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Five Years of Disruptive Innovation

By the ARK Invest Research Team

To mark five years since the launch of the Nikko AM ARK Disruptive Innovation Fund, Nikko AM and ARK Invest take a look at the five primary innovation platforms, their achievements over the last five years, and our expectations for them during the next five to ten years.

Artificial Intelligence (“AI”): “Driving” Autonomous Robotaxis

Generative AI made waves this year, increasing our confidence in the commercial viability of robotaxis and other autonomous mobility systems. Thanks to DALL-E-2, ChatGPT, and other breakthroughs, as well as the 70% annualized decline in AI training costs that we estimate, the productivity growth of knowledge workers should accelerate significantly during the next five to ten years. Neural networks are beginning to exceed human performance in a number of industries. Autonomous transportation should prove no different. In December 2018, Waymo debuted a limited robotaxi service with supervisors in the front seat.¹ Five years later, autonomous vehicles are roaming 18+ cities across the US and China, nine of which are offering service to the public with no one in the front seat. With robotaxis a reality, ARK’s research suggests that, in five years, global autonomous ride-hail platforms could be generating \$4 trillion in revenue and creating \$14 trillion in enterprise value.²

Energy Storage and Electric Vehicles: A Charged Future

In 2017, ARK forecasted that sales of electric vehicles (“EVs”) with 200+ miles in range would approach ~17 million globally in 2022. A global pandemic, supply challenges, commodity price spikes, and the consumer preference for longer ranges limited unit sales to 7.8 million,³ which nonetheless was 4-times the consensus estimate in 2017. ARK’s forecast missed by ~45%, but the consensus estimate was off by ~400%. ARK forecasts that EV prices will continue to decline, and that sales will increase more than 7-fold, or 50% at an annual rate during the five years ended 2027, rising from 7.8 million in 2022 to 60 million units, or approximately 10% of total auto sales globally in 2022 to ~65%.⁴

¹ Based on data from Krafcik, J. 2018. “Waymo One: The next step on our self-driving journey.” Waymo.

<https://waymo.com/blog/2019/08/waymo-one-next-step-on-our-self-driving.html>

² ARK Investment Management LLC, 2023. See also Chancellor, D. 2022. “Editing The Future.” Informa Pharma Intelligence.

<https://invivo.pharmaintelligence.informa.com/IV124991/Editing-The-Future>

³ See Irle, R. 2022. “Global EV Sales For 2022.” EVvolumes.com.

⁴ ARK Investment Management LLC, 2023, based on data from Bloomberg Finance L.P., data as of 01/19/23. See also Irle, R. 2022. “Global EV Sales For 2022.” EVvolumes.com. Forecasts are inherently limited and cannot be relied upon. For informational purposes only and should not be considered investment advice or a recommendation to buy, sell, or hold any particular security. Past performance is not indicative of future results.



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Robotics: The Automation Revolution

In 2018, ARK forecasted that industrial robot sales would grow at a compound annual rate of 19%, thanks to sensor technology that enables them to work alongside humans, thereby lowering costs. Since 2017, Amazon's robot fleet has increased 40% at an annual rate, from 100,000 to 750,000, and now is rising by 1,000 robots per day.⁵ Since 2018, the rate at which robots can "pick and place" has increased ~41% at an annual rate, from 250 to 1,000 items per hour, surpassing the 400 items per hour in human performance.⁶ The convergence between AI and robotics promises even greater capability, speed, and adoption during the next five years. ARK estimates that the combination of manufacturing robots and 3D printing could scale ~80% at an annual rate during the next seven to eight years, from \$70 billion in 2022 to ~\$9 trillion by 2030.

Genomics: The Leap into Multiomics

In 2018, ARK forecasted that the cost of sequencing a whole human genome would drop ~37% at an annual rate, from \$1,000 to ~\$100 in 2023. Today, the cost is ~\$150.⁷ Moreover, modern sequencing techniques are more accurate, reliable, and comprehensive, and should advance the goal of precision therapy. In addition, from 2018 to 2023, the number of gene-editing trials has more than quadrupled from 59 to 279.⁸ Rapid advances in artificial intelligence, DNA and RNA sequencing, CRISPR gene editing, and laboratory automation are spawning new therapies, enabling the treatment of diseases previously considered intractable. Increasingly, precision therapies likely will be multiomic, with mechanisms of action spanning across DNA, RNA, proteins, methylation, and more. Based on ARK's research, the enterprise value of companies focused on precision therapies could appreciate 29% at an annual rate, from ~\$500 billion to ~\$3 trillion by 2030.

Blockchain Technology: A Financial Evolution

Since 2018, the total market capitalization of cryptoassets has scaled roughly 66% at an annual rate, from \$100 billion to \$1 trillion as of June 30, 2023,⁹ thanks to maturing markets, deeper liquidity, and institutional adoption. Our research suggests that during the next five to ten years, Bitcoin, DeFi, and Web3 should continue to scale: cryptocurrencies and smart contracts could command market values of \$20 trillion and \$5 trillion, respectively.

⁵ Based on data from Amazon as of 12/31/22. See also Jabil Inc. 2021. "3D Printing Trends: Six Major Developments." Jabil Inc. <https://www.jabil.com/blog/3d-printing-trends-show-positive-outlook.html>

⁶ ARK Investment Management LLC, 2023, based on data from Roach, J. 2022. "Pinch-grasping robot handles items with precision." Amazon. <https://www.amazon.science/latest-news/pinch-grasping-robot-handles-items-with-precision>

⁷ ARK Investment Management LLC, 2023, as of August 31, 2023. This ARK analysis is based on a range of underlying data from external sources, which may be provided upon request.

⁸ ARK Investment Management, 2023. This ARK analysis is based on a range of underlying data from external sources, which may be provided upon request.

⁹ Based on data from CoinGecko. <https://www.coingecko.com/>



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Conclusion

According to ARK's research, the equity value associated with AI, Energy Storage, Robotics, Multiomics Sequencing, and Public Blockchains could scale roughly 15-fold, or 40% at an annual rate, to ~\$200 trillion during the next five to ten years. As a result, disruptive innovation could dominate equity market values, increasing from 10-15% of the total to more than 50%. Including cryptoassets, disruptive innovation could approach 70% of the global equity market valuation by 2030.¹⁰

About ARK Invest:

Headquartered in Saint Petersburg, Florida, USA, ARK Investment Management LLC is a federally registered investment adviser and privately held investment firm with 23.9 bn USD¹¹ assets under management. Specializing in thematic investing in disruptive innovation, the firm is rooted in over 40 years of experience in identifying and investing in innovations that should change the way the world works. Through its open research process, ARK identifies companies that it believes are leading and benefiting from cross-sector innovations such as robotics, energy storage, DNA sequencing, artificial intelligence, and blockchain technology. For more information on ARK Invest's research, insights, and the full Big Ideas 2023 report, visit www.ark-invest.com.

About Nikko Asset Management:

Nikko Asset Management is one of Asia's largest asset managers, with 219.2bn USD¹² under management, providing high-conviction, active fund management across a range of Equity, Fixed Income and Multi-Asset strategies. In addition, our complementary range of passive strategies covers more than 20 indices and includes some of Asia's largest exchange-traded funds (ETFs).

In the pursuit of excellence, we approach everything we do with an entrepreneurial mindset. This enables us to think differently, transforming intelligent insights into innovative, relevant investment opportunities for our clients. Leveraging our unique combination of a global perspective complemented by our Asian DNA, we aspire to create sophisticated and diverse solutions that set new standards in the asset management industry.

For more information, visit <https://emea.nikkoam.com/>

Nikko AM & ARK Invest

In 2017 Nikko AM enhanced its disruptive innovation-focused investment solutions by acquiring a minority stake in ARK Invest. The partnership has led to investment products across the spectrum of technologically enabled disruptive innovation in the public markets.

¹⁰ ARK Investment Management LLC, 2023. As of year-end 2022. Numbers are rounded. ARK estimates that \$13.4 trillion of market value is attributable to the disruptive technologies it covers today. By 2030 ARK estimates that market value attributable to these technologies will exceed \$206 trillion. Market value includes public companies, private companies, cryptocurrencies, and smart contract protocols. Forecasts are inherently limited and cannot be relied upon. For informational purposes only and should not be considered investment advice or a recommendation to buy, sell, or hold any particular security or cryptocurrency. Past performance is not indicative of future results.

¹¹ As of June 2023.

¹² As of June 2023.



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