI characters bought to life by Hollywood which often take thousands of hours to painstakingly create, such as Rachel in Blade Runner 2049. Increasingly though technologies and tools, such as Artificial Intelligence (AI) and Epic's Unreal Engine, are able to generate life-like digital humans in real time, and animate them - giving them the power to have authentic conversations and interactions with people. All of which, in turn, makes it increasingly difficult to differentiate between real humans and digital ones.

Some of the best known Digital Humans today hail from organisations such as Soul Machines whose neural network brain Avatars are becoming a global sensation and assuming jobs in everything from banking and customer service to teaching. Samsung, in the meantime, have their amazingly life-like Neon Digital Humans, and startups like Synthesia are disrupting the dull world of corporate communications.

And all of this is before we discuss virtual K-Pop members that get fans screaming for more, millionaire virtual influencers like Lil Miquela, and many others.

ACT NOW

The impact of Digital Humans on everything from business operations and customer engagement, to society itself should not be underestimated, and while the field is still developing it's definitely one for organisations to watch and eventually participate in.

EXPLORE:

- Business and impact assessments
- Emerging technology and technology roadmaps
- Future of Content, Entertainment and Media, and Customer Experience
- Legal and regulatory due diligence
- New business models, operating models, and products
- Partner ecosystems and solutions
- Societal trends

OVER THE TOP CONTENT

2ND YEAR ON THE LIST

QUICK TAKE

Seen by many in the industry as a disruptive trend this has accelerated, and continues to accelerate, the breakdown and disintermediation of many of the industry's traditional incumbents and players as it forces the re-shaping of the sectors value chain from the very top to the very bottom.

An example of the internet enabled **Direct to Consumer** model, in almost the truest sense, Over The Top Content (OTTC) bypasses broadcast, cable, and satellite platforms that have traditionally acted as content controllers and distributors.

Data sources: Allied Market Research, BCG, UScreen, and various.

IMPACT

When the first OTTC platforms emerged it was a significant enough moment for many executives in the industry to stop and take note of the trend, but it can be argued that in many cases their failure to realise this trends significance and act quickly enough to embrace it in many cases cost them significant market share. In many respects we can think of this trend as the sector's "E-Commerce" moment and its impact similar to that felt by the retail sector all those years ago which irrevocably changed customer behaviours.

In the US alone it is estimated that OTTC put over $600 Billion of market value back in play in terms of content creation, aggregation, and distribution, and today while the global OTTC market is estimated to be worth $121 Bn today by 2027 it's projected to reach $1.1 Tn with a CAGR of just under 30%.

While many people focus on the largest players in this space this trend also has another impact - it gives everyone the ability to create, aggregate, and distribute their own content which then means that the amount of competition for consumers eyeballs and hearts is now growing at an exponential rate.

EXAMPLES

The ability to digitise and stream content in ways that were difficult to do just a decade or so ago not only gives organisations the ability to monetise content in new ways, such as **Shoppable Video**, and analyse consumer behaviours in new ways at the most granular levels, but it has also led to an explosion in alternative business and revenue models including Advertising Video On Demand (AVOD), Subscription Video On Demand (SVOD), Transactional Video On Demand (TVOD), and other models, with 51% of revenues coming from AVOD and over 40% from SVOD services.

In the West Amazon, Netflix, and YouTube are the dominant market players with the likes of Apple TV, Disney+, Instagram TV, and others making rapid gains and between them all they have over 3.1 Bn monthly consumers between them - obviously with a huge amount of overlap. Elsewhere in China, meanwhile, competitive platforms such as Iqiyi, Tencent, and Youku rule the roost with a more modest estimated consumer count of over 1 Bn monthly consumers and growing fast.

ACT NOW

This trend represents a titanic shift in business and operating models for incumbents in the sector and, more notably, opens the door to the democratisation of content where literally anyone and everyone can become a content creator and content company. As a result while this trend has multiple benefits for consumers it will also inevitably lead to choice overload as consumers, who used to be limited to being able to pick from just a handful of content aggregators and distributors can now have their choice of billions of alternatives, and that's before we discuss the impact of **Synthetic Content** on the sector.

EXPLORE:

- Business and impact assessment
- Emerging technologies and technology roadmaps
- Future of Communications, Creativity and Innovation, and Media and Entertainment
- New business and operating models

SYNTHETIC CONTENT

2ND YEAR ON THE LIST

QUICK TAKE

Increasingly **Artificial Intelligence** (AI) and other technologies are being used to generate or manipulate different forms of media including audio, characters, imagery, text, VFX, video, and even immersive virtual worlds, which can then be combined together to create a wide range of final form synthetic content that includes everything from adverts, articles, and blogs, to books, music, movies, and even virtual influencers. In time this trend will democratise content creation and become the defacto way most content is produced but also lead to increasing **Attention Price Inflation**.

Data sources: 360 Research, EY, McKinsey, Nvidia, and various.

IMPACT

The impact of this trend will be wide ranging since it not only affects digital content creators but also many of the people making a living in, and from, the creative industry such as actors, artists, fashion models, influencers, marketing professionals, musicians, photographers, script writers, and many others. As a consequence trying to put definitive numbers against its impact is difficult.

By 2025 it is estimated that the global digital content creation industry will be worth $38 Billion and employ over 20 Million people - excluding amateurs and hobbyists which would swell those numbers significantly.

Meanwhile the overall global creative "economy" which includes everything from content consumption to the creatives themselves is worth an estimated $3 Trillion and growing at an average rate of 9% CAGR, with the content marketing industry itself worth an estimated $420 Billion and growing at a very healthy 16%.

The semi and fully autonomous creation, and then publication and distribution of content, will impact all these and the ripple effects will be felt everywhere.

EXAMPLES

The synthetic content industry is so new that most of the terminology is still being worked out. It's also important to note that when we discuss synthetic content we're not including DeepFakes since they're the use of AI to manipulate content rather than create it. So, with that point covered let's move onto some examples.

In the music industry Sony and Warner have signed AI musicians, and have created virtual pop stars - something that has been emulated by K-Pop whose members now include AI generated semi-autonomous life-like Digital Humans. Similarly Diesel, Prada, Reuters, Samsung, and WPP have also jumped on this trend and used Digital Humans to deliver everything from the news and corporate bulletins, to modelling clothes.

Elsewhere This Person Does Not Exist has been using AI to create royalty free synthetic imagery, Lexus has used AI to write its adverts, Springer has a book writing AI, and then in Russia noone noticed that it was actually an AI designing company logos for clients for over a year. All of which is just the tip of the iceberg ...

ACT NOW

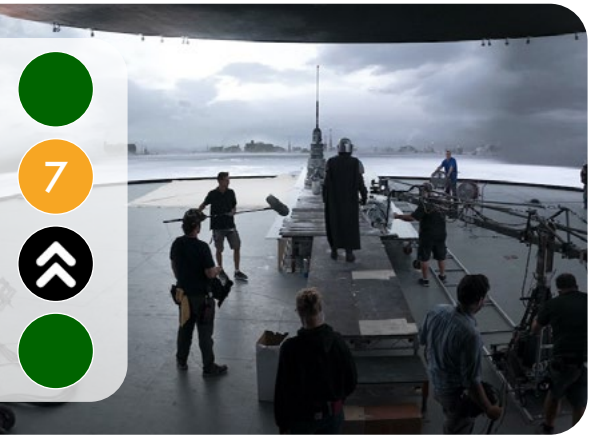
Synthetic content will not only transform who and what creates, publishes, and distributes content, it will also make it easier for people of all skill levels to create increasingly compelling and engaging content with little to no effort thereby democratising it for everyone. Not only will this lead to a torrent of new content being created but it will also blow apart all of the industry's associated norms and business models.

EXPLORE:

- Business and impact assessments
- Emerging technology and technology roadmaps
- Future of Content, and Entertainment and Media
- New business models, operating models, and products
- Partner ecosystems and solutions
- Social trends

VIRTUAL FILM PRODUCTION

2ND YEAR ON THE LIST



The set of the Mandalorian, Disney

QUICK TAKE

It used to be the case that if you wanted to create an advert, a TV series, or a movie you needed real actors and real locations, but now **Digital Humans** are giving some actors a run for their money, literally, and physical locations and sets can be created or replicated in virtual worlds using hi definition gaming engines - the outputs of which can then either be displayed on giant wrap around video walls in studios or straight into Virtual Reality (VR). By combining these with other virtual production techniques and tools creators can now seamlessly combine physical and virtual worlds to change how content is made.

Data sources: Disney,Epic, MPC, and various.

IMPACT

Widely seen as the future of film making, as well as **Gametelling** and more broadly video content in general as the costs involved continue to fall and the tools become easier and more intuitive, this trend has already seen numerous movies shortlisted for awards.

Not only is this trend helping put the tools of story making back into the hands of creators, and make it possible for them to explore the worlds their characters are living in in real time, but it's also helping them make creative decisions on the fly and save significant sums of money.

Furthermore, the ability to adjust virtual content and sets dynamically during filming rather than relying solely on post production also helps eliminate the need for expensive re-shoots, and just as importantly the need for expensive laborious post production rendering.

Today this market is estimated to be worth $1.5 Bn and is expected to hit $4.8 Bn by 2028, although the global pandemic has dramatically helped accelerate both the development and adoption of this trend so this figure will likely end up being much higher.

EXAMPLES

As the cost, flexibility, resolution, and usability of increasingly sophisticated gaming engines like Unity and Unreal have all improved this trend has been on the ascent now for some time, but it's now going mainstream and is rapidly becoming the way that the big studios are all making content. As a result there's a high chance that you've already seen movies and other content, including car ads, that have benefited from this trend, including examples such as the Lion King, Marvel and Star Wars movies, as well as TV mini series such as the Mandalorian and others.

In the case of the Mandalorian the creators used the Unreal engine to create realistic worlds which were then displayed behind the actors and props on 270 degree curved projection screens that were 20 feet high.

Then, stepping it up a notch the creators of the Lion King were the first to go full VR. First the crews visited and literally scanned vast tracts of the African plains which were then rendered into VR using the Unity game engine, and then the entire film was filmed in VR with the crews using an empty studio fitted with virtual rigs to create the shots "in situ."

ACT NOW

Eventually this trend will filter down to the rest of the market but despite that it's still a trend on the ascent and it's still a relatively complex task to create content in this way - albeit that it's cheaper, less logistically challenging, more flexible, and in many other ways superior to traditional content creation techniques. As the leaders in the space continue to hone their craft there's now no question in many people's minds that this represents the future of the industry.

EXPLORE:

- Best practises and case studies
- Business and impact assessments
- Emerging technology and technology roadmaps
- Future of Computing, Creativity and Innovation, Gaming, Media and Entertainment, Technology, and Work
- New business and operating models
- Partner ecosystems and solutions

RETAIL INDUSTRY TRENDS

CONTENTS

BOOK AN EXPERT CALL

WHAT IF ... WE NEVER BOUGHT ANYTHING AGAIN?

WHAT IF the concept of ownership vanished from our societal fabric, replaced entirely by a culture of renting? Imagine a world where people no longer buy goods outright but instead rent everything they need, from clothing and furniture to electronics and vehicles. This radical shift would undoubtedly reshape the way we perceive possessions and interact with the material world.

In this scenario, the benefits of renting over ownership become apparent. By embracing a rental economy, individuals gain access to a wider range of products and services without the burden of upfront costs. Renting fosters a culture of flexibility and adaptability, allowing people to experiment with different products and upgrade to newer models seamlessly. Furthermore, the environmental impact of consumerism is mitigated as goods are shared and reused, reducing waste and resource consumption.

However, the transition to a rental-based economy also raises profound questions and challenges. The notion of ownership is deeply ingrained in human psychology, providing a sense of security, stability, and identity. The shift towards renting may lead to feelings of detachment and impermanence, disrupting traditional notions of personal possessions and attachment.

Moreover, the rental economy introduces complexities related to ownership rights, liability, and accountability. Who bears responsibility for maintenance and repairs in a rented world? How do we ensure equitable access to goods and services in a system where everything is rented?

As we contemplate this scenario we are prompted to reconsider our relationship with material possessions and the meaning of ownership in a rapidly evolving society. While the idea of a rental-based economy offers certain advantages, it also necessitates careful consideration of the social, psychological, and ethical implications inherent in such a profound societal shift.

STATS THAT MATTER

98%

RETAILERS WITH 50 STAFF OR LESS, PCT. GLOBAL

NRF

2.3 ML

TOTAL WALMART EMPLOYEES, 2022

WALMART

24 ML

NUMBER OF E-COMMERCE SITES, GLOBAL 2022

FORBES

370 ML

EST. PEOPLE EMPLOYED IN RETAIL, GLOBAL 2022

GPT-4

$3,625

PER CAPITA RETAIL SPENDING, AVG. GLOBAL 2022

311 INSTITUTE

$29 TR

ALL RETAIL SALES, GLOBAL TOTAL 2023

INSIDER INTELLIGENCE

$5.2 TR

E-COMMERCE SALES, GLOBAL TOTAL 2023

INSIDER INTELLIGENCE

RETAIL

$538 BN

#1 E-TAILER, AMAZON, 2022 REVENUE, GLOBAL

AMAZON

$735 BN

DIGITAL RETAIL AD SPEND, GLOBAL TOTAL 2022

DENTSU

$611 BN

#1 RETAILER, WALMART, 2022 REVENUE, GLOBAL

WALMART

AUTONOMOUS RETAILERS

2ND YEAR ON THE LIST

QUICK TAKE

Autonomous retailers are organisations that can design, advertise, manufacture, and distribute goods without the need for human intervention. And the technologies that underpin them are all maturing and converging.

Already we can see organisations including Amazon and JD.Com developing end to end solutions, and filing the patents and investor notes, that enable this trend.

IMPACT

While there are organisations in the retail sector that target the upper end of the market, where customers value customer service and interaction with a human face, there are plenty of retailers for whom it's all amount moving commodity products at volume and at low margin. And at this end of the market every efficiency gain, every millionth of a cent saved on an individual process, counts. Therefore, for some, the allure of building a fully autonomous retailer, built on technologies that always reduce in cost and improve in performance that allows them to lower their operating costs well below anything their competitors could achieve, is all too appealing.

While autonomous retailers will operate from a cost base that we estimate will be at least 30% lower than their rivals, there are other impacts too such as the potential displacement of over 1.25 million warehouse staff in the US alone, and the eradication of all manner of alternative jobs, such as finance, HR, and even design staff.

EXAMPLES

While the development of fully autonomous retailers will come with a human cost, namely in the form of redundancies, that hasn't stopped the CEO's of some of the world's largest retailers such as JD.Com, a $50Bn Chinese online behemoth, announcing that they see the future of their companies as being autonomous. And they aren't alone - other CEO's in other sectors are also of the same opinion.

When we look at the different parts of the retail "stack" today we are seeing Artificial Intelligence (AI) design fashion lines and Synthetic Content generators publishing them online, we already have autonomous payments, and as for fulfilment and logistics we now have AI powered robots that can autonomously pack and fulfil orders faster than the average human picker, and from a distribution perspective we also have the emergence of autonomous robots and vehicles, from drones and vans to robot dogs and "Starships," that can make the last mile deliveries. Furthermore, we are also seeing the automation of customer support via bots and digital humans.

ACT NOW

Fully autonomous retailers will have a distinct cost advantage over their traditional competitors, and when mature they will be able to respond to changes in consumer demand and tastes almost immediately - no matter how complex those changes might be. While there are both advantages and disadvantages to the trend in our opinion organisations should investigate it and prepare for it.

EXPLORE:

- Consumer trends
- Emerging technologies and technology roadmaps
- Future of Customer Experience and Service, Manufacturing, Retail, Robotics, Technology, and Transportation
- Partner ecosystems and solutions

Data sources: Bureau of Labor Statistics, and various.

CASHIERLESS STORES

2ND YEAR ON THE LIST

QUICK TAKE

In the hunt for cost savings and the ultimate frictionless customer experience today several well know retail brands are rolling out cashierless stores which someone once described to me as the equivalent of legalised shoplifting, in other words you scan in with an app, enter a store, grab what you want and walk out without looking at anyone, talking to anyone, or paying anyone.

While this has been possible for a long time, both practically and technologically, the trend really gained worldwide attention when Amazon opened its first Amazon Go stores.

Data sources: Amazon, Grabango, and various.

IMPACT

While there are many operational and commercial advantages to running a cashierless store - let alone a fully autonomous store where robots stock and manage everything - one of this trends greatest impacts is on the tens of millions of cashiers around the world who rely on retailers for their livelihoods. And, asides from re-training or finding them other jobs to do there's no easy fix to this problem which means it will contribute to **Wealth Inequality**.

This asides though cashierless stores have multiple benefits. On the one hand they significantly reduce operational costs, as well as theft which accounts for 36% of all store loses and costs US retailers alone over $50 Billion annually. Then on the other they reduce customer time consuming friction by 80%, and the tracking technologies allow brands to gather highly granular information on consumers in store behaviours and buying patterns which then, in turn, can be used to refine the in store experience further and boost profits.

In raw numbers a typical 711 size store can cost in the region of $300,000 to fit out but those costs are diminishing as the trend matures.

EXAMPLES

A hat tip to the **Autonomous Retailer** trend the number of retailers embracing this trend increases every day but in general they are all retailers who operate small format, micro, or even nano stores. Furthermore, in the future this trend and some of these store formats could be included in **Autonomous Vehicles**.

Originally popularised by grocers the trend is now spreading to other corners of the retail market as the technology becomes more mature and refined, and as many operators sell the underpinning technology as a platform to other retailers. While all the companies use apps to manage the overall consumer experience Grabango uses cameras equipped with **Artificial Intelligence** (AI) and **Machine Vision** hidden in ceilings, fixtures, and on rails to keep track of shoppers movements and purchases, while Amazon Go prefers scales, shelf camera systems, and sensor systems. Then elsewhere AiFi uses sensor fusion and "webs of cameras" to track people and goods in the "space time domain" and uses biometrics to automatically ID people for a even better frictionless customer experience.

ACT NOW

Seen as the epitome of the 21st Century shopping experience cashierless stores have many advantages but organisations need to be cautious of altogether eliminating the human experience from in store shopping which could have a detrimental impact on the overall customer experience and therefore customer loyalty and spending.

EXPLORE:

- Emerging technologies and technology roadmaps
- Future of Customer Experience, Retail, Transportation, and the Workplace and Workforce
- Partner ecosystems and solutions

E-COMMERCE

2ND YEAR ON THE LIST

Augmented Reality meets E-Commerce

QUICK TAKE

Digitisation, the internet, and other digital channels including the **Metaverse**, have given organisations the ability to sell and engage with customers in new ways, whether it's traditional B2B, B2C, or **Direct to Consumer** (D2C), via traditional web sites or via online marketplaces and social spaces. The net result of which is that unless you're selling a highly complex or tailored product or service, which is now becoming easier thanks to the **Customisation** trend, then E-Commerce is undoubtedly one of your organisations top priorities. And, as a result, competition is heating up.

IMPACT

As the cost and convenience of creating E-Commerce sites, including any necessary compliance and **Payments** systems, continue to fall to the point where in some cases they're now free and as easy to set up as Drag and Drop, this trend's only headed one way.

No longer the sole preserve of large organisations E-Commerce fuels the **Power of the Individual** trend, and has firmly established itself as the primary route to market for the hundreds of millions of Entrepreneurs and **Solopreneurs** around the world who want to expand their geographic reach and grow sales, who now have over 24 Million E-Commerce stores, growing at 23% CAGR.

However, like all trends E-Commerce is evolving as the digital, physical, and virtual worlds merge with it and as organisations everywhere experiment with the **Meta-Economy**, **Immersive Reality**, the **Metaverse**, **PhyDigital Products**, **Shoppable Video**, and many other complimentary trends. As a result it's estimated that by 2025, fuelled with a growing **Connected Society**, E-Commerce sales will exceed $24.3 Tr and grow at 11.1% CAGR.

EXAMPLES

There are many examples, from Alibaba and Walmart, to Amazon and JD.com - the latter two of which are not only E-Commerce behemoths but who are also investing heavily in becoming the world's first fully **Autonomous Retailers**, a trend that will disrupt the retail sector all over again. Furthermore, they're also investing heavily in **Creative Machines** to design products, then using **Additive Manufacturing**, **Autonomous Vehicles**, and immersive reality, to reduce costs, improve delivery times, and help customers try on and visualise products in new ways.

Then, while platforms like EBay, Etsy, Shopify, and others, make it easy today for anyone to sell anything to anyone anywhere, another interesting example of the next evolution of E-Commerce includes Mondelez who've successfully combined the **Customisation** trend with their E-Commerce platforms to grow their OREOiD Cookies brand by over 64% while at the same time increasing prices and profits. Something that Nike too, with their NIKEiD brand are also famous for. So, if you thought E-Commerce was boring as you can see it's just getting started. Again.

ACT NOW

This trend is a part of all of our lives and has been for a decade or more now. However, as the digital, physical, and virtual worlds merge, and as new technologies and trends emerge we're now able to take E-Commerce to the next level and turn what used to be just a static 2D experience into an exciting interactive 3D experience where online and offline merge.

EXPLORE:

- Emerging technologies and technology roadmaps
- Future of Artificial Intelligence, Creativity and Innovation, Financial Services, Manufacturing, and Retail
- Partner ecosystems and solutions
- Product development and innovation

Data sources: Bloomberg, Coveo, Gartner, KPMG, Nielsen, and various.

PHYDIGITAL PRODUCTS

2ND YEAR ON THE LIST

The Fortnite Collection, Balenciaga

QUICK TAKE

It used to be the case that the only type of product you could buy would be a physical one. Then came the Computing Era and the internet, and a slew of other trends. Now, today all of us own some kind of digital product, whether it's a movie or music, or something else. Now though, thanks to trends including **Immersive Reality**, the **Meta-Economy**, and the **Metaverse**, we can own a physical product with digital elements embedded into it, as well as a virtual product which we can use in the virtual world, and a physical likeness or copy of that same product in the real world - these are phydigital Products.

Data sources: LVMH, Morgan Stanley, Nike, and various.

IMPACT

Not to be confused with the marketing trend **Phygital** ironically this trend could sound like a great marketing ploy as organisations everywhere try to up sell their physical products and get you to pay extra for a virtual copy of the same product that you can use and show off in the virtual world with, for example, your **E-Sports** or **ExerGaming** team mates, as well as your social followers.

While this trend has arguably been around for some time in a very crude format recent advances in several **Exponential Technologies** and trends have turbo charged it, and while it plays into and also leverages many other trends today there are plenty big name organisations who are embracing and experimenting with it in the belief that it will help them dominate the multi-trillion dollar Meta-Economy and help them build new revenue streams outside of their current core businesses.

In the gaming sector alone Digital Fashion is expected to be a $50 Bn market by 2026, and the phydigital market is so new that at the moment no market metrics exist for it but that asides noone is doubting the potential ...

EXAMPLES

There aren't a huge number of examples of this trend yet but that's not stopped LVMH, the world's largest luxury brand conglomerate, or organisations such as Nike piling into the space and experimenting. In LVMH's case they are now busy creating all manner of phydigital products including digital replicas of clothes - or skins - for avatars, as well as digital replicas of beauty products, jewellery, and other luxury goods from houses including Bulgari Christian Dior, Fendi, Gucci, and Louis Vuitton, which can all be shown off and worn as appropriate in both the online and offline, real, world.

Elsewhere Nike has been upping its stake as well, not only do they have their own **Virtual Mall**, which has now been visited by over 7 Million people, but they've also bought several virtual apparel companies such as RTFKT who on the one hand are selling their digital sneakers, for example, as **Non-Fungible Tokens** (NFTs), and on the other are now busy turning more of Nike's famous back catalogue into phydigital products. And that's before we discuss custom clothing like the $9,500 phydigital dress for an Instagram influencer ... and so on.

ACT NOW

Phydigital products represent a huge market opportunity for brands as more people become connected and there are now plenty of organisations that see them as an opportunity to build significant revenue streams and stakes in the virtual world, just as many of them have done in the real world. As a consequence organisations should at the very least experiment with this trend and get a point of view.

EXPLORE:

- Business and impact assessments
- Emerging technologies and technology roadmaps
- Future of Creativity and Innovation, Media and Entertainment, and Retail
- Partner ecosystems and solutions
- New business and operating models
- Product development and innovation

ROBOT CUSTOMERS

2ND YEAR ON THE LIST

QUICK TAKE

Traditionally it has always been humans who have decided which goods and which brands of goods to buy, but as machines and different technologies become more capable, connected, and smart increasingly its robots that are doing more of the decision making, buying, and negotiating for us, whether it's for washing up capsules and toilet rolls, compute resources, or even utility brokering.

This means, therefore, that increasingly in the future organisations will have to have strategies that target both human and robot customers alike.

Data sources: Various.

IMPACT

One of the greatest impacts this trend will have on organisations is its ability to disintermediate them from their customers quickly, at scale, and potentially irrevocably. So, while it is clear this trend is an opportunity for some it's a disruptive threat to others.

As we see more of these robo platforms emerge and scale, many of which will eventually be enhanced by **Artificial Intelligence** (AI) and **Blockchain** technology, these "Robot Customers" will be able to autonomously order all manner of goods and services on our behalf, form buying consortiums, make decisions on our behalf based on Big Data inputs, and swing markets at a speed and scale no organisation today has ever experienced.

Imagine, for example, every Amazon white labelled smart appliance in the world automatically re-ordering and re-stocking products from Amazon Fresh rather than other suppliers and you can see the potential impact of this trend - especially when scaled across other sectors. This trend also takes us a step closer to **Autonomous Retailers** and other forms of **Autonomous Organisations**.

EXAMPLES

Today many of us are getting acquainted with this trend at a basic level in both the B2B and B2C markets, whether it's the printer that automatically monitors ink levels and orders new cartridges before it runs out, Alexa which decides what product or brand to put in our shopping baskets, or the edge computing infrastructure that buys compute from cloud providers.

As basic as these examples are though in time we'll see the emergence of more sophisticated auto ordering platforms, such as the Samsung Smart Fridge that predicts you're running out of milk, sees millions of others are too, forms a buying consortium, negotiates a bulk discount via an E-Auction with suppliers, finalises the orders and shipping, and then puts the savings into a third party investment account where the money gathers interest until you withdraw it.

As nice as this sounds alternatively Samsung could process and fulfil these orders themselves rather than using third parties and automatically decide which brands to recommend or sell to you, thereby becoming the default supplier for everyone who uses their products.

ACT NOW

By leveraging new business models, such as giving smart products and other so such platforms away for free then earning money from the profits on orders or via subscription, organisations can create new revenue streams.

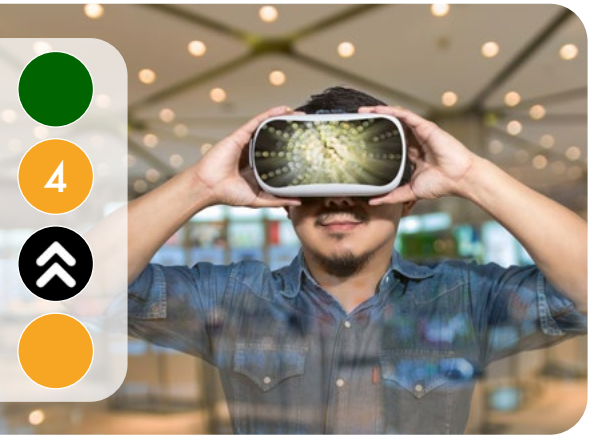
As the number of connected "smart" things, including smart speakers which also apply to this trend, increase we can see a time when today's dominant **Multi-Sided Platforms** can leverage this trend to their advantage to create even bigger monopoly positions. As a result it is imperative that organisations get ahead of this trend.

EXPLORE:

- Business and impact assessments
- Emerging technologies and technology roadmaps
- Future of Cyber Security, Financial Services and Retail
- New business models, operating models, and products
- Partner ecosystems and solutions

VIRTUAL SHOPPING MALLS

2ND YEAR ON THE LIST



QUICK TAKE

As immersive technologies improve in cost and performance it's natural that organisations are trying to find new ways to both extend and re-invent the retail experience.

Virtual malls, which can either be a digital twin of a physical mall, or a stand alone experience, are potentially the next evolution of retail as organisations try to merge the benefits of real brick-and-mortar experiences with the convenience of E-Commerce ones. Furthermore, as the technologies evolve so too will the experiences.

IMPACT

In spite of retail's surging top line growth the decimation of the high streets and malls is no secret, and whichever way you looked at the future of brick-and-mortar stores it's hard to be optimistic about their future survival - although they will survive. As E-Commerce sales surge on average by over 20% per annum to top $5Tn, now accounting for over 20% of all retail sales - up from 5% a decade ago - equivalent brick-and-mortar sales have grown by just 3% with big name brands going to the wall, and investment in global retail real estate declining by over 25%.

While both online and offline retail models have their advantages traditional retailers, especially during the pandemic, struggled under the weight of their commercial commitments, and are almost always disadvantaged by their cost of customer acquisition, cost of operation, and customer reach. It is therefore hoped that new models, such as virtual malls which often target younger audiences, might provide traditional retailers with some hope and so far the results have been impressive, albeit within certain countries and within narrow customer segments.

EXAMPLES

Even though Virtual Reality (VR) is still emerging as a viable consumer technology virtual malls have been trialled around the world for many years now, with companies such as Alibaba even unveiling new In-VR payment systems.

As organisations continue to experiment with the format, especially in APJ led by China and Singapore, a cottage industry has now emerged to help brick-and-mortar retailers create digital clones of their physical stores in just a day using technologies such as Lidar and AI powered Synthetic Content Video to VR generation. 5G will also fuel the trend as it enables the streaming of immersive experiences via the cloud, as will the emergence of new consumer smart devices and formats, all of which will help lower the cost of entry.

So far the most successful virtual malls have been developed by IMM in Singapore and HKTV in Hong Kong, which now has 4,200 virtual outlets, but Amazon and Walmart are also experimenting with the format and filing patents, and many large name brands such as Lego and Prada are also

ACT NOW

While the technology to enable virtual malls is still maturing we are getting very close to being able to create digital copies that look as lifelike as the real thing, and experience them as though we were there via the use of haptics and other emerging technologies. However, that said, their greatest barrier to adoption will be cultural and that's where Asia may have the lead on the West, and organisations must be careful of the hype.

EXPLORE:

- Consumer trends
- Emerging technologies and technology roadmaps
- Future of Entertainment, Gaming, and Retail
- Hybrid retail models
- New landlord business models
- Partner ecosystems and solutions
- Running MVP pilots

Data sources: Alibaba, Alliance Studio, EPIC, SCMP, and various.

SPORTS INDUSTRY TRENDS

CONTENTS

WHAT IF ... ROBOTS STARTED PLAYING SPORTS?

IN AN age defined by rapid technological advancement the integration of robots into sports has emerged as a compelling topic of speculation and debate. What if the familiar sights of human athletes on the playing field were supplemented - or even supplanted - by robotic counterparts? Such a scenario prompts us to consider the potential ramifications and possibilities that arise when machines enter the realm of athletic competition.

Picture a world where robots, equipped with advanced AI and mechanical prowess, take to the field, track, or court. These mechanical athletes possess unparalleled physical capabilities, executing movements with flawless precision and efficiency. With lightning fast reflexes and superhuman strength, they excel in sports traditionally dominated by human athletes, offering spectators a glimpse into the future of athletic performance.

However, this futuristic vision also raises complex questions about the nature of sports and the role of technology in shaping athletic endeavours. As robots join the ranks of athletes, concerns arise regarding fairness, ethics, and the essence of competition. How do we ensure a level playing field when mechanical players possess inherent advantages over their human counterparts? What safeguards must be in place to uphold the integrity and spirit of sportsmanship in this new era of athletic competition?

As we contemplate the potential impact of robots in sports, we are compelled to reflect on the evolving relationship between humans and technology. While the idea of robotic athletes presents exciting possibilities for innovation and spectacle, it also challenges our fundamental assumptions about athleticism, sportsmanship, and the essence of what it means to compete.

44 KMH

WORLDS FASTEST RUNNER, BOLT, 2009

IOC

8.5 KMH

WORLDS FASTEST SWIMMER, DRESSEL, 2017

IOC

$136 ML

HIGHEST PAID ATHLETE, RONALDO, GLOBAL 2023

FORBES

$56 BN

GLOBAL MEDIA RIGHTS MARKET VALUE, 2023

SPORT BUSINESS

5.1 BILLION

#1 SPORT BY FANS, FOOTBALL, GLOBAL 2023

FIFA

$512 BN

INDUSTRY SIZE, GLOBAL TOTAL 2023

RESEARCH & MARKETS

$55 BN

SPORTS TECHNOLOGY MARKET VALUE, 2023

GRAND VIEW

250 ML

EST. FOOTBALL PLAYERS, GLOBAL TOTAL 2023

FIFA

2.5 BILLION

#2 SPORT BY FANS, CRICKET, GLOBAL 2023

ICC

3.5 BN

#1 TOURNAMENT BY VIEWERS, FIFA WORLD CUP

FIFA

ALTERNATIVE SPORTS

2ND YEAR ON THE LIST

QUICK TAKE

Alternative Sports is the term given to sports that aren't regarded as being common, dominant, or mainstream - depending on your definition. But this doesn't necessarily mean that one day they won't be.

Such sports include base jumping, in line skating, motorcross, mountain biking, skateboarding, snowboarding, surfing, and many others, and while they may not be mainstream they're increasingly eating into the market share of more established sports and making some executives, for example in the American NFL, take note.

Data sources: Forbes, MarketWatch, Nielsen, RoundHill, and various.

IMPACT

While skating and mountain biking dominate the alternative sports market overall in the US alone the market is projected to reach a value of $13 Billion by 2023 with the majority of participants, and viewers, being between the ages of 15 and 35 years old.

Ironically one of the greatest impacts of this trend is being powered not by the sports themselves but by the rise of new content creators and content creator platforms that are helping extend the reach and appeal of these alternative sports.

Among others this impact is being felt the most by sports such as America's NFL, which recently secured an 11 year $100 Billion broadcast deal, but who are now increasingly worried about the pivoting of mainstream audiences towards these cheaper contract-free streaming alternatives. However, despite the NFL's worry they may be able to gain some solace in the fact that so far attempts to commercialise alternative sports has so far proved difficult which, ironically, will continue to mute their overall reach and impact.

EXAMPLES

Alternative sports have long been seen as sports in waiting, but many were heartened when the International Olympics Committee (IOC) took the decision to include some of them, including karate, skateboarding, sport climbing, and surfing, in the Tokyo 2020 Olympic Games that gave them a stage that allowed them to, in the words of some, communicate their message a lifestyle to billions of people.

While there are many examples of alternative sports one of the most interesting examples to highlight here are Table Tennis and Volleyball who between them command a global viewership of over 1.8 Billion people, and when you compare that with the NFL whose average viewership per game in 2020 declined by 7% to 15.4 Million that's impressive. And, just for the record, many in the industry are blaming the NFL's declining ratings on a "fragmented video landscape."

Sound familiar? It's no wonder then that the NFL are now experimenting with streaming games on Twitch ...

ACT NOW

The role that new content creators and new content platforms play on helping boost the prominence and ratings of alternative sports should not be underestimated, especially as major sports leagues attempt to do their utmost to control and, ironically, restrict the distribution of their content. It should also be remembered though that part of the alternative sports appeal based on the fact that they are alternative, and ergo not mainstream. As a result organisations looking to exploit the trend should tread cautiously.

EXPLORE:

- Business and impact assessments
- Future of Communications, Entertainment and Media, and Sports
- New business models, operating models, and products
- Partner ecosystems and solutions

BOOK AN EXPERT CALL

EXPLORE STARTUPS & MORE

AUGMENTED TRAINING

2ND YEAR ON THE LIST

QUICK TAKE

There is no denying the impact that technology continues to have on helping amateur and professional sports people alike improve their sports performance. But, that technology comes in multiple forms and formats hence my using the umbrella term Augmented Training for this trend.

While the benefits vary wildly, by demographic, by sport, by technology, and so on, improvements in Olympic performance, for example, so we can offer some level of consistency, vary between 24% and a staggering 221%. And that's the tip of the iceberg.

Data sources: Sheffield Hallam University, and various.

IMPACT

There is no denying that technology is helping improve the sports performance of individuals and teams alike, so much so that there's a name for it - **Tech Doping**. What might surprise you though is the breadth of technology that's now being used to grind out gains which includes everything from **Additive Manufacturing**, **Artificial Intelligence** (AI), Big Data, **Machine Vision**, and **Wearable Technology**, through to **Immersive Reality**, as well as **Neural Interfaces** technologies. While the field is too big to go into detail here I can provide you with some interesting, and odd, examples of this trends impact.

In the past 111 years the one hour Olympic cycling record has improved by 221% because of technological improvements in bike manufacturing and materials, and because of the ability of coaches to capture, analyse, and interpret athlete data that lets them optimise training. And, elsewhere the US Olympic ski team used brain stimulating technologies to improve their propulsive force by over 13%, and the cycling team saw a 5.2% gain in explosive force. All of which is before we look at more conventional tools ...

EXAMPLES

From tailored 3D printed carbon fiber bikes and professional cyclists who train using Zwift's Virtual Reality (VR) rigs, to Parkrun enthusiasts who are using their Fitbits and other wearable tech to monitor their heart rates and recovery speeds, and Strava to monitor their run, technology is everywhere and at every level of sport.

As we continue to see **Exponential Technologies** mature though, whether it's Smart Clothes with built in **Artificial Intelligence Coaches** like those being demonstrated by Speedo, Smart Contact Lenses and Glasses that overlay pertinent health and performance data over the users field of vision, and sensors that can gather even the most granular biochemical, biomarker, biomechanical, and other valuable biometric data, there's no doubt that augmented training will have an even bigger impact in the future than it does today.

All of which is before we discuss how sports such as Formula 1 are also using VR to help drivers visualise circuits, sharpen their reactions, and improve muscle memory, or the US Olympic team's use of Neurotraining technology.

ACT NOW

If you have any interest at all in improving sports performance then this trend cannot be ignored, but as we continue to see new innovations and technologies across the board it's also one you should explore thoroughly.

EXPLORE:

- Business and impact assessments
- Data Governance and Privacy
- Future of Health and Wellness, Manufacturing, and Sports
- New business models, operating models, and products
- Partner ecosystems and solutions

EXERGAMING

2ND YEAR ON THE LIST

Exergaming, Supernatural VR

QUICK TAKE

Exergaming, the trend which combines exercise with gamification and gaming and which is increasingly performed in Virtual Reality (VR) or other **Immersive Reality** environments is becoming increasingly popular as the amount of content and its quality improves and as the technology used to bring it all "to life" matures. A great way for people of all backgrounds and abilities to exercise and participate in different sports wherever they are there are a lot benefits and upsides to this trend, especially as costs come down and as the authenticity and usability of the platforms evolve over time.

IMPACT

While it's never been necessary to pop down a gym to get fit this trend clearly shows that consumers have an appetite for all manner of alternative exercise formats whether it's this trend, **Ghosting**, or more conventional on demand fitness products.

Specifically, in 2021 the global virtual fitness market was valued at $10.7 Bn, a growth of over 77% from 2019's figures, and by 2027 this is projected to grow by 33% CAGR to reach over $59 Bn. Furthermore, turbocharged by the global COVID-19 pandemic, and adding fuel to this trend is the overall growth of on demand fitness where we saw spending increase by over 128% during the same period, compared to just 6% growth for traditional gyms.

As technology advances and gives users everywhere the ability to exercise in new ways, and in ways that bring in all of their five senses, as well as in increasingly realistic and immersive environments, there is plenty to like about this trend especially as technologies such as **Telepresence** continue to mature and help turn what's primarily a solitary self-led activity into a more collaborative and social one.

EXAMPLES

Exercising and working out is a crucial part of maintaining your overall mental and physical health, but with busy schedules and commutes, as well as other daily pressures it can often be difficult to attend live workout classes, which is why this trend is on the ascent. And, as you'd expect there are lots of examples we could explore.

Some of the more notable examples include the use of exergaming in hospital rehab environments where patients, albeit often with specialised conditions, are able to use virtual fitness platforms to improve muscle strength and tone as well as use them to improve their mental health and wellness. And, so far research has shown that patients using these systems recover up to 30% faster than those who aren't.

Moving out of the hospital and rehab environment, as we see the emergence of **Digital Humans** and **Artificial Intelligence Coaches** which can be incorporated into the experience and provide real time instruction and form feedback, platforms like FitXR and Supernatural VR are bringing all manner of new gamified worlds into people's living rooms.

ACT NOW

Exercising at home used to involve little more than a small set of resistance equipment and a foam mat, but today this trend lets you go head to head with anyone, anywhere, anytime and turn exercising into a fun and outrageous multi-world multi-dimensional gaming experience. It's therefore no stretch to say that this trend has transformed exercise for many people and that it's here to stay as different technologies continue to mature and as the content becomes even better and more common.

EXPLORE:

- Business and impact assessments
- Emerging technologies and technology roadmaps
- Future of Communications, Media and Entertainment, and Sports
- New business and operating models
- Product innovation

Data sources: Allied Market Research, Bloomberg, Market Watch, and various.

GHOSTING

2ND YEAR ON THE LIST

Virtually Live, Formula E

QUICK TAKE

Thanks to trends such as **5G**, **E-Sports**, **Haptics**, **Immersive Reality**, **Volumetric Capture,** and others the days of just being able to follow your favourite sports stars on TV are over because now you can "ghost" and play or race against them in real time - or not - wherever you are in Augmented (AR), Mixed (MXR), or Virtual Reality (VR), or in purpose built **Augmented Arenas**. Ghosting, the act of playing or racing against a digital clone or copy of a real life player, is now not just feasible but it's commercialising as different organisations switch up the customer experience.

Data sources: Nike, and various.

IMPACT

The ability to race against a virtual avatar of the real Usain Bolt or play against or alongside Novak Djokovic in an augmented arena to see how well you compare as you're coached in real time by an **Artificial Intelligence Coaches**, or just for fun, is no longer just some fan fantasy. It's real in the most literal sense. And this is just one example of the power of this trend which will only continue to accelerate as we see different trends, including **Digital Humans**, gain momentum in the gaming, media and entertainment, and sports industries.

Ultimately not only will this trend completely alter the **Fan Experience** but it will also give organisations the opportunity to create new hybrid sports in which thousands of people can simultaneously compete with pros and amateurs alike, while at the same time providing them with the opportunity to create new brands, products, revenue streams, and routes to market.

As for sizing this market opportunity however since it is still so nascent no specific data exists but the market sizes of both physical and E-Sports are large enough for it to be full of potential.

EXAMPLES

While this trend is still nascent some of the best examples so far have come from franchises such as Formula-E who first dipped their toe into the market in 2018 and created the global "Virtually Live" ABB FIA E-Championship series that used CGI and innovative telemetry technology to give fans the opportunity to put their skills to the test and race professional Formula-E drivers in real time as they pounded around the circuits.

Extending the concept out though with advances in multiple technologies this same principle could be applied to almost any sport, both traditional and non-traditional, including individual and team sports, including everything from athletics, cycling, shooting, and swimming, all the way through to drone racing and many new sports which could be purpose built to maximise the benefits and user experiences the trend is capable of delivering both now an into the future.

ACT NOW

Many of us have imagined in our minds playing with or alongside professional sports personalities and teams in our heads, but today technology is bringing imagination to life and making it possible.

EXPLORE:

- Emerging technologies and technology trends
- Future of Artificial Intelligence, Communications, Gaming, Media and Entertainment, and Technology
- New business models, operating models, and products
- Partner ecosystems and solutions
- Running MVP pilots

TELECOMS INDUSTRY TRENDS

CONTENTS

BOOK AN EXPERT CALL

WHAT IF ... EVERYONE WAS SATELLITE CONNECTED?

THE PERVASIVE influence of satellite systems has seamlessly woven a web of connectivity that spans the entire globe. This era of unprecedented interconnectivity has ushered in a new paradigm, where individuals, communities, and businesses are linked together in ways unimaginable just a few decades ago. At the core of this interconnected network are satellite systems, which serve as the backbone of modern communication and information exchange. With satellites orbiting the Earth, individuals across continents have instantaneous access to high-speed internet, enabling seamless communication, collaboration, and access to information regardless of geographical location.

The benefits of this global connectivity are multiple. Businesses leverage satellite enabled technologies to expand their reach, optimise operations, and tap into new markets. From E-Commerce platforms reaching customers in remote regions to multinational corporations coordinating global supply chains, satellite systems play a pivotal role in driving economic growth and facilitating international trade.

Moreover, satellite enabled technologies have revolutionised various industries, including agriculture, healthcare, transportation, and emergency services. Farmers utilise satellite imagery and precision agriculture techniques to optimise crop management and increase yields, while healthcare providers leverage tele-medicine to deliver remote care to under served populations. In times of crisis, satellite communication systems provide vital links for disaster response teams, facilitating rapid coordination and saving lives.

Beyond its practical applications, the interconnectedness facilitated by satellite systems fosters global cooperation and collaboration. It transcends borders, fostering mutual understanding and collective action on pressing global challenges, from climate change to public health crises. In essence, it's not merely a technological advancement but a catalyst for societal transformation, underscoring the importance of fostering inclusivity, innovation, and cooperation on a global scale, paving the way for a more connected, resilient, and prosperous future for all.

STATS THAT MATTER

4,519

OPERATIONAL STARLINK SATELLITES, 2023

SPACEX

58%

PCT. OF INTERNET TRAFFIC FROM MOBILES, 2023

EARTHWEB

81%

STREAMING, PCT. OF INTERNET TRAFFIC, 2023

BLUE CORNOA

4.8 ZB

INTERNET TRAFFIC, TOTAL DATA VOLUME, 2023

CISCO

5.18 BILLION

INTERNET USERS, GLOBAL TOTAL 2023

STATISTA

$3 TR

INDUSTRY SIZE, GLOBAL TOTAL 2023

RESEARCH & MARKETS

12 BN

CELLULAR CONNECTIONS, INC. IOT, GLOBAL 2023

GSMA

TELECOMS

1.4 ML KM

SUBMARINE CABLES, GLOBAL TOTAL 2023

TELEGEOGRAPHY

4.8 BILLION KM

FIBER OPTIC CABLING, GLOBAL TOTAL 2023

MARKETS&MARKETS

300 X

MOBILE TRAFFIC, INCREASE IN 10 YEARS

ERICSSON

CLOUD NATIVE NETWORKS

2ND YEAR ON THE LIST

QUICK TAKE

There is no doubt that the future of computing, or to be more accurate service delivery, is **Cloud Computing** and that as a result CSPs and their networks as well as the way that applications are designed and run need to adapt in order to deliver the most optimal user experiences. Cloud native, which is a term adopted from the IT industry, is therefore the term used to describe the building and running of network functions that take advantage of this model that lets CSPs develop and deploy networks more quickly thereby making it easier for them to respond to increasing demand and new services.

Data sources: Ericsson, Juniper, Nokia, and various.

IMPACT

The continued growth of mobile data traffic and new services over the past few years has put most legacy network architectures, such as those using Virtualised Network Functions (VNF), under significant strain and as **5G** Core and 5G SA deployments continue to accelerate around the world this will only get worse which is why 84% of surveyed Communications Service Providers (CSP) plan on moving to cloud native models sooner rather than later with some already making the leap.

It's also why the industry overall believes that deploying cloud native networks, with Cloud Native Functions (CNF) that include automation, microservices, and software containers, aren't just necessary to deliver on 5G's promise, but that they're critical.

The necessary transition from legacy architectures to a cloud native one that also includes BSS and OSS though isn't straight forwards, but ultimately over the medium and long term this trend will help service providers reduce capital and operational expenditure and help them improve time to market while at the same time improving overall network flexibility, resilience, and scalability.

EXAMPLES

Cloud native networks allow customers and operators alike to realise the full benefit and potential of cloud computing and cloud services, whether it's as a basis to improve their network operating models or to deliver the best experiences and services to customers, but this trend requires organisations to re-design almost everything from application development, infrastructure, and processes, to management and orchestration.

While the move from VNF based networks to CNF based ones is a big under taking though organisations such as Accenture, Cisco, Ericsson, Google, Nokia, Redhat, and others are collaborating to help public and private CSPs make the transition and develop cloud native vertical stacks that stretch all the way from the datacenter infrastructure layers at the bottom to the application and service layers at the top.

As such some of the more notable examples of this trend include AT&T, Verizon, and Vodafone who were among the first to begin their transformation journeys and move from "cloud ready" to cloud native in 2020.

ACT NOW

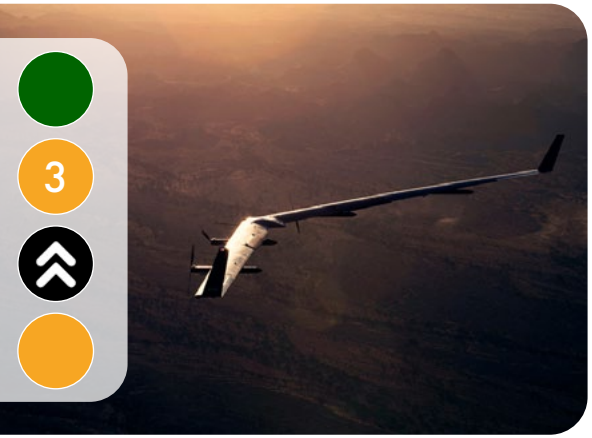
Being cloud native not only requires a radical re-think of the CSP tech stack it also requires them to transform everything from their approach to culture, hiring and development, procurement, technology standards adoption, and many others. Despite these necessary shifts though everyone in the industry appears to be singing off the same hymn sheet and voicing their support for the transformation to happen sooner rather than later.

EXPLORE:

- Best practises and case studies
- Business and impact assessments
- Emerging technologies and technology roadmaps
- Future of Communications and Technology
- Standards development
- Partner ecosystems and solutions

HIGH ALTITUDE PLATFORMS

2ND YEAR ON THE LIST



A solar powered HAPs drone

QUICK TAKE

High Altitude Platforms (HAPs) are airborne platforms such as aircraft, airships, balloons, and drones, that operate at altitudes between 17km and 22km which provide wireless communications services to users in dense urban environments as well as across wide geographic areas.

Especially useful for providing rapid and reliable coverage for areas with poor communications infrastructure, as well as disaster zones, HAPs are playing an increasingly important role in enabling and providing global communications services.

Data sources: Various.

IMPACT

Today the majority of communications services, certainly in developed countries, are provided via a combination of fixed line and wireless communications technologies, and needless to say remote areas where infrastructure is costly and hard to install often gets saddled with poor coverage at best or no coverage at worst.

Not only does this situation mean over half the world's population still has little to no internet connectivity it also means that many parts of the world remain off grid and unable to access the benefits that connectivity offers.

HAPs are one solution that help overcome this problem by providing connectivity from above that can be easily and cheaply beamed to local base stations then onto users.

However, while the market is estimated to be worth $450 Million by 2026 it is only growing at an average of 3% CAGR as would be providers struggle to develop and deploy the right mix of autonomous platforms and get tangled up in logistics and regulatory issues.

EXAMPLES

While the principle of using HAPs to connect various parts of the world is sound organisations such as Google, with Project Loon, and Facebook with Project Aquila, have found that the idea is harder to execute than they anticipated and in both cases canned their respective projects.

But, despite Google's failings ironically Project Loon played a vital role in helping connect disaster zones, such as those in Peru after catastrophic floods hit the country, and demonstrated that the technology does in fact have a future - albeit once the "kinks," especially in terms of reliability and Return on Investment, are worked out.

In spite of these setbacks not only do HAPs look like they will play a pivotal role in the forthcoming 6G era as part of the technology's so called Integrated Space-Air-Ground-Underwater Network (ISAGUN) standards, but organisations like ThalesAlenia with their Stratobus airship project and Avealto are trying to keep the dream alive.

ACT NOW

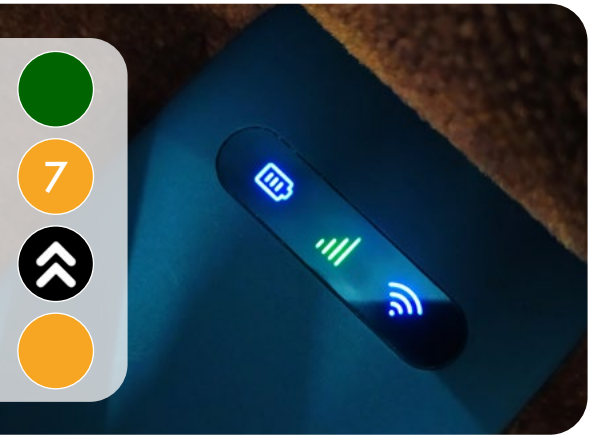
There is little doubt that HAPs will play a role in future global communications networks and help bring coverage to the under served parts of the world, but as many organisations are finding out to their cost developing and deploying autonomous technologies that are designed to stay aloft and operating for years at a time is difficult. However, while at the moment this trend may be ahead of its time it's our advice that you keep an eye on it.

EXPLORE:

- Business and impact assessments
- Emerging technologies and technology roadmaps
- Future of Communications, Energy, Materials, and Transportation
- Legal and Regulatory environments
- New business models, operating models, and platform opportunities
- Partner ecosystems and solutions

OTT BROADBAND

2ND YEAR ON THE LIST



QUICK TAKE

It used to be the case that if you wanted home or office broadband then you needed to be connected to a physical fiber network, but as mobile communications technologies such as 4G, **5G**, and eventually 6G, as well as **Satellite Internet** systems have improved in latency, speed, and reliability in many cases this is no longer the case and customers are able to "cut the cord." Asides from being disruptive to traditional fixed line broadband providers this trend also represents a permanent shift in customer behaviours, especially as all these different technologies improve with age.

Data sources: OpenVault, and various.

IMPACT

Those people living in cities have always had access to better quality broadband than their peers living in rural areas, and while there is still a gap between the two new mobile and satellite communications technologies not only mean it's decreasing but also mean that in some cases those people living in rural areas have access to faster broadband than those in urban areas.

However, while many OTT Broadband providers might rejoice at the news of being able to take business from their traditional fixed line competitors as the trend of **Over The Top Content** (OTTC) accelerates we're also seeing a massive increase in data traffic with the average US household in 2021 consuming a whopping 520.8 Gb of data a month which, needless to say would put the networks of even the best **Cloud Native Networks** CSP's under massive strain as time goes on.

Nevertheless though in the UK and other countries it's now estimated that over 30% of people use OTT Broadband as their primary broadband provider with 61% saying it's a better experience than using traditional FTTC fixed line, and that number's increasing.

EXAMPLES

The **Work From Anywhere** trend, as well as other workplace trends, is partially responsible for more people than ever before using OTT Broadband as their primary way to connect, but unlimited mobile data plans have also played their part especially as more people embrace the OTTC trend.

However, as customer data volumes continue to ramp we have to question how long CSPs will be comfortable providing these plans, especially as more people have the option to cut the cord - the cord which today is arguably transferring the bulk of the OTTC traffic.

That asides though with OTT Broadband playing an increasingly important role in peoples lives, with 76% of 18 to 34 year olds saying it would influence where they choose to live, it's clear the trend's having wide reaching consequences.

ACT NOW

Over time this trend is likely to continue ascending, especially as mobile and satellite communications speeds increase and in spite of the fact that new laser and optics technologies are pushing FTTC fixed line speeds into the Terabit range. And while this trend gives operators the ability to deliver new services and attract new customer segments they must be careful to pay attention to the rise in data traffic which, as other trends continue to ascend, will likely accelerate exponentially.

EXPLORE:

- Business and impact assessments
- Emerging technologies and technology roadmaps
- Future of Artificial Intelligence, Communications, Creativity and Innovation, Media and Entertainment, and Work
- New business and operating models

SATELLITE INTERNET

2ND YEAR ON THE LIST

QUICK TAKE

While people have talked about being able to use constellations of satellites to connect the world for decades now it is only in the past decade that the cost of rocket launches and launching goods into space has become low enough to make it an economic reality.

Now, as thousands of satellites head into LEO and VLEO orbits what once seemed as fanciful thinking is becoming reality and it's already disrupting the established communications industry status quo.

IMPACT

Today only half of the world's population has access to reliable communications and connectivity services, but this trend will change that and by the end of the decade everyone who has the means to connect will be able to - and that is significant.

The acceleration of the satellite internet trend - with multiple countries and organisations now entering the race - will not only change the economics of the global communications industry, but as the technologies improve, especially in terms of speed and latency, it will completely disrupt traditional terrestrial providers and their business models.

Never before have we seen individual private organisations gifted the opportunity to become the global telecommunications provider of choice, and that's what we could be looking at here. Furthermore, by 2027 it's estimated the satellite communications market will top $122 Billion in revenues with an average growth rate of over 9% CAGR, and that the overall addressable market will be worth over $1 Trillion.

EXAMPLES

While there are many examples the two that stand out at the moment, all be the fact that they will soon be joined by other significant competitors, are OneWeb and SpaceX's Starlink projects.

While OneWeb is now literally getting off the ground Starlink meanwhile has global coverage with thousands of satellites in orbit, millions of people on the waiting list, and is already providing 4G busting speeds of over 200 Mbps at 20ms latency - both of which will improve quickly in the years to come as the organisation zero's in on speeds of 1.5 Gbps and a sub 5ms latency.

Originally targeting the $72 Billion US market and still in the early stages of scaling Starlink already has a staggering valuation of $81 Billion, based on revenues of $10 Billion by 2025, and by 2040 it's estimated they will have over 340 million subscribers.

It's therefore no surprise that organisations including Amazon, Arianespace, Boeing, and others, as well as Canada, China, Europe, and Japan are putting the wheels in motion to launch their own rival networks.

ACT NOW

There is alot of hype still about the future potential of satellite internet but so far the numbers and the technology have held up and even the regulators are enthusiastically embracing the trend. That said though as ever we would advise organisations proceed with caution and evaluate the trajectory of the market and the technologies thoroughly before developing a point of view.

EXPLORE:

- Business and impact assessments
- Emerging technologies and technology roadmaps
- Future of Communications, Manufacturing, and Space
- Investment options
- Legal and Regulatory environments
- New business models, operating models, and platform opportunities
- Partner ecosystems and solutions

Data sources: Morgan Stanley, Nasdaq, SpaceX, and various.

TRANSPORT INDUSTRY TRENDS

CONTENTS

BOOK AN EXPERT CALL

WHAT IF ... EVERYONE WORKED IN VR?

BY 2035 the once relentless drone of grid locked vehicles and the chaos of rush hour traffic are but distant memories of a bygone era. No longer are peoples daily lives dominated by where they live or the time zone they live in, or the daily commute. Traffic accidents are a thing of the past and some roads, now abandoned and unused, start to fall into irreversible disrepair. In this multiverse instead using vehicles it's not a new kind of vehicle or high speed train that's whisking us to work, it's an invisible pair of Virtual Reality (VR) smart contact lenses.

In this new era of full bodied telepresence the lines between the virtual and the real worlds have all but been eliminated and people can no longer differentiate between the real and virtual worlds. With a blink of an eye people are instantly at work in the virtual office. Enabled by Artificial Intelligence (AI), haptics, better than real high definition rendering, and ultra high speed networks they can interact with and talk with human colleagues and virtual colleagues effortlessly, exchange ideas, and take leisure breaks without ever having to leave home - or the coffee shop.

With advancements in haptics and other sensory virtual technologies a colleague's handshake feels firm, a coffee feels mug cool and comforting in one's hand, the office bagel smells and tastes real, and the rustling of virtual papers is eerily tangible. But these VR offices and worlds do more than mimic reality - they augment it. One's office backdrop can be the blackness of deep space, a serene forest, or a Thai beach, the hubbub of office chatter can be silenced with a single button click, and a companion for a virtual coffee is but an invite away.

The dawn of this new world will not only transform the world of work but will also redefine all aspects of our global society - and ergo the need for transportation itself - turning what were once stressful journeys into nothing more than a blink of an eye ...

STATS THAT MATTER

102 BN

ROAD PASSENGER JOURNEYS, GLOBAL 2022

ITF

12 BN

RAIL PASSENGER JOURNEYS, GLOBAL 2022

ITF

4.5 BN

AIR PASSENGER JOURNEYS, GLOBAL 2022

ITF

2.9 BN

WATER PASSENGER JOURNEYS, GLOBAL 2022

ITF

1.31 MILLION

TOTAL GLOBAL ROAD DEATHS, 2022

WHO

65 ML KM

ROAD NETWORK SIZE, GLOBAL TOTAL 2022

GRIP

1.3 ML KM

RAIL NETWORK SIZE, GLOBAL TOTAL 2022

WORLD BANK

TRANSPORT

95.7 ML

CARS PRODUCED, GLOBAL TOTAL 2022

OICA

1.44 BILLION

NUMBER OF CARS ON THE ROAD, GLOBAL TOTAL 2022

HEDGES & CO

26 ML

ELECTRIC CARS, GLOBAL TOTAL 2022

IEA

AUTONOMOUS VEHICLES

2ND YEAR ON THE LIST

Autonomous Semi-Truck Vera, Volvo

QUICK TAKE

Alongside **Vehicle Electrification** Autonomous Vehicles represent one of the most significant disruptive shifts the sector has seen in its entire history.

Furthermore, now that manufacturers are free to eliminate the need for vehicle dashboards, pedals, and steering wheels they are now left with autonomous "pods" that let them re-imagine their industry at the most fundamental levels - whether it's embracing **Mobility as a Service** (MaaS), offering new services, or designing new **Modular Vehicles** and **Uni-Modal Transportation** systems.

Data sources: HGV Allliance, WHO, and various.

IMPACT

The impact of autonomous vehicles on the economy, environment, and society as a whole - let alone the sector - will be staggering in many different ways.

On the one hand they will let urban planners radically transform cities and infrastructure, and on the other they will give people with disabilities new freedoms. But that's just the beginning. Globally 1.3 Million people a year are killed in car crashes and Autonomous Vehicles should be able to reduce that by 99% - while this is a very good thing some of the consequences of this include the impact on the healthcare industry's human organ transplant needs, and also insurance premiums and revenues.

Furthermore, this trend will also help optimise traffic flow and reduce congestion, energy consumption, and pollution, reduce the amount of vehicles on the roads by an estimated 30% in the long term, and potentially make 18 Million taxi drivers and over 6 Million truck drivers - as well as the hundreds of millions of people who directly and indirectly rely on them and the sector - redundant. All of which represent shifts of titanic proportions.

EXAMPLES

Not only do Autonomous Vehicles give manufacturers the opportunity to create radical new vehicle concepts but they also let them re-imagine the sector and what's possible when different vehicle modules can be swapped in and out at will to change both the form and function of said vehicles.

While this rend ultimately signals the death of the car, and the rise of the "Pod" some of the best examples of the art of the possible hail from the automotive industry from manufacturers including Citroen, Mercedes, and Toyota who have all created their own modular vehicle designs which, for example, let their vehicles fulfil almost any function.

In the morning, for example, the Citroen Skate, Mercedes Vision Urbanetic, and Toyota E-Palette can all take on the duty of a school coach or taxi, then they can swap vehicle modules and perform **Autonomous Last Mile Deliveries** before transitioning again to become mobile diners, gyms, hotel suites, offices, shops, and all manner of other functions. And then, in Airbus' case they can hook into an EVTOL chassis and provide **Flying Taxi Services**.

ACT NOW

Autonomous vehicles will change society at a fundamental level - they will free up people's time, improve people's health, longevity, and productivity, and change our cities and our environment for the better while at the same time opening up a multitude of new market opportunities for manufacturers and operators. But they will also have consequences in terms of the mass dislocation of jobs.

EXPLORE:

- Emerging technology and technology roadmaps
- Future of Entertainment and Media, Healthcare, Logistics, Supply Chains, Retail, and Transportation
- New business models and product concepts
- Urban planning initiatives

HIGH SPEED RAIL

2ND YEAR ON THE LIST

Hyperloop concept, Zeleros

QUICK TAKE

For decades the fastest trains have those like the famous Japanese L0 Series Maglev which travel in excess of 370mph or 600 kmh, and even though many have tried so far these trains still hold the record for the fastest in the world. However, after Elon Musk took an 1800's British design for a vacuum tunnel based transportation system under the river Thames to heart the race to create the first levitating supersonic trains, dubbed Hyperloops has been on and now trains that can travel as fast as 2,500 mph or 4,000 kmh, are on the drawing boards.

IMPACT

Despite some people questioning the feasibility of the technology behind Hyperloops, as well as the sky high costs associated with building out regional, intra-regional, and trans-continental Hyperloop networks, which if fully realised could transport goods and people anywhere in the world within 14 hours at the speed of air travel and for the cost of road freight with zero emissions, ultimately the benefits of this technology are clear.

Not only would trains that can travel at Mach 1 or above extend the economic areas of many cities and allow people hundreds of miles away to reach them in 30 minutes or less, but Hyperloops could also disrupt both the aviation and logistics industries, especially when you factor in their lower operating costs and almost enviable environmental credentials.

Hyperloops then also become even more interesting when you consider their role in helping accelerate and shape the future of the **Autonomous Last Mile Deliveries** and **Uni-Modal Transport** trends, both of which could change the economics and future of goods and passenger transport.

EXAMPLES

As more governments around the world conduct due diligence studies there's no doubting that Hyperloops and other trains of this ilk could have a significant economic and environmental impact with, for example, Chicago and Pittsburgh estimating that a Hyperloop network between the two cities would create in excess of $300 Bn of economic benefit, eliminate over 2.4 Mn tons of CO2, and remove 1.9 Bn cars from their roads over a 30 year period. Numbers not to be sniffed at.

However, as organisations around the world try their hardest to develop the first commercially available Hyperloop systems that can travel at Mach 1 or above many of them are falling by the way side, including Virgin Hyperloop's own passenger Hyperloop system which was dissolved after the company axed its staff and doubled down on CargoSpeed, their joint cargo venture with DP World.

Not to be out done though, as organisations like Zeleros make good headway, further East the Chinese have their own plans to create their own Hyperloop alternative, the T-Flight, capable of travelling at above Mach 3.

ACT NOW

There's no doubting that we have the technology to create supersonic trains, but developing them and getting them certified is one thing, and funding the development of the high speed networks they'll need to run is an entirely different matter, and that's going to be the challenge for this trend. And that's before we discuss the rise of many other alternative transportation systems such as **Flying Taxi Services**, green **Supersonic Aircraft**, and others that could challenge them both economically and technologically.

EXPLORE:

- Benefits and impact assessments
- Emerging technologies and technology roadmaps
- Future of Communications, Energy, Technology, Transportation, and the Workplace and Workforce
- Infrastructure funding
- Partner ecosystems and solutions

Data sources: DP World, FT, US DoT, and various.

MOBILITY AS A SERVICE

2ND YEAR ON THE LIST

The Autonomous Travel Suite, Aprilli

QUICK TAKE

As we continue to see progress in the development and deployment of **Autonomous Vehicles** manufacturers around the world are switching their business models from selling vehicles to selling Mobility as a Service (MaaS).

Not only does this represent a fundamental shift in their business and operating models, but it also opens up new opportunities for growth and market expansion, especially when combined with the **Modular Vehicles** and **Uni-Modal Transportation** trends.

IMPACT

Breakthroughs in Autonomous Vehicles and the death of the car, for example, as it becomes a "blank slate space" or pod on wheels, are changing how people and goods get from A to B - whether those two points are close together, or on the other side of continents. As a result the impact of this trend will be wide reaching, affecting automotive manufacturers and transportation organisations alike, and also affecting the Energy, Insurance, Healthcare, and Media sectors - all of which will see new opportunities and threats emerge, such as the loss of General Insurance (GI) business as we see the continued emergence of **Self-Insured Organisations**, or the emergence of commuters who, now freed from the shackles of driving, can consume content with impunity.

Seen by many as the **Digitisation** of the sector analysts estimates of the growth and size of the market in the years to come vary wildly between $271 Bn and $1.7 Tr by 2025, with growth rates of between 23% and 15% CAGR respectively, with urban penetration rates of 40% as analysts flounder with their figures and include both old and new service offerings.

EXAMPLES

While traditional public service transportation systems have offered MaaS for a long time now, by offering different ticketing and subscription models, this trend is now expanding to include all vehicle types and all service offerings - from cars, vans, and trucks, to more futuristic concepts including **Flying Taxi Services** and self-driving shops on wheels from the likes of Toyota with their E-Palette concept.

This latter example is especially interesting since today we think of mobility in terms of the movement of people and goods rather than of "spaces." However, as new vehicle formats emerge that allow organisations to put different spaces on wheels all of a sudden players in this space have the potential to offer everything from autonomous hotel rooms, bars, dining, doctors surgeries, games rooms, gyms, maker spaces, offices, schools, shops, and more on wheels - all under the umbrella of MaaS.

MaaS will also allow consumers, for the first time, to rent out their own vehicles - such as Tesla's model - and earn an income from them which then flips the concept of car ownership on its head.

ACT NOW

MaaS gives organisations in all sectors the ability to expand into new markets, and re-invent mobility and the customer and passenger experience, and as such the impact of this trend will be greater than many realise.

EXPLORE:

- Business and impact assessments
- Emerging technologies and technology roadmaps
- Future of Energy, Financial Services, Infrastructure, and Transportation
- New business models and product concepts
- Partner ecosystems and solutions

Data sources: BIS, Deloitte, Emergen, and various.

MODULAR VEHICLES

2ND YEAR ON THE LIST

An autonomous hotel room, Citroen x Sofitel

QUICK TAKE

At their most basic level you can think of modern Modular Vehicles as vehicle frames with wheels, on top of which you can put different modules or pods. While this trend makes maximum use of the **Autonomous Vehicles** trend it allows vehicle manufacturers and operators to change the form and function of their vehicles at will.

Not only does this open up radical new markets and opportunities for them, and allow them to create new innovative business models and operating models, but it also allows them to re-invent their product and service offerings.

Data sources: Various.

IMPACT

Ultimately the biggest impact of this trend will be to make all manner of previously centralised or fixed location services mobile and give vehicle manufacturers and operators, as well as their extended Partner ecosystems and solutions a new way to monetise products and services, and extend their brand reach.

In short, now that "spaces" are mobile, and vehicles are autonomous, organisations have a blank canvas from which to work and show off their ideas.

While this trend also benefits heavily from the **Mobility as a Service** trend, which is estimated to be worth between $271 Bn and $1.7 Tr by 2025, with growth rates of between 23% and 15% CAGR respectively, with urban penetration rates of 40%, at the moment it's still a very new market with more unknowns than knowns.

However, that doesn't stop organisations from exploring new market opportunities and concepts, pushing the boundaries and thinking outside of the box.

EXAMPLES

So far there are enough vehicle manufacturers exploring this trend that it looks like there is a high probability of it becoming commercially available at scale in the medium term future, and even though some of the vehicles and concepts look awkward that's what exploration is all about.

At its core this trend opens up a whole new host of "as a Service" opportunities that, as demonstrated by the likes of Citroen, Mercedes, and Toyota, among others, with their Skate, Vision Urbanetic, and E-Palette concepts respectively, open the door to everything from "Mobile Gym as a Service" and "Mobile Hotel Room as a Service" to all manner of other opportunities that include everything from autonomous mobile bars, dining, doctors surgeries, games rooms, maker spaces, offices, schools, shops, and many more.

Include Airbus, with it's own modular vehicle frame and EVTOL pod and suddenly organisations could also soon be offering **Flying Taxi Services**. So, as you can see the opportunities are literally sky high.

ACT NOW

The ability to bring traditionally centralised and fixed location services to people wherever they are via MaaS could not only revolutionise some industries - such as healthcare where the doctors surgery could literally come to your neighbourhood - but it also offers a new opportunity to reshape our cities and re-think both urban and rural lifestyles and services.

EXPLORE:

- Emerging technologies and technology roadmaps
- Future of Infrastructure, and Transportation
- New business and operating models
- New product concepts

UNI-MODAL TRANSPORTATION

2ND YEAR ON THE LIST

A Uni-Modal pod, NeXT

QUICK TAKE

Today governments and transport operators everywhere think in terms of Multi-Modal Transportation - where an individual travelling from A to B has to take multiple different vehicles and vehicle formats, such as cars and trains, in order to reach their destination.

However, as we see the emergence of **Autonomous Vehicles** and **Mobility as a Service** this is no longer necessarily the case as, with the right infrastructure and operating models, consumers can get into one vehicle, or autonomous pod, and stay in it throughout their entire journey.

Data sources: Various.

IMPACT

The concept of Uni-Modal Transportation (UMT), for the first time, takes a consumer first view of future transport networks rather than a disparate operators view. After all, today consumers often have to switch transportation modes multiple times to reach their final destination with all the cost, safety, reliability, stress, and time issues that goes with it.

Ultimately the biggest benefit of UMT is the fact that consumers can buy a service with one operator, and remain in one vehicle of their choosing for the whole journey as they travel door to door.

Ironically, today some of the future benefits of this trend can be quite well highlighted with the maritime industry where goods are loaded into containers. As the goods move from A to B they stay in the same physical space, but the vehicles that transport these containers, or these "Pods,"changes. Imagine having to keep transferring those goods every time the mode of transport changes and you have a basic idea of what we as consumers are having to deal with today as our status quo.

EXAMPLES

Unsurprisingly, the ability to get into one kind of vehicle, or use purpose built autonomous **Modular Vehicles**, and go door to door in it's very appealing. And while this trend is still nascent there are now a few countries looking into rolling it out - one of which is the UAE where customers will soon be able to hail a customised autonomous Next Pod to take them to their destination.

Taking a journey from Dubai to Abu Dhabi as our example customers will be able to hail their pod like an Uber and get into it as it pulls up outside their building. Once on board it will whisk them to the local Hyperloop station where the pod loads itself into specially designed carriages. Then, when the Hyperloop arrives in Abu Dhabi it simply disembarks and travels to the customers final destination. No transfers involved and a seamless rider experience if ever there was one.

Intriguingly variations of this trend could also be used to take pre-checked passengers and their luggage straight from their homes directly to the airport gates, so as you can see there are multiple opportunities to change the status quo.

ACT NOW

There are far too many examples of where today's Multi-Modal Transportation systems are overly costly and inefficient. Uni-Modal Transportation offers governments and organisations the opportunity to create a truly seamless, integrated transportation networks.

EXPLORE:

- Business and impact assessments
- Future of Infrastructure and Transportation
- Urban planning initiatives

BOOK AN EXPERT CALL

EXPLORE STARTUPS & MORE

VEHICLE ELECTRIFICATION

2ND YEAR ON THE LIST

QUICK TAKE

The transportation industry is one of the world's most polluting, for a variety of reasons, and as a result of environmental, political, and societal pressure and incentives manufacturers the world over, representing every type of vehicle - from aircraft, bikes, and cars to cargo ships, vans, and trucks - are now electrifying their products.

As we see huge amounts of investment continue to pour into the sector, and as we see dramatic improvements in battery energy density and other energy technologies, as well as infrastructure investment, this trend is set to accelerate.

Data sources: EPA, IEA, World Bank, and various.

IMPACT

Today the global transportation industry accounts for over 24% of all global greenhouse gas emissions, with road vehicles accounting for two thirds of that value, and emissions have been growing at a rate of 2% annually for the past two decades.

Over the past couple of years sales of Battery Electric Vehicles (BEV), especially cars, has increased by over 40% year on year, albeit from a low base, and now represent 3% of all global car sales and around 1% of the total global car stock.

While sales overall are surging as the trend gets under way the high cost of BEV's, in the absence of any subsidies, is still a major hurdle to adoption, although significant improvements in battery and vehicle design and manufacturing now mean that in the next few years many BEV's will be cheaper to buy than traditional combustion engine vehicles and, more importantly, will have a much lower TCO. Furthermore, while many people still have concerns about these vehicles environmental credentials there are already a myriad of supporting technologies coming to their aid.

EXAMPLES

Today almost every vehicle manufacturer, whether it's Daewoo and Hitachi Heavy Industries who are building some of the world's largest cargo ships, Airbus and Boeing , Tesla or Toyota, or hundreds of other vehicle manufacturers, are all electrifying their products, and they are doing it using a variety of energy types - from Ammonia and Hydrogen, through to more common-a-garden energy sources such as Biofuels, Lithium Ion (LiON) batteries, photovoltaics, and Solid State batteries.

Within the shipping industry there is a battle brewing between using Ammonia and Hydrogen as a primary energy source, supplemented by LiON and renewables, whereas in the aviation industry the battle is increasingly Biofuels versus Hydrogen versus LiON, with others appearing to be moved down the priority list.

Meanwhile, in the road based EV market it's LiON all the way - that is until the hundred or so other energy alternatives, which include everything from alternative battery types, high efficiency photovoltaic materials, hydrogen, and wireless energy technologies, become viable.

ACT NOW

While vehicle electrification is its own trend, and there are many ways that fleets are being electrified, it's part of the larger trend of a sustainable Carbon Zero future. As such developments in this space will be accelerated by developments elsewhere.

EXPLORE:

- Consumer trends
- Emerging technologies and technology roadmaps
- Future of Energy, Infrastructure, Manufacturing, and Transportation
- Partner ecosystems and solutions

Notes:

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