TOP 20
Metatrends
& Moonshots

FOR 2022-2032

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BUSINESS MODEL & ABUNDANCE METATRENDS...................... 19

Following are a series of 20 "**Metatrends & Moonshots**" developing and accelerating over the next 10 years. Think of **Metatrends** as the waves of exponential tech advancements that will revolutionize industries and redefine tomorrow's generation of businesses. Think of Moonshots as areas where entrepreneurs, creatives, and leaders are looking for a 10X improvement rather than settling for 10 percent. Understanding where the world is heading over the decade ahead allows us to imagine and create the businesses that will not only survive, but also thrive during this period. It is a superpower for predicting what happens next and implementing your vision of the future - at scale.

THE RISE OF ARTIFICIAL INTELLIGENCE (EVERYWHERE)

1. Everything is Smart and Embedded with Intelligence

The price of specialized machine learning chips is dropping rapidly as global demand increases. At the same time, expanding 5G networks coupled with ever-increasing compute on the cloud, means we're heading towards a future in which all devices in our environment will become intelligent and interactive. Your child's toy remembers his or her face and name.
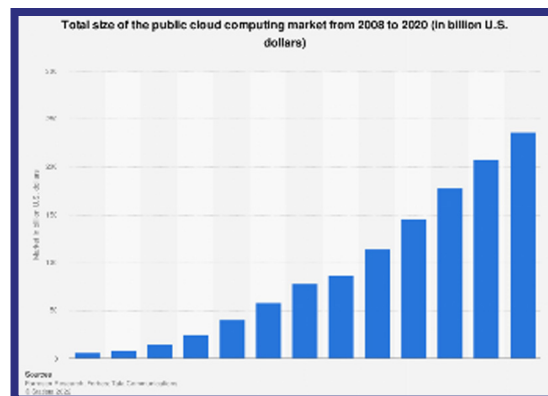
Your kids' drone safely and diligently follows and captures video of all the children at the birthday party. Appliances respond to voice command and anticipate your needs. Our environment - lighting levels, music selection, temperature desire - will also respond "automagically" to your desires. This Metatrend is **enabled by the convergence of** 5G networks, embedded sensors, IoT/IoE networks, edge-cloud computing, and machine learning systems on the cloud. This Metatrend will impact a multitude of industries from retail, security, health, industrial, transportation networks, education, and home living.

2. AI Will Achieve Human-Level Intelligence

Technologist and futurist Ray Kurzweil famouly predicted that 2029 is the date when "AI will achieve human levels of intelligence." Inmid-2022, Elon Musk also predicted that AI would grow, "Vastly smarter than any human and would overtake us by 2025".

"2029 is the date I predicted when AI will achieve human levels of intelligence."
- Ray Kurzweil

"Vastly smarter than any human and would overtake us by 2025."
- Elon Musk

In the coming decade, AI algorithms and machine learning tools will be increasingly made open source, available on the cloud, thereby allowing any individual with an internet connection the ability to amplify their creativity, improve their problem-solving skills, and increase their earning capacity. Examples of this include GPT-3 (and soon GPT-4), DALL-E and DALL-E2. This Metatrend will be **driven by the convergence of** massive amounts of cloud computing, large supply of labeled data, and global high-bandwidth connectivity. Every industry from healthcare, education, and entertainment to design, finance and retail will be significantly impacted.

3. AI-Human Collaboration Will Skyrocket Across All Professions

The rise of "AI as a Service" (AIaaS) platforms will enable humans to partner with AI in every aspect of their work, at every level, in every industry. AIs will become entrenched in everyday business operations, serving as cognitive collaborators to employees -supporting creative tasks, generating new ideas, and tackling previously untenable innovations. In some fields, partnership with AI will become a requirement. For example, in the future, making certain medical diagnoses without the consultation of AI may be deemed malpractice. Authors will write their blogs, stories, and books in partnership with algorithms like GPT-3 / GPT-4. Artists and designers will use DALLE-2. Software programmers and engineers will partner with AIs to produce code and engineer prototypes.

4. Most Individuals Utilize a 'JARVIS-Like' Software Shell to Improve Their Quality of Life

As services like Alexa, Google Home, and Apple Homepod increase their capabilities, they will expand to become part of our lives 24/7, serving as our interface with the world around us. Imagine a JARVIS-like "software shell" that you give permission to listen to all of your conversations, read your email, and monitor your blood chemistry.

With access to such data, these AI-enabled-software shells will learn your preferences, anticipate your needs and behavior, shop for you, monitor your health and help solve your problems in support of your goals. Your JARVIS-like software will call an autonomous uber for you whenever needed, before you have to ask, will alter the room's temperature, and serve up your favorite food before you ever ask. Imagine the world's best "executive assistant" who is all-knowing and almost psychic as it meets all of your needs and desires.

RISE OF ROBOTICS (HUMANOID, MOBILITY)

5. Humanoid Robots & Avatars Are Arriving

Functional and useful humanoid-robots and avatars will enter daily life this decade. They will look and operate like human beings with legs, arms, fingers and an opposable thumb, allowing them to navigate and interact with the anthropomorphic world around us. As described by Elon Musk in October of 2022 about the TeslaBot, named Optimus, "It will upend our idea of what the economy is... it will be able to do basically anything humans don't want to do... it's going to bring an age of abundance." Musk went on to say that Teslabot, which will cost less than $20,000, will eventually become "more valuable than cars".
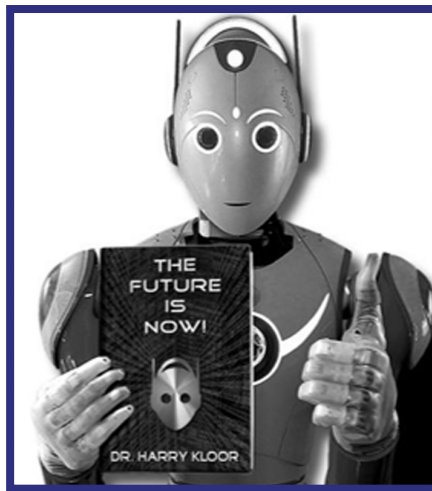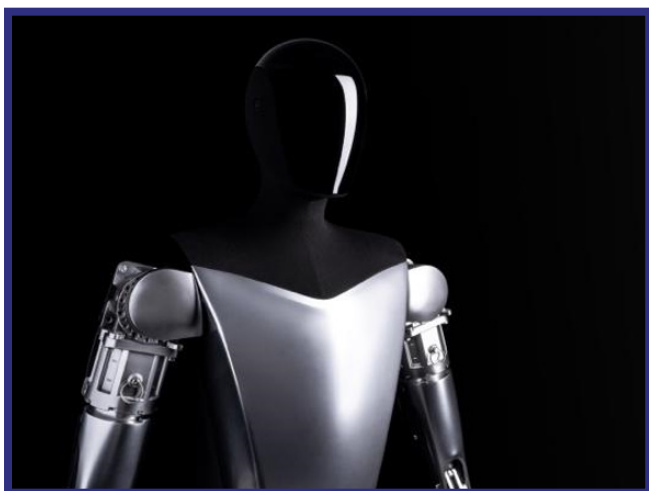
These robots are powered by AI and are **enabled by the convergence of** AI, robotics, sensors, material sciences, high bandwidth communications, and edge computing. In addition to these independent AI-driven robots, there is also a new generation of humanoid avatars that are remotely operated by humans wearing a VR headset and haptic suits. These avatars enable a remote human operator to feel like they are occupying the avatar event when operating from hundreds of miles away. These robots and avatars will help fulfill services jobs that are dull, dangerous, or dirty and will enable companies and entrepreneurs to have the labor they require during times of shortage.

6. Autonomous Cars & Flying Cars Will Redefine Human Travel (Faster & Cheaper)

Fully-autonomous vehicles from Tesla, Waymo (Alphabet) and GM-Cruise (just to name a few) will enable "car-as-a-service" fleets operating on-demand UBER-like services. Cost of ground transportation will decrease 2x to 4x as a result. Your kids and elderly parents will never drive.

A significant percentage of parking garages, driveways, and parking structures will eventually be transformed into alternative usable space. Autonomous cars will take all shapes and sizes and serve as functional "3rd spaces" used for entertainment, sleeping, or meeting rooms as drive time becomes work or play time. At the same time, aerial ride-sharing, eVTOL (electric Vertical Take-off Or Landing) or flying cars will also become fully operational in most major metropolitan cities this next decade.

Where you live and work will begin to transform as these systems shrink travel time and thereby distance. Previously difficult to reach geographies (islands, rural areas, mountain tops) will become accessible. Individuals seeking the solitude of the country will also have access to the shopping, food, and entertainment of metropolitan city-centers, connected through eVTOL technology. This meta-trend will be **driven by the convergence of** machine learning, sensors, materials science, battery storage improvements, and ubiquitous gigabit connections.

7. On-Demand Delivery (& Production) Will Birth an "Instant Economy of Things"

Urban dwellers will learn to expect "instant fulfillment" of their retail orders as drone and robot last-mile delivery services carry products from local supply depots to your doorstep. This capability, coupled with the deployment of regional on-demand digital manufacturing (3D printing farms), means that even customized "stuff" can be obtained within hours anywhere, anytime.

Just as FedEx and Amazon pioneered the concept of next-day and same-day delivery, and Domino's invented the idea of 30-minute delivery, this Metatrend will be a critical differentiator for those wishing to promise anything faster and cheaper-the instant economy of things. This Metatrend is **driven by the convergence of** networks, 3D printing, robotics and artificial intelligence.

GLOBAL CONNECTIVITY & UBIQUITOUS SENSORS

**8. Global Gigabit Connectivity Will Connect Everyone, Everywhere, Always at Ultra-low Cost**

The deployment of ubiquitous 5G (both licensed and unlicensed) plus the launch of a multitude of global satellite networks (Starlink, OneWeb, Kuiper, etc.) will allow for ubiquitous, low-cost global communications for everyone, everywhere. In the realm of ground-based cellular networks, by 2025 there will be 2.8 billion connected on 5G.

At the same time, 6G is also under development, which will be 100x faster. In Earth's orbit, a number of multi-thousand-satellite systems are being deployed that will ultimately cover every square meter of the Earth. Thus far, Starlink is the largest orbiting network with 2,500+ operational satellites, heading towards a goal of 30,000. This system today offers speeds up to 100 megabits/second. Terrestrial and space-based global connectivity will add an additional 2 billion new minds into the global economy and spur conversations representative of new consumers and creators, who will drive tens of trillions of dollars into the global economy.

9. IoT/IoE - Trillion-Sensor Economy: The Ability to Sense and Know Anything, Anytime, Anywhere

In addition to connecting human users, the growing terrestrial and satellite communication networks are also enabling the growth of the IoE (the Internet of Everything). Humanity is covering the planet in sensors. Health-related sensors on your body and in your body will be measuring your physiology 24x7. Sensors in your home will listen and watch, providing security and support.
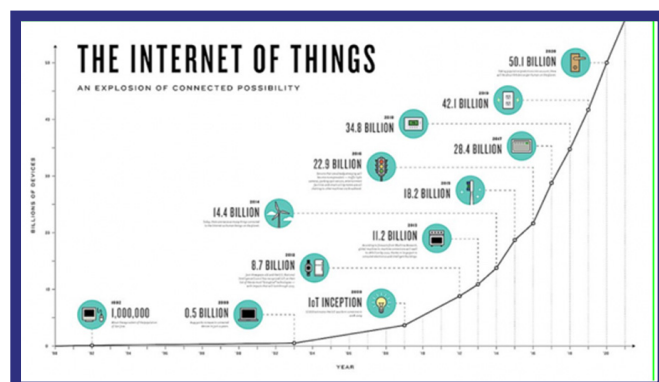
Industrial sensors will monitor every aspect of the supply chain and manufacturing will optimize production, efficiency and safety. Sensors in autonomous cars will visualize the roads and surroundings through cameras, LIDAR and radar, visualizing all activities in our cities and neighborhoods. Fleets of drones in the sky, and satellite constellations in Earth's orbit will monitor every square meter of the Earth's surface. Finally, forward-looking cameras on your AR (augmented reality) headsets will capture a permanent record of our activities and surroundings, what we eat and who we interact with. Today we are birthing a "trillion sensor economy" in which everything is being monitored, imaged and listened to at all times. This Metatrend is **driven by the convergence of** terrestrial, atmospheric, and space-based sensors, combined with machine learning and data networks. In this future, it's not "what you know," but rather "the quality of the questions you ask" that will be most important.

10. High-Bandwidth Brain-Computer Interfaces (BCI)

Technologist/futurist Ray Kurzweil predicted that in the early-2030's we will begin networking the human neo-cortex with the cloud over high-bandwidth connections. Early to medium-term applications will focus on treating a wide range of neurological disorders (e.g. spinal cord injuries), ultimately aiming to restore sensory and movement function for individuals suffering sensory of motor dysfunction.

The longer-term moonshot vision aims towards non-medical applications that seek to create machine interfaces that will attempt to supplement normal human cognitive abilities, with the potential to increase the human sensorium, our memory, and intelligence expanding how we interact with each other and the world. Companies like Neuralink (famously founded by Elon Musk) and Paradromics, utilize micron-scale threads that are inserted into areas of the brain that control movement. Companies like Kernel are building the next generation of brain measurement systems using wearable sensors that offer high-quality neural signal and full-head coverage. OpenWater, a company founded by Dr. Mary Lou Jepsen, is using red-laser holography to read and write onto the surface of neurons. This Metatrend is **enabled through the convergence of** material sciences, machine learning, and robotics.

RISE OF WEB3 & THE METAVERSE

11. Emergence of Web3/Metaverse (AI + VR/AR + Blockchain)

Citibank estimates that the metaverse could be worth $13 trillion by 2030 and have up to 5 billion users. While Web2 allowed us to transfer data in the form of documents, photos and videos, Web3 will emerge as the internet of value, built on blockchain, NFTs, DAOs, and the metaverse allowing us to transmit ownership. The metaverse is a s**ocial and ownership layer on the internet,** providing self-sovereign identity, connecting people, places, and things. It provides guaranteed authenticity and chain of title (ownership) across time and space via blockchain. Web3/ Metaverse is powered by a combination of VR/AR, 5G networks, blockchain, and AI. It will transform how we live our everyday lives, impacting every industry from retail and advertising, to education and entertainment. This decade: "Artists and storytellers will be to Web3 what software engineers were to Web2."

12. High-Resolution VR Will Reinvent Commerce & Collaboration

High resolution, low-weight VR headsets in combination with high-bandwidth connectivity and AI generated imagery will allow anyone to shop for everything from clothing to real estate from the convenience of their living room in a fun and highly efficient manner. Need a new outfit? Your AI knows your detailed body measurements and can whip-up a fashion show featuring multiple copies of your avatar wearing the latest 20 designs on a runway. Want to see how your furniture might look inside a house you're viewing online? No problem, your AI can show you, and give you a tour.

Zoom revenue
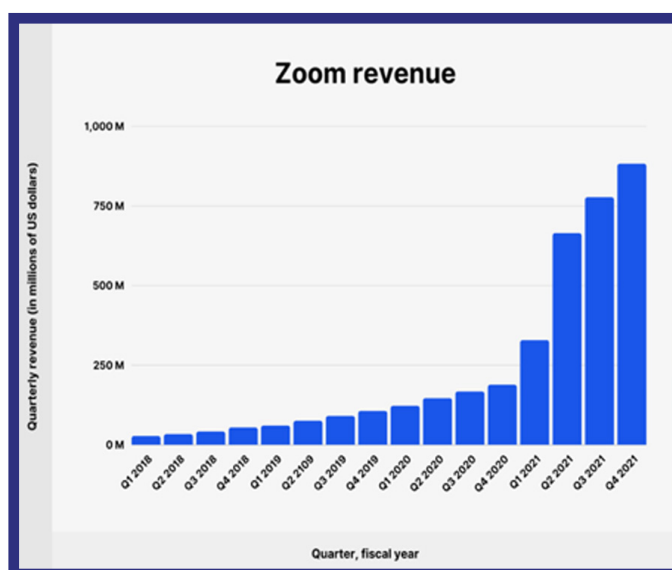
Perhaps more important than commerce is the impact these technologies will have on the future of collaboration and work. The COVID-19 pandemic disrupted the workplace and sent the vast majority of employees home to work using Zoom, Microsoft Teams, Google Meet, Slack and other collaborative tools leading to their meteoric adoption and use.While functional, such first-generation collaboration technologies completely lacked the social elements of the traditional workplace, making them less than adequate. Driven by this innate human need, a new generation of virtual and fully-immersive collaboration environments will arrive mid-decade following the release of Apple's AR/VR headset and the next generation META Oculus gear. Early versions of this virtual group workplace will enable you to choose youravatar **and surrounding, interact with friends,** co-workers and AI-bots. This Metatrend is en-abled through the convergence of VR, machine learning, and high-bandwidth networks.

INCREASING HEALTHSPAN

13. CRISPR/Gene Therapies

CRISPR is becoming a potent gene-editing tool capable of correcting gene-mediated age-related disease, thereby ameliorating symptoms and/or 'curing' diseases. CRISPR has the potential to address cancer, neuro-degenerative and inflammatory diseases. CRISPR and other gene therapies also have the potential to treat or cure a vast range of infectious diseases ranging from AIDS and Ebola. Finally, and perhaps most profound, as gene-editing technologies continue to increase both their precision and ease of use, they will allow families to treat and ultimately cure hundreds of inheritable genetic diseases ranging from hemophilia and sickle-cell anemia to transthyretin amyloidosis (a fatal liver disease) and Huntington's disease. CRISPR also holds vast potential to enable the de-extinction of lost species. Founded by Ben Lamm and George Church, PhD, Colossal Biosciences is using CRISPR

technology to bring back the woolly mammoth and other species. This Metatrend is **enabled through the convergence of** various biotechnologies (CRISPR, Gene Therapy), genome sequencing, and AI.

14. Increased Human Healthspan

A dozen game-changing biotech and pharmaceutical solutions (currently in Phase 1, 2, or 3 clinical trials) will reach consumers this decade, adding an additional 10+ years to the human healthspan. Aging will increasingly be categorized as a disease, thereby driving increased research towards stopping and/or reversing ageing with a goal of adding 30+ healthy years in the decade that follows. Various technologies will be developed to address the 9 hallmarks of aging.

Companies such as Vaxxinity (combating heart disease and strokes with a PCSK9 vaccine), Celularity (using placenta derived stem-cell replenishment), Immunis (delivering immune system pre-cursors and growth factors), Elevian (producing GDF-11) and a multitude of other entrepreneurial efforts. Gene therapy will be used to edit or replace defective genes as a way to correct for genetic disorders. Cell therapy (the addition of autologous and allogeneic stem cells) will be used to replace or augment a patient's stem cells population. A combination of Senolytic medicines, natural killer cells and vaccines will be used eliminate senescent 'zombie' cells which cause inflammation.

Cellular reprogramming using a combination of "Yamanaka factors" will be used to reverse epigenetics of cells and thereby their biologic age. Technologies such as wnt pathway modifiers, endo-vaccines, and supplementation of NMN/NAD+ are among other treatments that wil impact healthspan. This Metatrend is **driven by the convergence of** genome sequencing, CRISPR technologies, AI, quantum computing, and cellular medicines.

## 15. Demonetized, Democratized & Preventative Healthcare

The COVID-19 Pandemic began the disruption and re-invention of healthcare, a process that will continue and accelerate in the decade ahead. This re-invention is illustrated by two specific trends: First, the transition of healthcare from the hospital and doctor's office into the home. Biometric sensors on our bodies (wearables), in our bodies (implantables and consumables) and in our environment (home and office) will feed continuous data to our medical-AIs, and through them to our physicians. Such continuous monitoring will enable medicine to transition from reactive, to preventative, allowing disease to be detected at its earliest stages. The second trend involves increased use of AI as our primary diagnostician and health coach enabling medicine to be further democratized and demonetized. In the following decade, increasing capabilities of robotics, enabled by AI, will allow for robotic surgery and democratized and demonetized point-of-care treatment.

ENERGY, ENVIRONMENT & FOOD

16. Globally-Abundant, Cheap Renewable Energy

Continued advances in solar, wind, geothermal, hydroelectric, and fusion power, along with localized grids, will continue to drive humanity towards cheap, abundant, and ubiquitous renewable energy. The price per kilowatt-hour will continue to drop at the same time that energy storage drops below 3-cents/ kilowatt-hour. The result will be the continued displacement of fossil fuels globally. The world's poorest countries are also the world's sunniest countries, accordingly driving humanity towards an age of energy abundance.
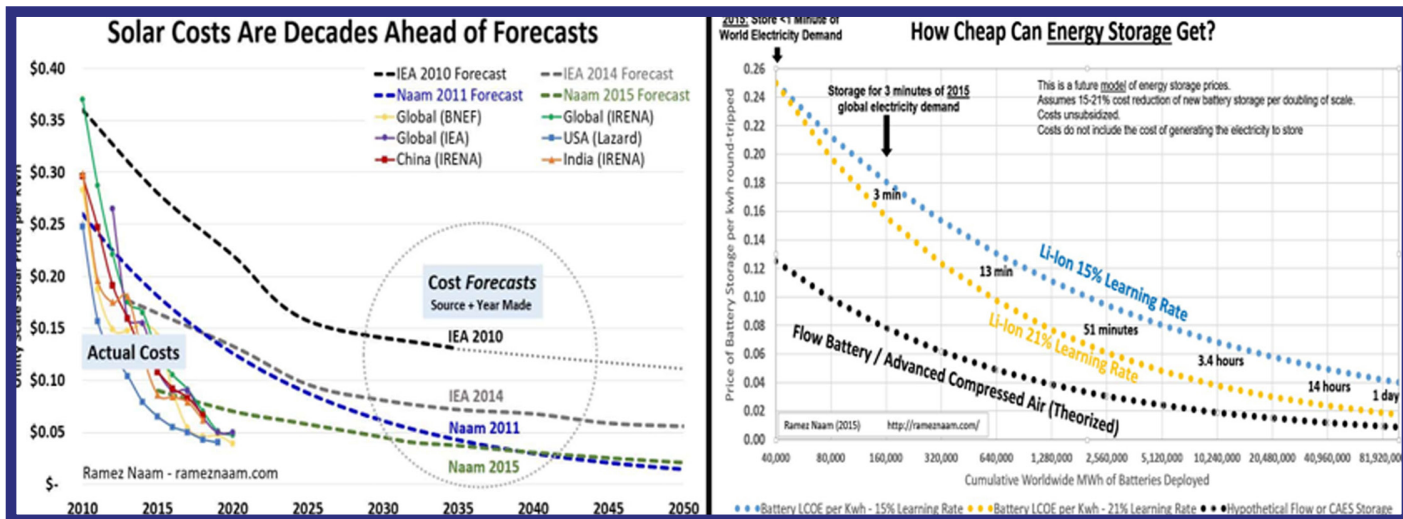
17. Increased Focus on Sustainability & Carbon

An increase in global environmental awareness and concerns over global warming will drive companies to focus on sustainability both from a necessity and from a marketing point of view. Breakthroughs in material sciences and AI will allow companies to drive improvements in carbon-capture and recycling waste of all type. A wide range of new technologies, coupled with policy changes and economic incentives, will move humanity towards gigaton carbon capture. All industries from computing to food production will feel increasing pressure to develop low-carbon-footprint alternatives to their current methodologies and infrastructure. This Metatrend is enabled through the convergence of material sciences, AI, and broadband networks.

18. Cellular Agriculture & Vertical Farming

This next decade we will witness the birth of the most ethical, nutritious, and environmentally sustainable protein production system devised by humankind. Referred to as Stem-cell based meat, cellular agriculture or Cell-based meat, the cost of producing a single molecule of cell-based beef burger has fallen from $1M/kg in 2000 to about $100/kg in 2020.

Source: RethinkX, Morgan Stanley Research
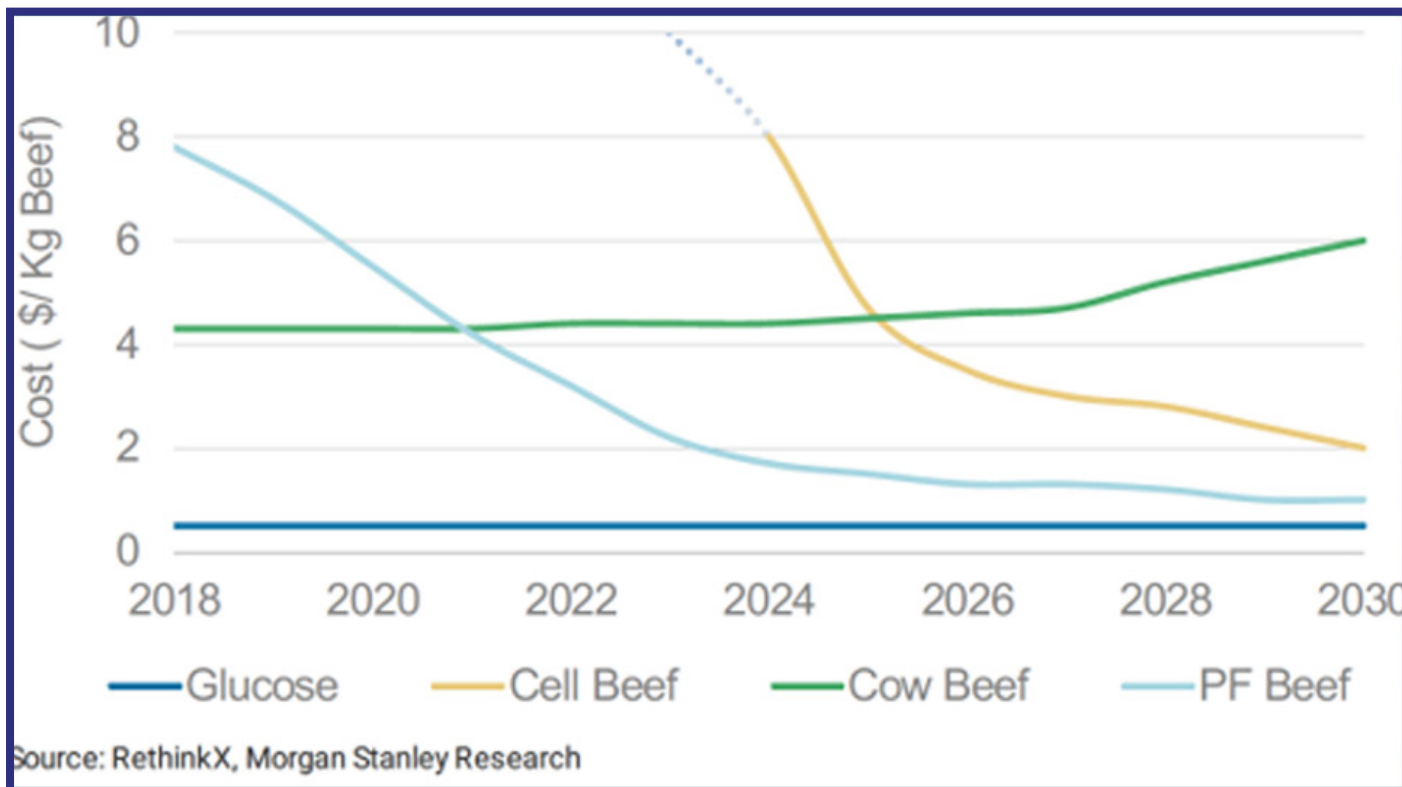
This cost is expected to fall below $10/kg by 2025, thus creating a mass-market cost-equivalent way of replacing beef at minimal environmental cost and reducing animal slaughter. Similar price reduction is being seen in Stemcell-based chicken and fish. This technology will allow the production of beef, chicken, and fish anywhere, on-demand, and will be more nutritious and environmentally friendly than traditional live-stock options. Companies such as OMeat and JUST are now scaling production. Vertical farms offer an innovative and flexible solution to global agricultural challenges such as volatility due to climate changes, droughts and floods. Studies show that vertical farming is not only more nutritious, but can produce up to four food-production cycles of food per year, something that is impossible in traditional agriculture. It can also reduce the transport costs of food because it is produced in close proximity to the point of consumption.

Finally, vertical farming will also reduce the need for pesticides. An example of such a company is Infarm, who has raised >$600M and achieved unicorn status in 2021. The company's aim is to make "infarming" sustainable and impactful and has been on a major expansion push with nearly 600 sites and partners globally. This Metatrend is **enabled through the convergence** of biotechnology, material sciences, machine learning and AgTech.

BUSINESS MODEL & ABUNDANCE METATRENDS

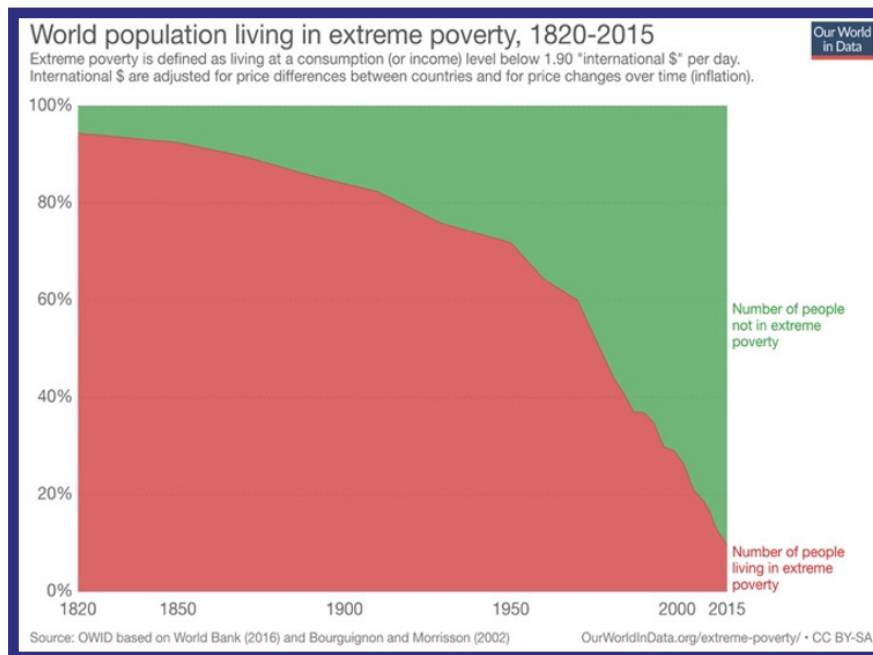### 19. Onshoring Manufacturing & Offshoring Labor

The disruption in supply chains and the labor market caused by the Covid-19 pandemic drove a global shift towards on-shoring manufacturing. The use of robotics, 3D printing and advanced automation has allowed western companies to "on-shore" production at a reasonable cost, shifting away from lower-cost Asian production facilities.
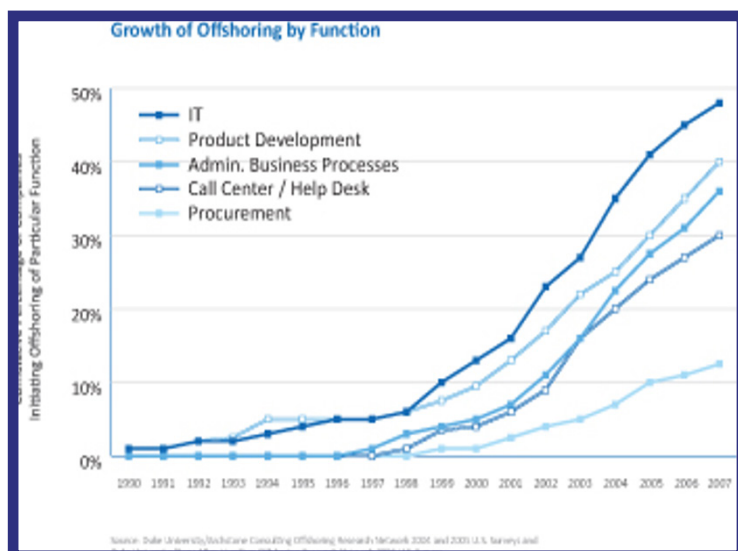
This shift has allowed companies to concurrently "own their supply chain" and reduce shipping costs and timelines. At the same time, collaboration technologies such as Zoom and Slack are allowing companies to off-shore their talent, expanding access to highly sought-after experts globally.

20. Increasing Global Abundance

From 2016 through 2021, the global economy hit all-time highs in the global flow of seed capital, venture capital and sovereign wealth fund investments. While we will witness some temporary ups and downs in the wake of future recessions, the overall trend will likely continue upwards.

World population living in extreme poverty, 1820-2015

Extreme poverty is defined as living at a consumption (or income) level below 1.90 "international $" per day. International $ are adjusted for price differences between countries and for price changes over time (inflation).

Our World in Data

Number of people not in extreme poverty

Number of people living in extreme poverty

Source: OWID based on World Bank (2016) and Bourguignon and Morrisson (2002)   OurWorldInData.org/extreme-poverty/ • CC BY-SA

Capital abundance leads to the funding and testing of "crazy" entrepreneurial ideas, which in turn accelerates innovation. In the decade ahead, the number of individuals in extreme poverty will continue to drop, as the middle-income population continues to rise, continuing a metatrend that has existed for much of the past century.

Everyday goods and services (finance, insurance, education, healthcare and entertainment) are being digitized and becoming demonetized and democratized, available to billions on digital devices. This Metatrend is **driven by the convergence of** high-bandwidth/low-cost communication, ubiquitous AI on the cloud, growing access to AI-aided education, and AI-driven healthcare.

If this type of information is valuable to you, consider learning more about my year-round Executive Mastermind called **Abundance360** (A360). A360 is the highest-level program of Singularity University. (www.Abundance360.com).

I've created a free AI-driven resource that scans the world's news, journals and tweets looking for daily breakthroughs related to these 20 Metatrends. It's called **FutureLoop**. You can subscribe, for free, at www.FutureLoop.com. Every day you will receive an email summary of the top 10 - 15 exponential breakthroughs in this area, curated and summarized by our AI system.