



Impact Investing:

Is Innovation the Key to Accelerating Progress toward the United Nations' Sustainable Development Goals?

Published: March 11, 2021

Author: Brett Winton, Director of Research at ARK Invest



Impact Investing: Is Innovation the Key to Accelerating Progress Toward the United Nations' Sustainable Development Goals?

As you read this whitepaper: more than 700 million people live in extreme poverty, are undernourished, lack access to basic drinking water, and live without electricity; more than 200 million are malarial; one in five children is not attending school, and 750 million adults—two-thirds of them women—are illiterate.¹ In the world's cities, a quarter of the population lives in slums and nine out of ten breathe polluted air.² At the same time, the developed world's growth may have come at significant cost: over the course of a century the oceans have become 26% more acidic and the air 2°F warmer, both trends that appear to be accelerating.^{3,45} In the face of these tragedies the world's geopolitical response seems woefully insufficient.

In 2015, the UN General Assembly formulated and committed to the 17 Sustainable Development Goals (SDGs)⁶ in a concerted effort to end poverty, protect the planet, sustain economic growth, and lay the infrastructure for peace and prosperity by 2030.⁷ ARK has organized the 17 goals into four broad-based sustainable ambitions: economic convergence, healthy economic growth, environmental action, and infrastructure for the future, as shown below.

Figure 1: ARK's Breakdown of Four Sustainable Ambitions



Source: ARK Investment Management LLC, 2021.
Data sourced from the UN sustainable development goals website; <https://www.un.org/sustainabledevelopment/>

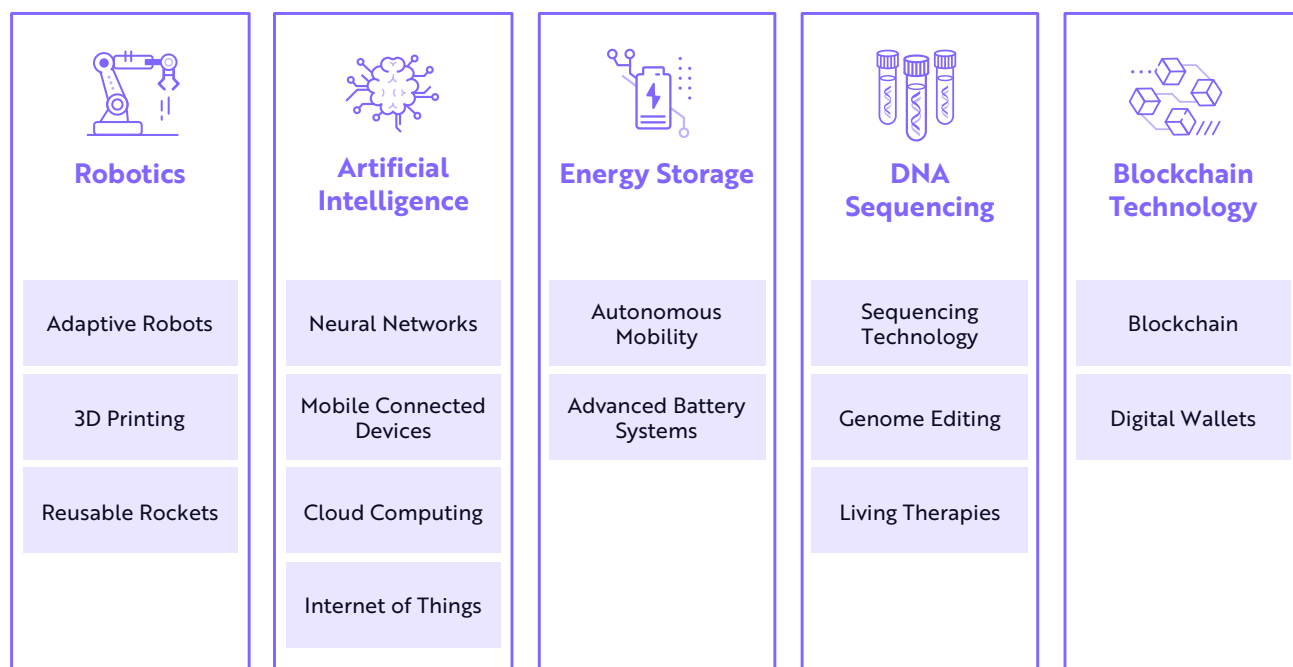
- 1 "United Nations Sustainable Development – 17 Goals to Transform Our World." United Nations, United Nations, www.un.org/sustainabledevelopment/
- 2 *ibid*
- 3 *ibid*
- 4 Measured relative to the early 1900s, see "Climate Change: Global Temperature: NOAA Climate.gov." Climate Change: Global Temperature | NOAA Climate.gov, 15 Mar. 2021, www.climate.gov/news-features/understanding-climate/climate-change-global-temperature.
- 5 See page 456 of the IPCC Special Report on the Ocean and Cryosphere in a Changing Climate, www.ipcc.ch/srocc/.
- 6 sustainabledevelopment.un.org/topics/sustainabledevelopmentgoals.
- 7 General Assembly resolution 70/1, Transforming Our World: the 2030 Agenda for Sustainable Development, A/70/L.1 (25 September 2015), available from https://www.un.org/en/development/desa/population/migration/generalassembly/docs/globalcompact/A_RES_70_1_E.pdf



Six years later, the UN no longer expects to reach those goals by 2030. According to Francesca Perucci, the UN Chief of the Statistical Services Branch, "Almost all areas where you see progress, if you look at the rate, or the pace of progress, it is never sufficient to meet the targets."⁸ This statement may be true, but it overlooks the role that disruptive innovation could play in changing the pace of progress. ARK believes that achieving the UN Sustainable Development Goals is possible. Innovation could be the key.

According to ARK⁹ and shown below, five innovation platforms are evolving simultaneously in the global economy, marking an important moment in history. We believe that historians will deem this era as one of unprecedented technological foment. They will identify robotics, artificial intelligence, energy storage, DNA sequencing, and blockchain technology as transformative innovation platforms that entered critical inflection points during this decade. While the commercial impact of their productivity boosts could be profound, the five platforms also are likely to bend the curve for each of the UN SDGs, increasing the probability of many successes by 2030.

Figure 2: ARK's Five Innovation Platforms



Source: ARK Investment Management LLC, 2021

⁸ Lieberman, Amy. "SDGs Show Slow Progress, Not on Track to Reach 2030 Targets, UN Reports." Devex, Devex, 22 June 2018, www.devex.com/news/sdgs-show-slow-progress-not-on-track-to-reach-2030-targets-un-reports-92971.

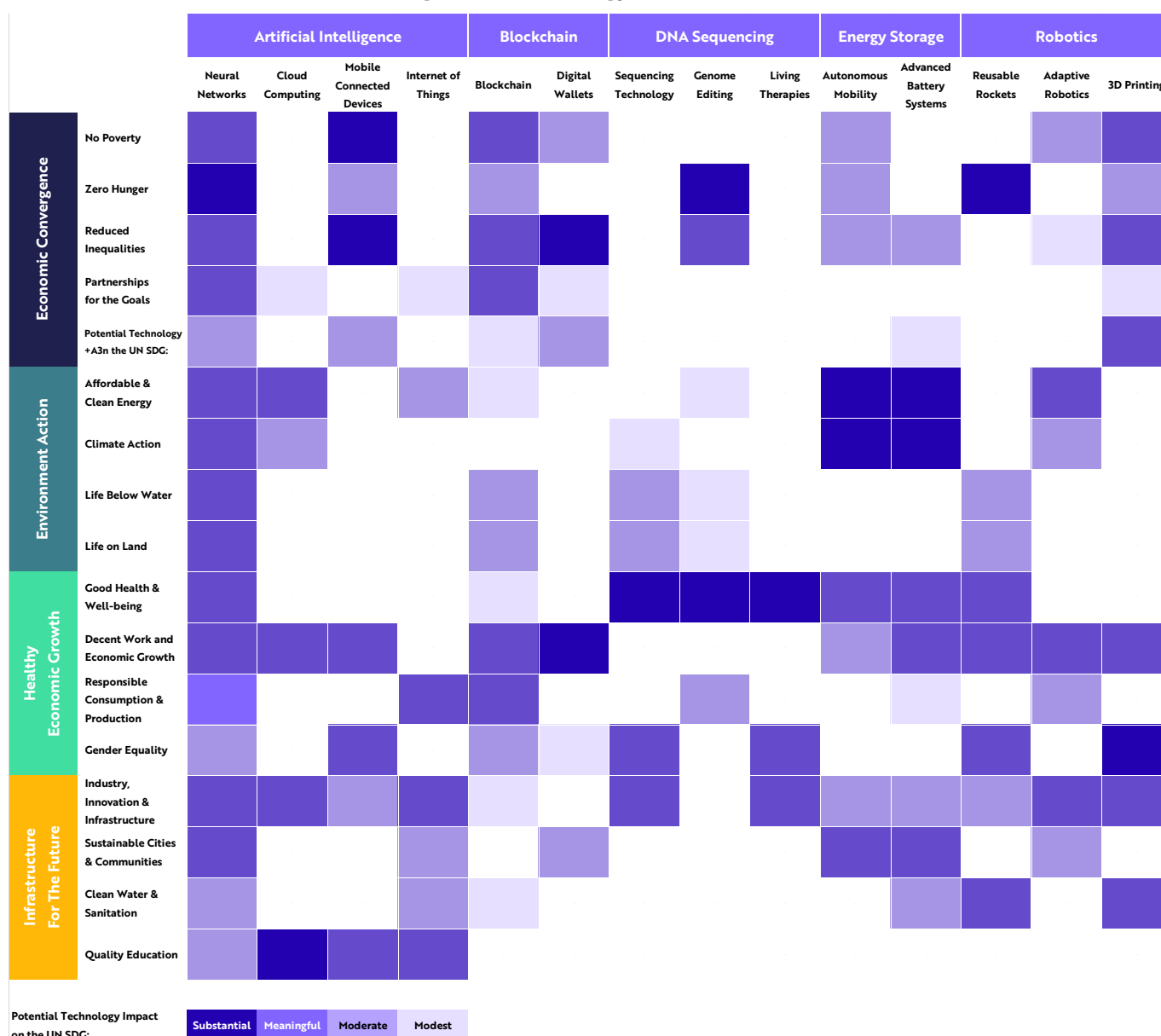
⁹ "White Paper: Disruptive Innovation: Why Now?" ARK Investment Management." ARK Invest, 11 Feb. 2021, ark-invest.com/white-papers/innovation-why-now-white-paper/.



Innovation Investing is Impact Investing

ARK's research suggests the potential impact of innovation on the UN SDGs is quantifiable and, in some cases, profound. ARK disaggregates the five innovation platforms into 14 underlying technologies, each with cost decline and demand elasticity curves that can be quantified, and dimensions their commercial potential and their potential impact on the UN SDGs. Each of the 14 technologies could accelerate progress toward several UN sustainable development goals, as shown in the table below.

Figure 3: Technology vs SDGs Grid



Source: ARK Investment Management LLC, 2021, data sourced from <https://www.un.org/sustainabledevelopment/>



According to our research, the five innovation platforms should impact every UN SDG positively. In the table below, we detail a number of examples.

Figure 4: Impact Examples

	Robotics	Artificial Intelligence	Energy Storage	DNA Sequencing	Blockchain
Economic Convergence	<ul style="list-style-type: none"> Farm productivity increases through automation Reusable rockets should enable satellite internet, providing connectivity to the billions unconnected 	<ul style="list-style-type: none"> Digital Wallets can help bank the 1.7 billion people that are unbanked Artificial intelligence can facilitate precision agriculture and increase farm yields 	<ul style="list-style-type: none"> Autonomous vehicles can enable access to mobility at lower cost Autonomous tractors and farm equipment can increase crop yield and reduce pesticide usage 	<ul style="list-style-type: none"> Food production yield increases due to gene edited crops, livestock and aquaculture are expected to exceed population growth. 	<ul style="list-style-type: none"> With Bitcoin, value can be stored and transferred without third-party intervention Digital document management can increase transaction velocity
Environmental Action	<ul style="list-style-type: none"> 3D printed aircraft engine parts can reduce fuel consumption Drones can monitor water conditions and search for illegal logging 	<ul style="list-style-type: none"> Artificial intelligence can analyze satellite images and detect illegal fishing and other crimes Artificial Intelligence makes renewable energy production more efficient 	<ul style="list-style-type: none"> Because of electric vehicles, oil demand could peak soon Ocean acidification can be reduced by replacing fossil fuel power plants with batteries 	<ul style="list-style-type: none"> Economic viability of biofuels depends upon productivity to be delivered by gene editing Gene edited aquaculture can reduce pressure on global fish stocks 	<ul style="list-style-type: none"> Full cycle carbon emission tracking and transparency will require distributed ledger tracking of supply chains
Healthy Economic Growth	<ul style="list-style-type: none"> Automation can increase productivity and wage growth 3D printing can lower the amount of materials needed for production 	<ul style="list-style-type: none"> IoT devices like the Apple Watch can predict atrial fibrillation, diabetes and sleep apnea Over-the-air updates improve products and lower replacement waste 	<ul style="list-style-type: none"> Autonomous vehicles are likely to reduce car crashes We believe autonomous vehicles could cost \$0.26 per mile in 2021, down from \$0.70 in 2016 	<ul style="list-style-type: none"> CRISPR gene editing could delete, replace or repair genes, reducing chronic conditions Liquid biopsies can help look for mutated DNA in the ~20m cancer survivors 	<ul style="list-style-type: none"> Bitcoin combines elliptic curve cryptography and secure custody to enable what we believe the strongest form of jurisdiction-agnostic property rights
Infrastructure for the Future	<ul style="list-style-type: none"> Collaborative robots should catalyze more flexible manufacturing and bring production closer to end-customers. 3D printing improves supply chain efficiency and sustainability. 	<ul style="list-style-type: none"> Smartphones are a critical distribution channel to facilitate many technological innovations Online education lowers barriers to education and AI can amplify the reach of superstar teachers 	<ul style="list-style-type: none"> ARK believe autonomous vehicles can make cities safer, potentially reducing accident rates by 80%. 	<ul style="list-style-type: none"> By sequencing genomes, patient health outcomes should be meaningfully better as sequencing could be used for preventative medicine 	<ul style="list-style-type: none"> Next generation real estate platforms can reduce the burden, friction and cost of renting, buying & selling homes/ apartments.

Source: ARK Investment Management LLC, 2021, data sourced from <https://www.un.org/sustainabledevelopment/>; "Big Ideas 2021: Innovation Research by ARK Invest." ARK Invest, 22 Feb. 2021, ark-invest.com/big-ideas-2021/.

The following three case studies offer more detailed analyses of the impact that technologies could have on the UN SDGs.



1. Goal #13 - Climate Change: Autonomous Mobility and Advanced Battery Systems

Despite attempts to avert it, the average global temperature continues to rise, primarily because of carbon dioxide emissions from burning fossil fuels.¹⁰ Currently, the global economy sends more than a 1,000 tonnes of CO₂ skyward per second, 20% of which is attributable to ground transport.¹¹ The 1.4 billion cars on today's roads have been profoundly useful in moving people and packages

¹⁰ See figure 1.4, accessed May 3rd 2021: "Topic 1: Observed Changes and Their Causes." IPCC 5th Assessment Synthesis Report, [ar5-syr.ipcc.ch/topic_observedchanges.php](https://www.ipcc.ch/topic_observedchanges.php)

¹¹ 2020 CO₂ emissions are expected to total 34 billion tonnes, which reduces to ~1,100 tonnes per second. In 2019 ground transportation comprised 19% of emissions. Data source <https://carbonmonitor.org>.

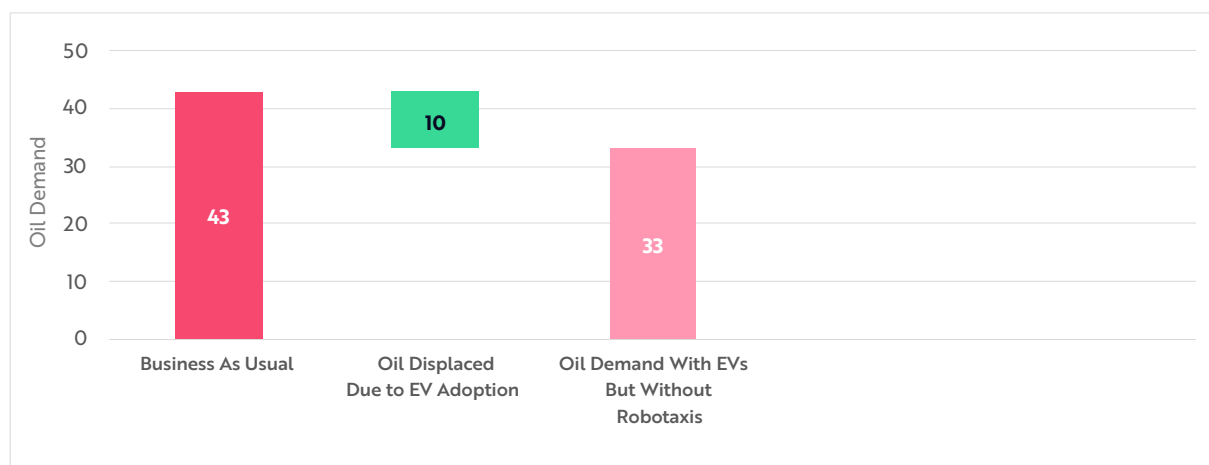


from place to place,¹² but more than 99.5% of them still burn fuel.¹³ Barring a transformation in this technology stack, in the 2020s alone cars and trucks are likely to emit almost 20% of the world's remaining carbon dioxide budget for holding global temperature rises below 1.5 degrees Celsius.¹⁴

Technology could change this course. Thanks to the cost declines in lithium-ion batteries as well as advances in artificial intelligence, electric vehicles are likely to transition from niche to mainstream products. According to ARK's research, the sticker price of an electric vehicle (EV) with 350 miles in range will be lower than that of the median gas-powered new car in the US.¹⁵ Already, EVs are superior to gas-powered cars as measured by performance, maintenance, safety, and operating costs. Given lower EV sticker prices, we believe only consumers with specialized needs or preferences will choose gas-powered vehicles.

BP projects that cars and trucks will consume more than 40 million barrels of oil per day through 2030.¹⁶ ARK expects the adoption of EVs to reduce 2030 oil demand by approximately 10 million barrels per day, as shown below. Because commodity prices are determined at the margin, this outlook does not bode well for oil prices.

Figure 5: 2030 – Potential Reduction in Oil Demand Due to Electric Vehicles
(mm barrels per day)



Forecasts are inherently limited and cannot be relied upon.

Source: ARK Investment Management LLC, 2020; Data sourced from BP Statistical Review of Energy

¹² Saja, Fabio. "How Many Cars Are There In The World?" DriveTribe, DriveTribe, 19 Apr. 2020, drivetribe.com/p/how-many-cars-are-there-in-the-world/.
¹³ ARK estimates that roughly 7 million electric vehicles have been sold cumulatively through year-end 2020.

¹⁴ BP expects cumulative oil demand for cars and trucks to stabilize at roughly 43 million barrels of oil per day. 490 kg of CO₂ are emitted per barrel of oil per http://oci.carnegieendowment.org/#oil/saudi-arabia-ghawar. This suggests business as usual cumulative car and truck CO₂ emissions over the course of the decade at approximately 80 billion tonnes. https://www.carbonbrief.org/guest-post-refining-the-remaining-1-5c-carbon-budget estimates remaining carbon emissions budget to fall between 230 billion and 670 billion tonnes of CO₂.

¹⁵ "Big Ideas 2021: Innovation Research by ARK Invest." ARK Invest, 22 Feb. 2021, ark-invest.com/big-ideas-2021/.

¹⁶ "Energy Outlook 2020 Edition." Bp.com, Bp, www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/energy-economics/energy-outlook/bp-energy-outlook-2020.pdf.

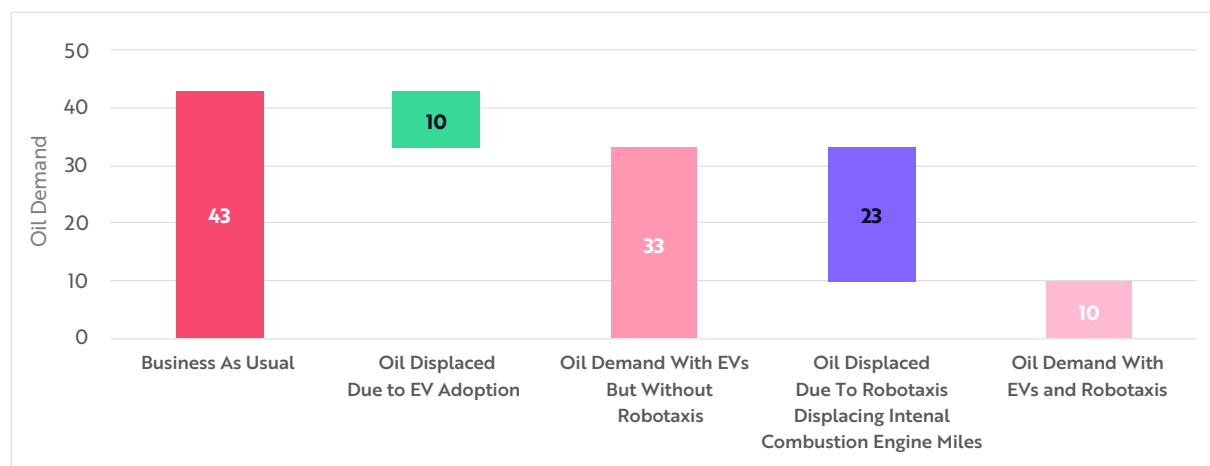


While inexpensive electric drivetrains could curtail oil demand, they will not end the use of the 1.4 billion gas-powered cars on the road today. Those cars could emit roughly 100 billion tonnes of CO₂ during their useful lives,¹⁷ unless technology offers consumers a more attractive choice.

Autonomous electric robotaxis could provide a more attractive choice. According to ARK's research, autonomous robotaxis are likely to price profitably at roughly \$0.25 per mile, 60% below the amortized cost of a personal vehicle.¹⁸ Robotaxis could offer the same point-to-point mobility as the existing gas-powered vehicle fleet with fewer accidents and more convenience. Consumers will not have to prepay for transportation or pay for parking. Watching videos or working in the back seat, they will not have to concentrate on driving either. As a result, as measured by vehicle-miles-traveled, robotaxis should take share from the existing vehicle fleet.

ARK forecasts that robotaxi services will begin to proliferate and scale commercially by 2025.¹⁹ Lowering utilization of the existing vehicle fleet, they are likely to displace more oil than will the transition to electric drive trains alone. ARK estimates that robotaxis and electric vehicles will reduce the oil demand for cars and trucks by more than 75%, roughly two-thirds of the decline attributable to the radical economics of robotaxi systems, as shown below.

Figure 6: 2030 – Potential Oil Demand Reduction Due to EVs and Robotaxi Capability
(mm barrels per day)



Forecasts are inherently limited and cannot be relied upon.

Source: ARK Investment Management LLC, 2020; Data sourced from BP Statistical Review of Energy

¹⁷ "White Paper: Mobility-As-A-Service: ARK Investment Management." ARK Invest, 11 Feb. 2021, ark-invest.com/white-papers/self-driving-cars-white-paper/.

¹⁸ Per ARK estimates the marginal cash cost of operating a fully owned Toyota Camry is approximately \$0.30 per mile.

¹⁹ "Big Ideas 2021: Innovation Research by ARK Invest." ARK Invest, 22 Feb. 2021, ark-invest.com/big-ideas-2021/.

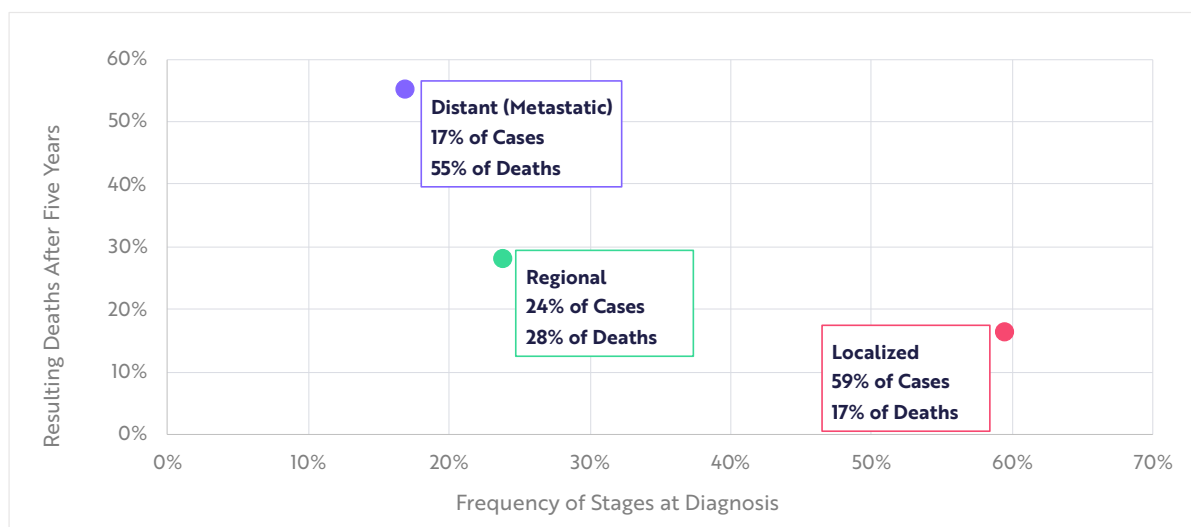


2. Goal #3 - Good Health and Well-Being: Liquid Biopsies

Cancer is the cause of roughly 17% of deaths globally. In 2020, cancer accounted for almost 20 million diagnoses and roughly 10 million deaths.²⁰ For every two people diagnosed, another cancer patient died.

If diagnosed early, cancer often is manageable. In the US, more than 80% of the deaths occur in patients whose cancer already has metastasized prior to the diagnosis ("regional" and "distant" cases shown below.) Researchers estimate that blood tests that diagnose early-stage cancer could reduce the overall cancer mortality rate by more than 25%.²¹

Figure 7: Distant (Metastatic) Cancers Are the Minority of New Cases But the Majority of Deaths



Source: ARK Investment Management LLC, data sourced from Nowak, M. A., et al. "The Linear Process of Somatic Evolution." *Proceedings of the National Academy of Sciences*, vol. 100, no. 25, 2003, pp. 14966–14969, doi:10.1073/pnas.2535419100, SEER. "SEER*Explorer." *Surveillance, Epidemiology, and End Results Program*, 2020, seer.cancer.gov/explorer/.

Paired with advances in machine learning and synthetic biology, cost declines in next generation sequencing are likely to make such blood tests a reality. Traditional imaging diagnostics, such as CT-scans and bronchoscopies, require significant capital expenditures but are useful only for the diagnosis of certain cancers. In contrast, blood-based sequencing tests, also known as liquid

20 Sung, Hyuna, et al. "Global Cancer Statistics 2020: GLOBOCAN Estimates of Incidence and Mortality Worldwide for 36 Cancers in 185 Countries." *American Cancer Society Journals*, American Cancer Society, 4 Feb. 2021, acsjournals.onlinelibrary.wiley.com/doi/full/10.3322/caac.21660.

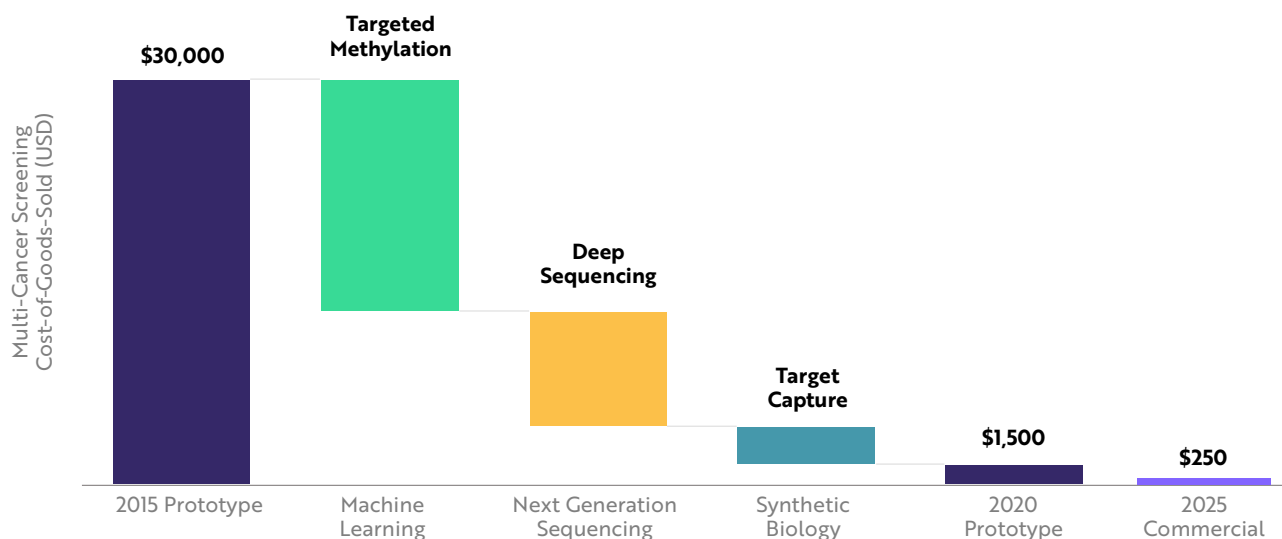
21 "New Research Suggests Multi-Cancer Early Detection Blood Test Could Reduce Late-Stage Cancer Diagnoses by More Than Half." *GRAIL*, 16 Dec. 2020, grail.com/press-releases/new-research-suggests-multi-cancer-early-detection-blood-test-could-reduce-late-stage-cancer-diagnoses-by-more-than-half/.



biopsies, search for fragments of mutated DNA in patient bloodstreams and can identify cancer tumors much less expensively and earlier than traditional imaging techniques.

While researchers have considered such tests theoretically possible, they have been unsure about the precision and costs associated with them until recently. In 2015, a state-of-the-art liquid biopsy pan-cancer test would have cost health systems a prohibitive \$30,000.²² According to our research, in the past year, advances in next generation sequencing, machine learning, and synthetic biology have pushed the costs down to the \$1,500 range, similar to those of traditional imaging techniques.²³ Within the next five years, ARK anticipates that liquid biopsy costs could fall by roughly 80%, as shown below.

Figure 8: The Combination of Innovative Technologies is Driving Down Screening Costs (2015-2025)



Forecasts are inherently limited and cannot be relied upon.

*Source: ARK Investment Management LLC, data sourced from Liu, M.c., et al. "Sensitive and Specific Multi-Cancer Detection and Localization Using Methylation Signatures in Cell-Free DNA." *Annals of Oncology*, vol. 31, no. 6, 2020, pp. 745–759, doi:10.1016/j.annonc.2020.02.011, Illumina, and Twist Bioscience.*

ARK believes detecting it early will be key to transforming cancer from a killer into a chronic disease. A pan cancer liquid biopsy promises not only early detection but also access to life-saving diagnoses. Moreover, the cost declines and improvements in blood-sample-based cancer detection are likely to continue well beyond 2025. Even in geographies without the budgets or infrastructure to support widespread imaging, early screening could become routine, potentially lowering the global rate of cancer mortality.

²² ARK estimate derived from the cost to sequence and the published sequencing intensity of liquid biopsy experiments being run at that time, notably by Grail.

²³ Grail recently announced out-of-pocket pricing for its Galleri liquid biopsy test at \$949: "Cancer Screening Cost with the Galleri Test: Galleri™." Galleri, www.galleri.com/the-galleri-test/cost.



3. Goal #8 - Decent Work and Economic Growth: Digital Wallets

Financial inclusion is critical to a range of UN Sustainable Development Goals. In 2016, the UN Secretary General's office documented the link between financial inclusion and eight UN SDGs: eliminating extreme poverty, reducing hunger and promoting food security, achieving good health and well-being, fostering quality education, promoting shared economic growth, promoting innovation and sustainable industrialization, and building a more equitable and peaceful society.²⁴

We believe digital wallets offer a critical entry point for financial inclusion, especially in emerging markets. Between 2011 and 2017, the global unbanked rate declined as smart phones and digital wallets increased, as shown below. Between 2014 and 2017,²⁵ mobile money accounts grew the fastest in low-income countries as mobile phone adoption jumped more than 1700 basis points to 67%.²⁶

Figure 9a: Mobile Phone Penetration & Unbanked
(% of Global Population, 2011-2017)

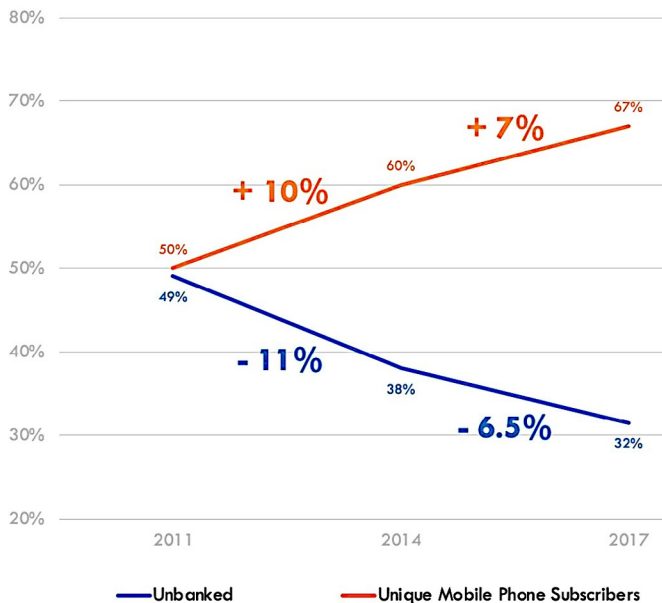
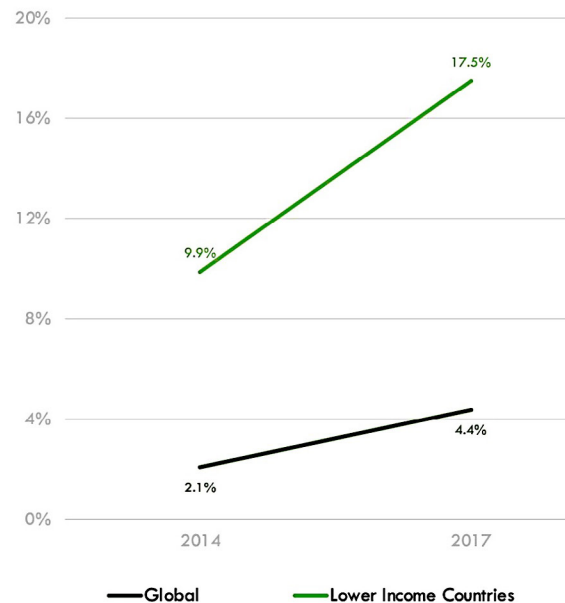


Figure 9b: Mobile Money Account Penetration
(% of Population, 2014-2017)



Source: ARK Investment Management LLC;
Data sourced from State of the Industry Report on Mobile Money (2011-2017), GSMA; Global Findex Database, World Bank.

²⁴ United Nations Secretary-General's Special Advocate for Inclusive Finance For Development (UNSGSA): https://www.unsgsa.org/files/5614/6118/2625/sdgs_paper_final_003.pdf

²⁵ Years for which the World Bank's Findex database offers data on mobile money account penetration.

²⁶ Smartphone penetration between 2014 and 2017 grew from 11% to 41% in South Asia and 14% to 32% in Sub-Saharan Africa, according to the World Bank's Findex database: <https://globalfindex.worldbank.org/>.



Digital wallets have had positive impacts on consumption, savings, poverty, risk sharing, investment, and migration, particularly in emerging markets.²⁷ When migrants used digital wallets to remit income to Bangladesh, they cut poverty in rural households by 42%.²⁸ In Uganda, after the adoption of digital wallets, the food security of households far away from bank branches increased by 45%.²⁹ Urban migrant households that used digital wallets in Bangladesh saved 296% more than those who did not.³⁰ In China, thanks to digital wallets, mobile payment volume increased from de minimis levels in 2013 to 250% of GDP in 2020,³¹ boosting business formation and income while protecting households against income shocks.³²

The positive impacts of digital wallets on financial inclusion take on more importance when considering the high cost of legacy financial services that often hits low-income populations – especially in emerging markets – hardest. For example, although the global weighted average cost of sending \$200 abroad dropped below 5% for the first time in 2020,³³ remittances between and among most emerging market corridors remained expensive. Today, average remittance costs associated with sending \$200 from South Africa to Nigeria are 14.5%,³⁴ 13.1% between Ghana and Nigeria³⁵ and 15.1% between South Africa and Mozambique.³⁶ Some banks charge up to 30% of transactions in fees and foreign exchange costs. Even in developed markets like the US, low-income consumers can face extremely high fees. Payday lenders, for example, charge borrowers effective average interest of 391% at an annualized rate.³⁷

In ARK's view, acquiring users at dramatically lower customer costs (CAC) and leveraging digital-only business models, digital wallets not only offer financial services more cost-effectively than traditional institutions but also can service consumers – especially lower income earners – who previously would have been unprofitable. Square's Cash App, for example, is acquiring customers for roughly \$5,³⁸ while our research indicates that traditional banks pay \$1000.³⁹ As a result, Cash App is 'banking' previously unbanked/underbanked consumers in the southeast of the US, as

27 Bill & Melinda Gates Foundation. "The Impact of Mobile Money on Poverty", April 2021. https://docs.gatesfoundation.org/Documents/ImpactofMobileMoneyonPoverty_ResearchBrief.pdf

28 Bill & Melinda Gates Foundation. "The Impact of Mobile Money on Poverty", April 2021. https://docs.gatesfoundation.org/Documents/ImpactofMobileMoneyonPoverty_ResearchBrief.pdf

29 Wieser, Christina, et al. "The Impact of Mobile Money on Poor Rural Households: Experimental Evidence from Uganda." SSRN, 6 Aug. 2019, papers.ssrn.com/sol3/papers.cfm?abstract_id=3430525.

30 Bill & Melinda Gates Foundation. "The Impact of Mobile Money on Poverty", April 2021. https://docs.gatesfoundation.org/Documents/ImpactofMobileMoneyonPoverty_ResearchBrief.pdf

31 "Big Ideas 2021: Innovation Research by ARK Invest." ARK Invest, 22 Feb. 2021, ark-invest.com/big-ideas-2021/.

32 Huang, Yiping, et al. "Mobile Payment in China: Practice and Its Effects." Asian Economic Papers, MIT Press, 1 Oct. 2020, [www.mitpressjournals.org/doi/full/10.1162/asep_a_00779](https://doi.org/10.1162/asep_a_00779).

33 The World Bank, "Remittance Prices Worldwide - Issue 36, December 2020". https://remittanceprices.worldbank.org/sites/default/files/rpw_main_report_and_annex_q42020.pdf

34 "Remittance Prices Worldwide." Sending Money from South Africa to Nigeria - Remittance Prices Worldwide, remittanceprices.worldbank.org/en/corridor/South%20Africa/Nigeria.

35 "Remittance Prices Worldwide." Sending Money from South Africa to Nigeria - Remittance Prices Worldwide, remittanceprices.worldbank.org/en/corridor/South%20Africa/Nigeria.

36 "Remittance Prices Worldwide." Sending Money from South Africa to Mozambique - Remittance Prices Worldwide, remittanceprices.worldbank.org/en/corridor/South-Africa/Mozambique.

37 "Fact v. Fiction: The Truth about Payday Lending Industry Claims." Fact v. Fiction: The Truth about Payday Lending Industry Claims | Center for Responsible Lending, 1 Jan. 2001, www.responsiblelending.org/research-publication/fact-v-fiction-truth-about-payday-lending-industry-claims.

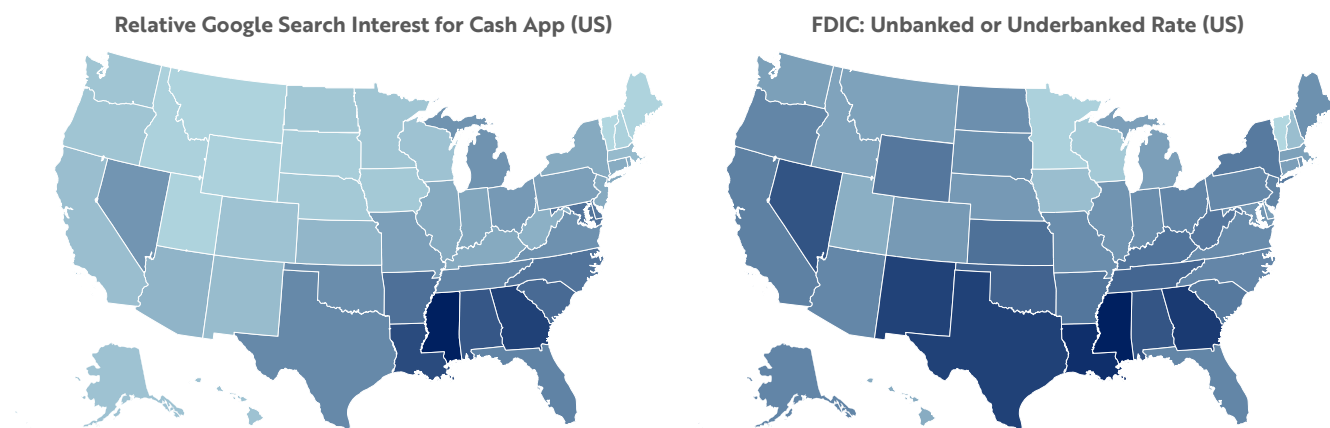
38 Square, Q4 2020 Shareholder Letter. https://s27.q4cdn.com/311240100/files/doc_financials/2020/q4/2020-Q4-Shareholder-Letter-Square.pdf

39 "Big Ideas 2021: Innovation Research by ARK Invest." ARK Invest, 22 Feb. 2021, ark-invest.com/big-ideas-2021/.



illustrated in the charts below by the overlap of Google Search interest for Cash App as a proxy for adoption and the unbanked rate by state. In the future, we believe Cash App probably will offer small-dollar loans at maximum APRs of 60%,⁴⁰ less than a seventh the APR of payday loans.

Figure 10: Google Search vs Unbanked Rate



For informational purposes only and should not be considered investment advice, or a recommendation to buy, sell or hold any particular security.

Source: ARK Investment Management LLC; Based on data from Google Trends; FDIC Survey of Household Use of Banking and Financial Services 2020, FDIC.

Conclusion

These three case studies illustrate how innovation might accelerate progress toward the UN Sustainable Development Goals. Broadly, we believe the five innovation platforms and the companies enabling their underlying technologies will offer the United Nations the best hope for achieving its Sustainable Development Goals by 2030.

Our research indicates that economic convergence will accelerate—the world will become flatter and the economic opportunity will become more evenly distributed: as digital wallets allow finance to become more inclusive, as reusable rockets allow internet access to become cheap almost anywhere on Earth, as artificial intelligence and gene editing collapse the cost of food production, and as the autonomous electric mobility systems deliver step-change reductions in the cost of getting from place to place.

⁴⁰ Ha, Anthony. "Square's Cash App Tests Money Borrowing for up to \$200." *TechCrunch*, TechCrunch, 12 Aug. 2020, techcrunch.com/2020/08/12/square-cash-app-borrowing.



We believe that environmental action will begin to meaningfully change the world's sustainability trajectory: as electric mobility reduces oil demand, as artificial intelligence enables more efficient provision of energy from renewable sources, as gene edited aquaculture reduces pressure on wild fish stock, as 3D printed aircraft parts deliver people from place to place at a lower energy cost, and as distributed ledgers allow governing bodies to track and hold global actors to account more efficiently.

Our research suggests that the characteristics of economic growth will be healthier:

- at human scale where gene sequencing and artificial intelligence advances are likely to unlock markets measured in the 10s of billions while delivering profound progress against complex diseases like cancer.
- at societal scale where smart contracting platforms are likely to more firmly secure property rights for individuals, and
- at global scale where battery technology and 3D printing should materially decrease the natural resource required to move people and things from place to place.

About the Author



 @wintonARK

Brett Winton, Director of Research at ARK Invest

Brett joined ARK in February 2014 and has worked alongside Cathie Wood for almost 15 years since their time at AllianceBernstein. As Director of Research, Brett guides and manages the proprietary research of ARK's investment team. The team recognizes that disruptive innovation demands a dynamic and universal approach. By researching across sectors, industries and markets, ARK's investment team seeks to gain a deeper understanding of the convergence and market potential of disruptive innovations, and thus size investment opportunities more appropriately.

Prior to ARK, Brett served as a Vice President and Senior Analyst on the Research on Strategic Change team at AllianceBernstein. In that role, Brett conducted thematic research, served on the thematic portfolios strategy committee under Cathie Wood's stewardship, and advised portfolio managers across asset classes. His research topics included Global Energy in the Face of Carbon Dioxide Regulation; Social Media and the Rise of Facebook; the Reformation of the Financial Services Landscape; and the Emergence of Electric Vehicles. He also is the Founder and Principal at iamB Consulting, providing strategy consulting to early stage startups. Prior to 2007, Brett worked in business development in the Radio-Frequency Identification industry after serving as a founding teacher at a charter high school in Los Angeles.

Brett earned his Bachelor of Science in Mechanical Engineering at the Massachusetts Institute of Technology (MIT).



©2021-2025, ARK Investment Management LLC. No part of this material may be reproduced in any form, or referred to in any other publication, without the express written permission of ARK Investment Management LLC ("ARK").

The information provided is for informational purposes only and is subject to change without notice. This report does not constitute, either explicitly or implicitly, any provision of services or products by ARK, and investors should determine for themselves whether a particular investment management service is suitable for their investment needs. All statements made regarding companies or securities are strictly beliefs and points of view held by ARK and are not endorsements by ARK of any company or security or recommendations by ARK to buy, sell or hold any security. Historical results are not indications of future results.

Certain of the statements contained in this presentation may be statements of future expectations and other forward-looking statements that are based on ARK's current views and assumptions and involve known and unknown risks and uncertainties that could cause actual results, performance or events to differ materially from those expressed or implied in such statements. The matters discussed in this presentation may also involve risks and uncertainties described from time to time in ARK's filings with the U.S. Securities and Exchange Commission. ARK assumes no obligation to update any forward-looking information contained in this presentation.

ARK and its clients as well as its related persons may (but do not necessarily) have financial interests in securities or issuers that are discussed. Certain information was obtained from sources that ARK believes to be reliable; however, ARK does not guarantee the accuracy or completeness of any information obtained from any third party.

ARK Invest Management LLC

3 East 28th Street, 7th Floor
New York, NY 10016

info@ark-invest.com
www.ark-invest.com

 Join the conversation on Twitter
@ARKinvest