



# Charting Disruption

Insights into the World's Most Powerful Disruptive Themes

—  
Q4 2020

## What's in this Edition?

COVID-19 induced disruption continued through Q4 2020 as the world grappled with surges in infections and faced obstacles to reopening. In this edition of *Charting Disruption*, we explore how the below themes evolved and what we should expect from them in 2021.

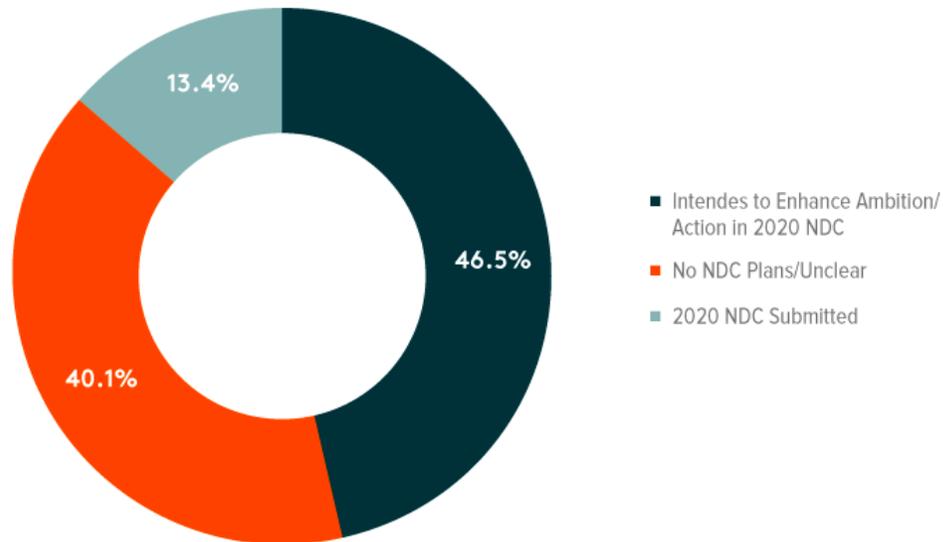
CleanTech: A Necessity-Driven Market	2
Genomics: Success in Pandemic Proving Ground	3
FinTech: Payment Adoption a Global Trend	4
EVs, Lithium, & Battery Technology: Hitting The Accelerator	5
Cannabis: Gaining Greater Acceptance in U.S.	6
Telemedicine & Digital Health: Health Care Finally Embracing Digital Tech	7
Cloud Computing: Work-From-Home is Here to Stay	8
Data Centers & Digital Infrastructure: The Hardware Behind Digitalization	9
Robotics: Automation & Reshoring Point to Adoption	10
Social Media: New Monetization Strategies Fuel Recovery	11
Video Games & Esports: A New High Score	12
Education: Lessons Learned	13
U.S. Infrastructure Development: Major Legislation in 2021?	14
Q4 2020 Thematic Research Highlights	15
Global X Thematic Growth ETF Suite	16

# CleanTech: A Necessity-Driven Market

2020 is one of the hottest years on record. Without emissions mitigation efforts involving CleanTech, the environmental, social, and economic impacts of continued warming could be catastrophic. Recent decarbonization commitments from China, Japan, Korea, Canada and the EU and an incoming climate-conscious Biden Administration in the U.S. could result in accelerated CleanTech investment.

## COUNTRIES REPRESENTING ~60% OF GLOBAL EMISSIONS SUBMITTED/PLAN TO SUBMIT PARIS AGREEMENT NDCs

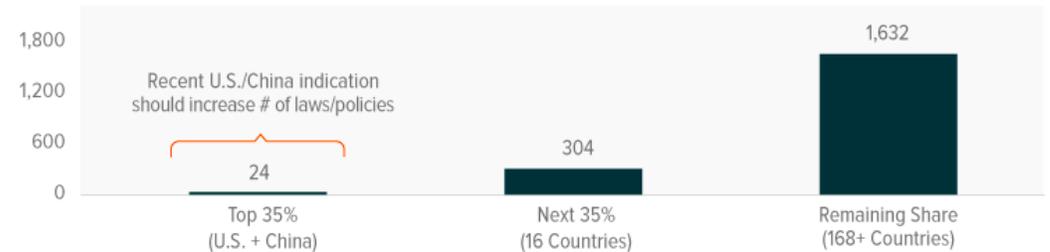
SHARE OF GLOBAL GREENHOUSE GAS EMISSIONS BY NDC STATUS (%)



Note: Nationally Determined Contributions (NDCs) are regularly updated climate pledges requested by the Paris Agreement. Source: Global X ETFs, Climate Watch, World Resources Institute, Dec 2020.

## FUTURE & EXISTING CLIMATE CHANGE LAWS/POLICIES SHOULD DRIVE CLEANTECH INVESTMENT IN COMING YEARS

CLIMATE LAWS/POLICIES BY EMISSIONS SHARE SEGMENT (#)



EMISSIONS SHARE SEGMENT COMBINED GDP (\$T)

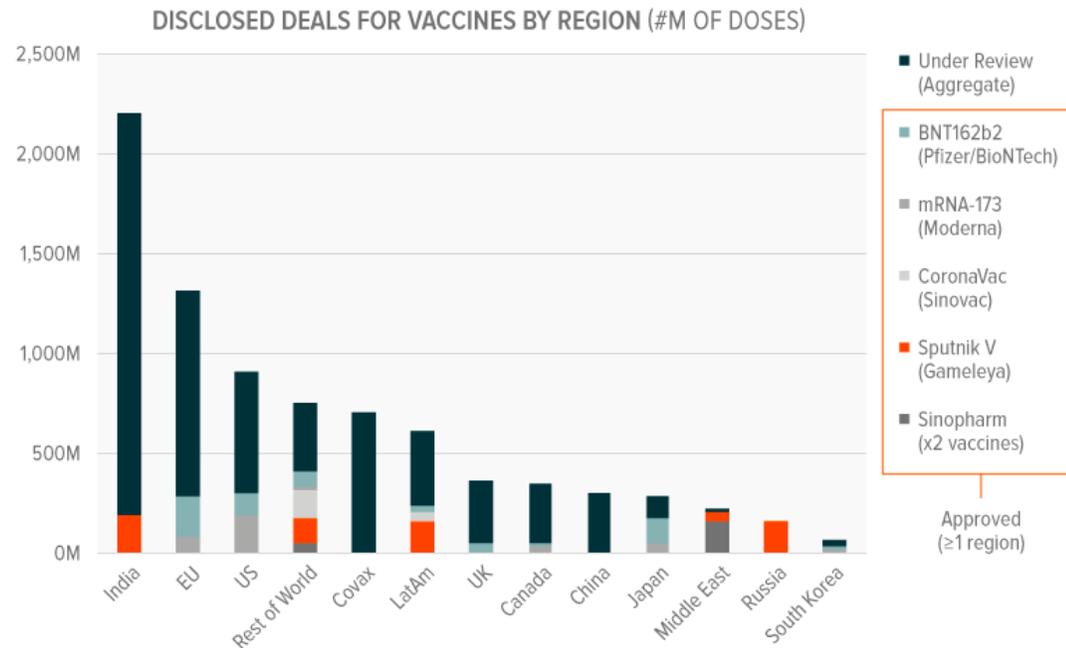


Note: Climate laws/policies tracked by GRI (Top); GDP most recent reported in current \$USD (Bottom). Source: Grantham Research Institute, World Bank, Climate Watch, World Resources Institute, Global X ETFs, Dec 2020.

# Genomics: Success in Pandemic Proving Ground

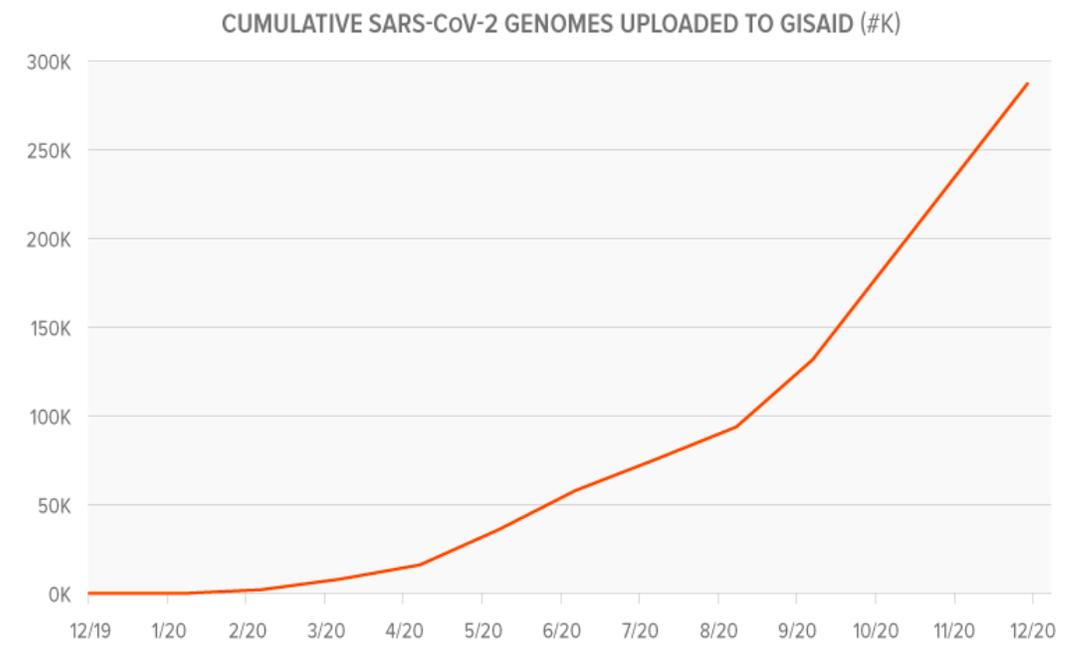
Genomics benefitted from the massive mobilization of resources for virus mitigation efforts throughout 2020. From the discovery of the virus and surveillance to the development of diagnostics and pharmaceuticals, the recent advancement of genomics-related science and technology gave the world tools to fight COVID-19.

## MULTI-OMICS APPROACHES LED TO DEVELOPMENT OF MULTIPLE APPROVED VACCINES IN RECORD TIME



Note: Approved = used in inoculations as of 12/22/20, may not reflect country-level approval; excludes undisclosed doses. Source: Global X ETFs, Bloomberg, Regulatory Affairs Professionals Society, Dec 22 2020.

## NEXT-GENERATION SEQUENCING ADVANCEMENTS ENABLE EXPONENTIAL GROWTH OF SARS-CoV-2 GENOME SHARING

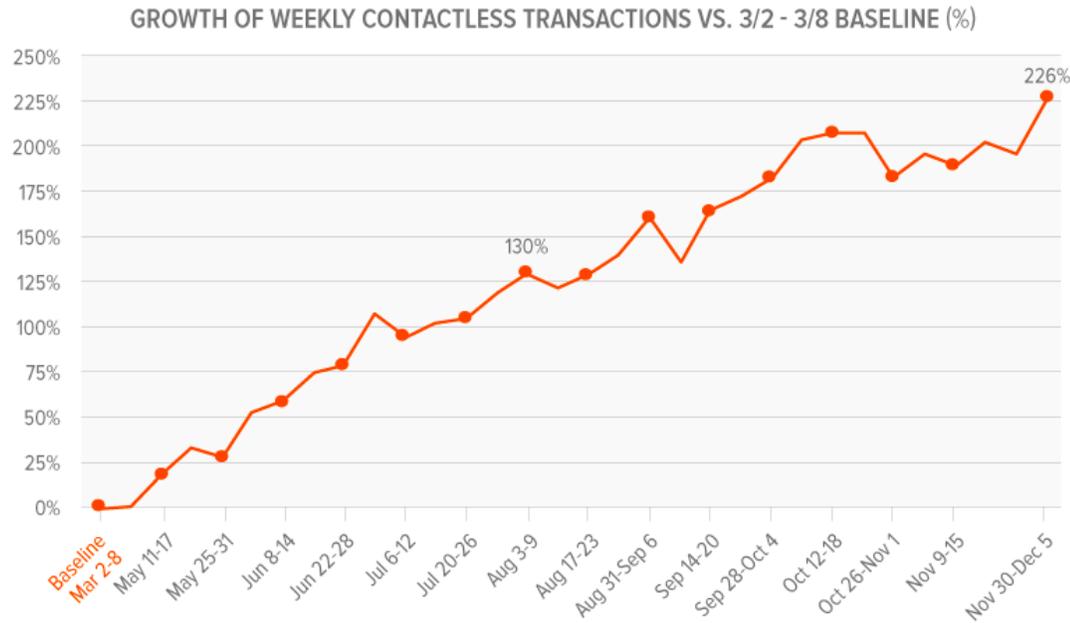


Note: GISAID is the predominant/most comprehensive genome sharing database for influenza viruses & SARS-CoV-2. Source: Global X ETFs, GISAID, Dec 22 2020.

## FinTech: Payment Adoption a Global Trend

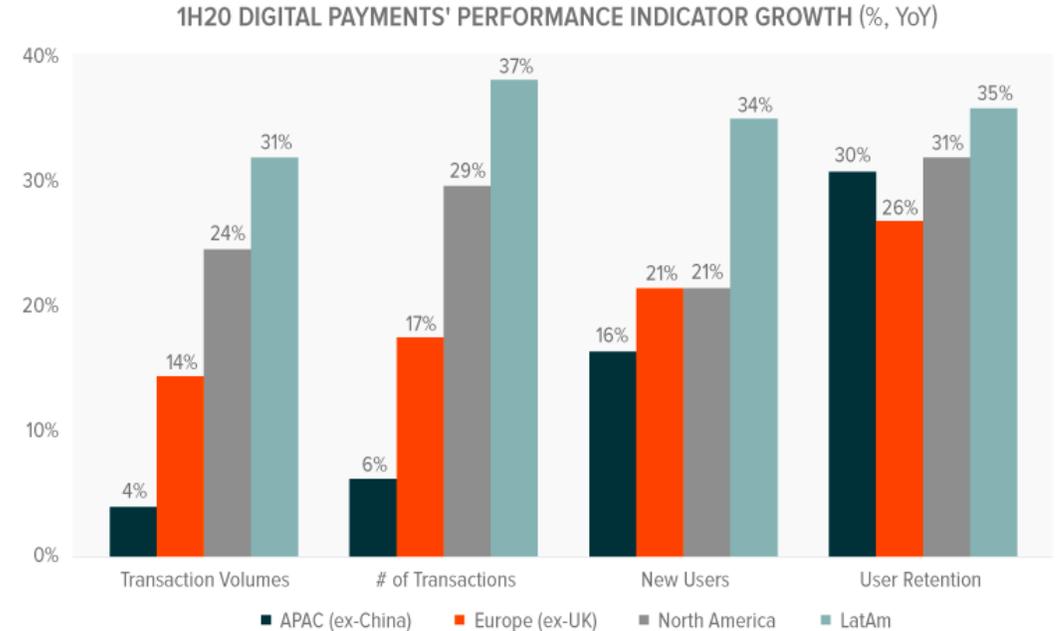
FinTech adoption accelerated as consumers grappled with the pandemic reality. Digital payment systems benefitted from integration with online retail platforms amid a surge in e-commerce spending. Contactless payment volumes also accelerated as consumers ditched physical cash for more hygienic digital alternatives. Now that the necessary infrastructure is in place, digital payments could continue to accelerate post-pandemic.

### CONTACTLESS TRANSACTIONS CONTINUE TO TREND UPWARD, REFLECTING BEHAVIORAL SHIFT AS WE APPROACH NEW NORMAL



Note: N = 60k small businesses in US that use CardFlight software to accept digital payments.  
Source: Global X ETFs, Card Flight Small Business Report, Mar-Dec 2020.

### PANDEMIC DRIVES GLOBAL DIGITAL PAYMENT ADOPTION/USE, NOTABLE SURGES IN NORTH AMERICA & LATIN AMERICA

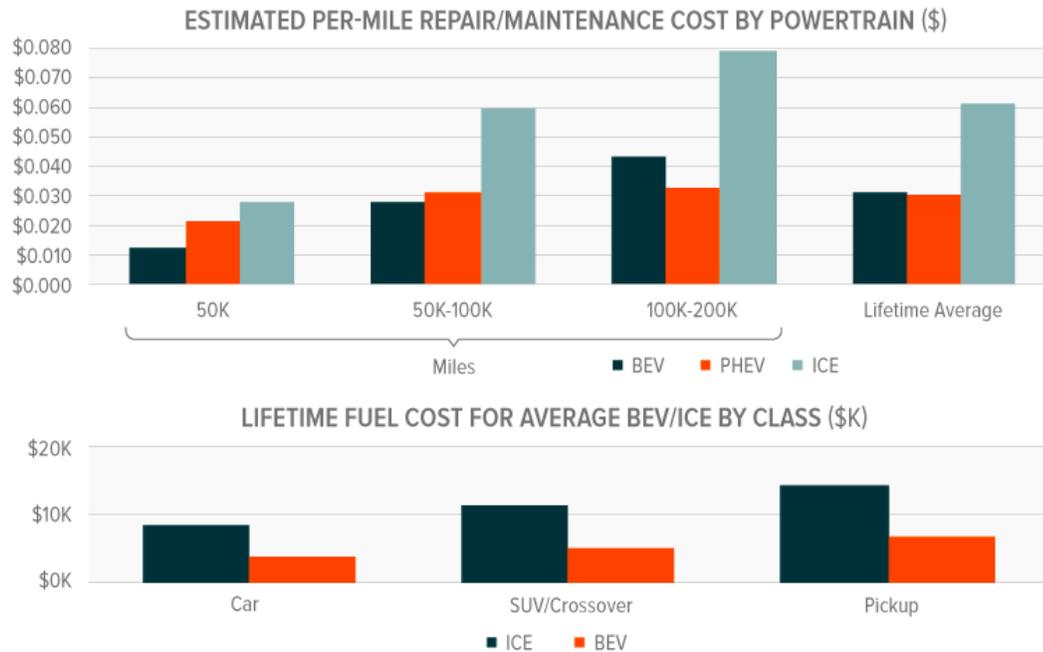


Note: Survey of 9,431 FinTechs by World Bank, CCAF, WEF, finalized on 10/10; YoY = Year-over-Year.  
Source: Global X ETFs, World Bank, CCAF, World Economic Forum, Dec 2020.

# EVs, Lithium, & Battery Technology: Hitting the Accelerator

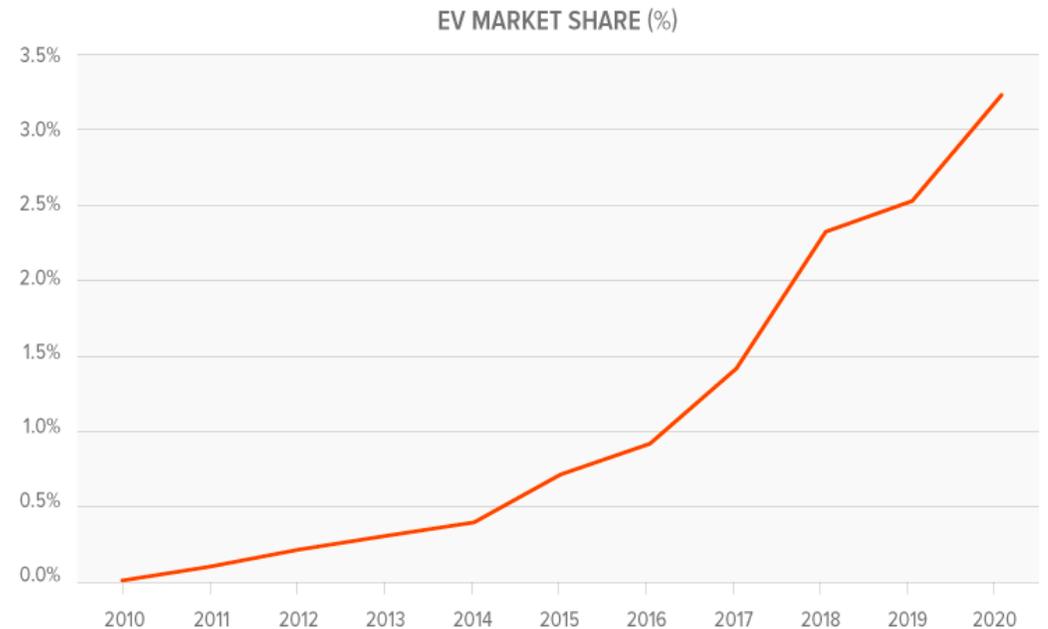
Despite the pandemic's initially negative impact on the automobile market, electric vehicles (EVs) gained market share on internal combustion engine (ICE) vehicles. Beyond falling EV costs, consumers are incentivized by greater reliability and fuel cost savings. Mounting regulations like emissions fines are further reducing ICE sales. As this continues and battery prices drop, EVs' market share should rise.

## GAS & MAINTENANCE COST SAVINGS CONTRIBUTING TO RAPID EV ADOPTION



Note: Consumer Reports analysis of 2019/20 data; Present value at 3% discount rate in '19 \$USD, over 200k lifetime; PHEV (Plug-in Hybrid), BEV (Battery Electric), ICE (Internal Combustion). Source: Consumer Reports, Global X ETFs, 2020.

## EV ADOPTION CONTINUED IN 2020, DRIVEN BY COST SAVINGS & POLICIES LIKE EMISSIONS FINES

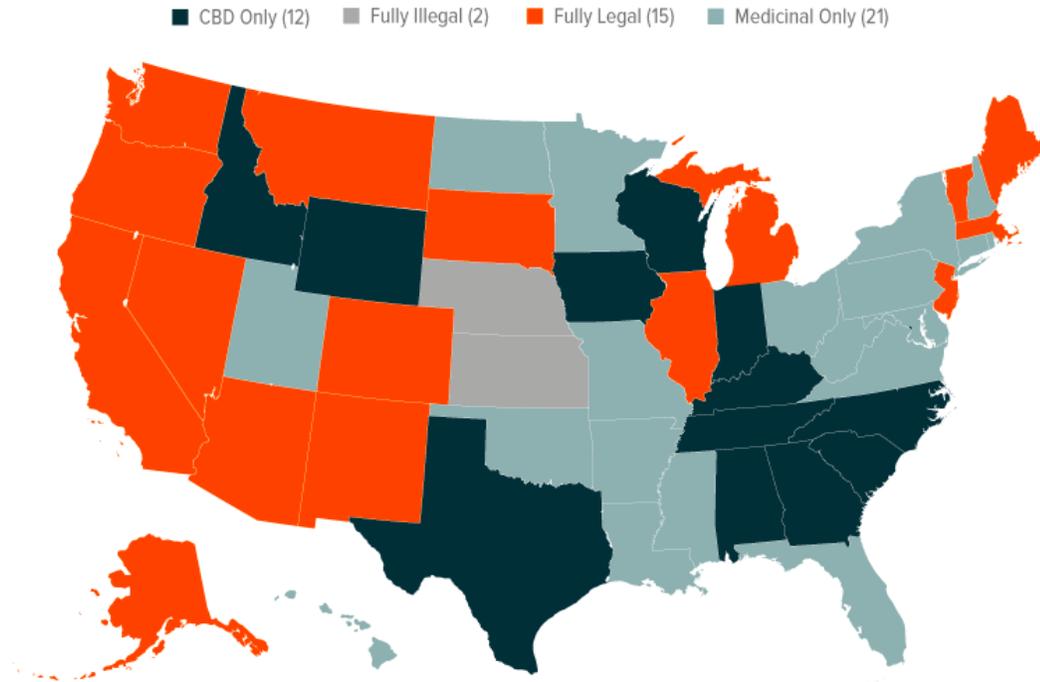


Note: Data from IEA analysis of EV-Volumes (2020) & IEA Data. Source: IEA, EV-Volumes, Global X ETFs, Dec 2020.

## Cannabis: Gaining Greater Acceptance in U.S.

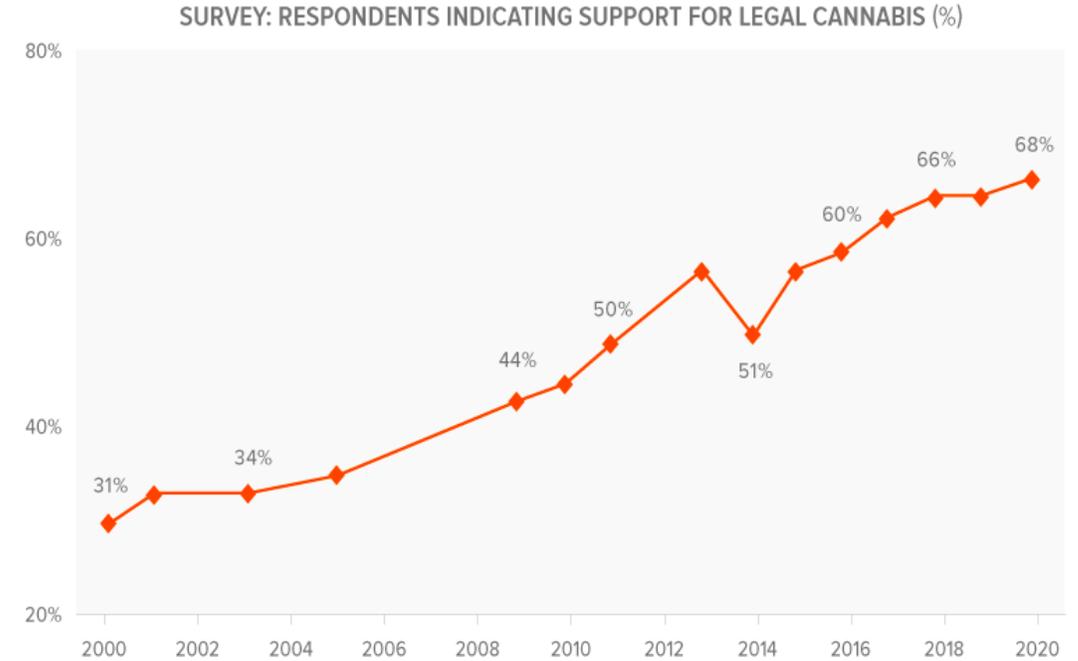
This Fall, cannabis' legal status appeared on 5 state election ballots, with voters approving measures in each case. Arizona, New Jersey, and Montana voted to legalize cannabis for recreational use; South Dakota approved it for recreational and medical use; and Mississippi became the first southern state to legalize it for medical use. While it is still illegal at the federal level, state-level progress could pave a path toward national legalization.

### 2020 U.S. STATE ELECTIONS EXPANDED CANNABIS' LEGAL STATUS AT STATE-LEVEL



Source: Global X ETFs, Cannabis Business Times, November 2020.

### SUPPORT FOR LEGALIZATION OF CANNABIS REACHES ALL-TIME HIGH IN U.S.

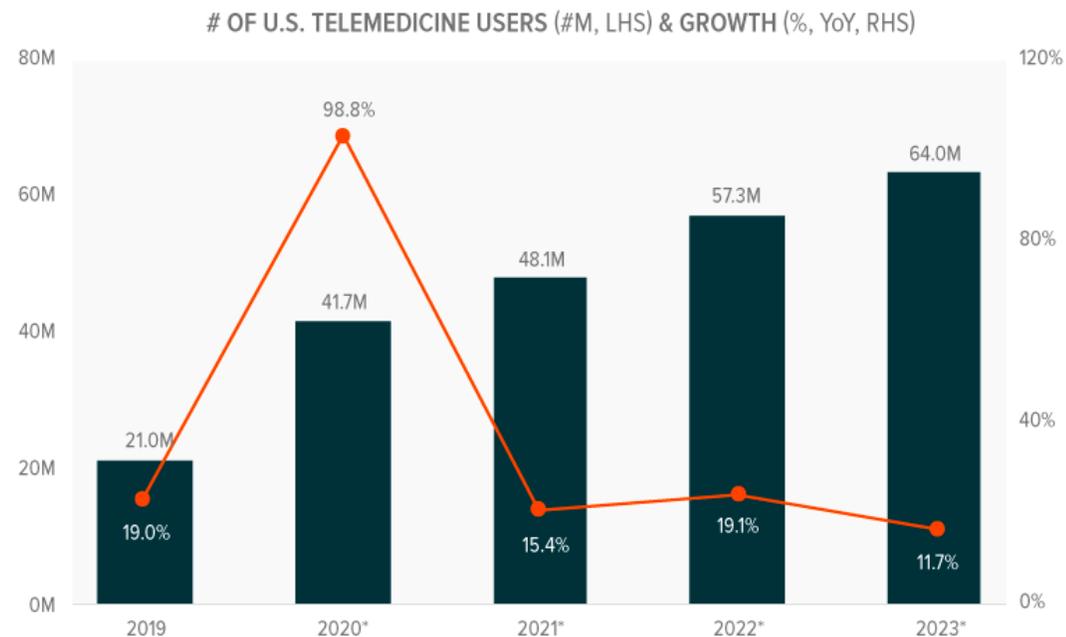


Note: Chart reflects composite of 15 Gallup polls conducted from 2000-2020.   
 Source: Gallup, Nov 2020.

## Telemedicine & Digital Health: Health Care Finally Embracing Digital Tech

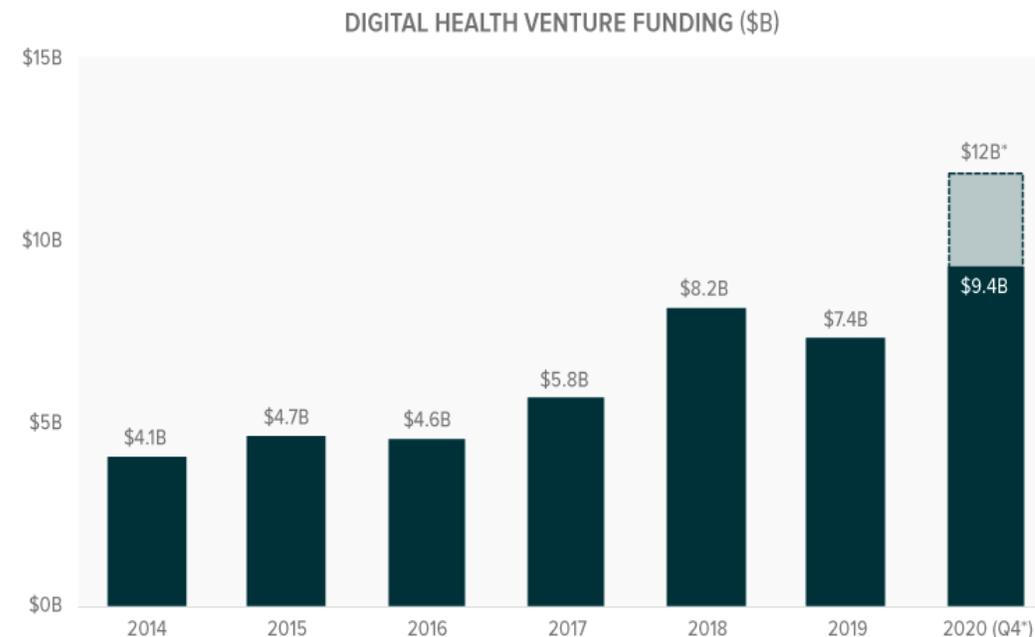
2020's global lockdowns and infection fears drove patients and providers to telemedicine services. Artificial intelligence (A.I.)-equipped analytics software became a valuable tool for drug and vaccine development, symptom identification, and hospital triaging. Many relied on connected devices like wearables to monitor their health. In our view, this adoption accelerated a structural shift that will continue to play out in the years to come.

### U.S. TELEMEDICINE USERS DOUBLED IN 2020, GROWTH EXPECTED TO NORMALIZE & CONTINUE IN COMING YEARS



Note: \*Estimate; YoY = Year-over-Year.  
Source: eMarketer, Oct 2020.

### 2020 DIGITAL HEALTH VENTURE FUNDING BREAKS RECORD THROUGH 3 QUARTERS, SETTING UP FUTURE INDUSTRY GROWTH

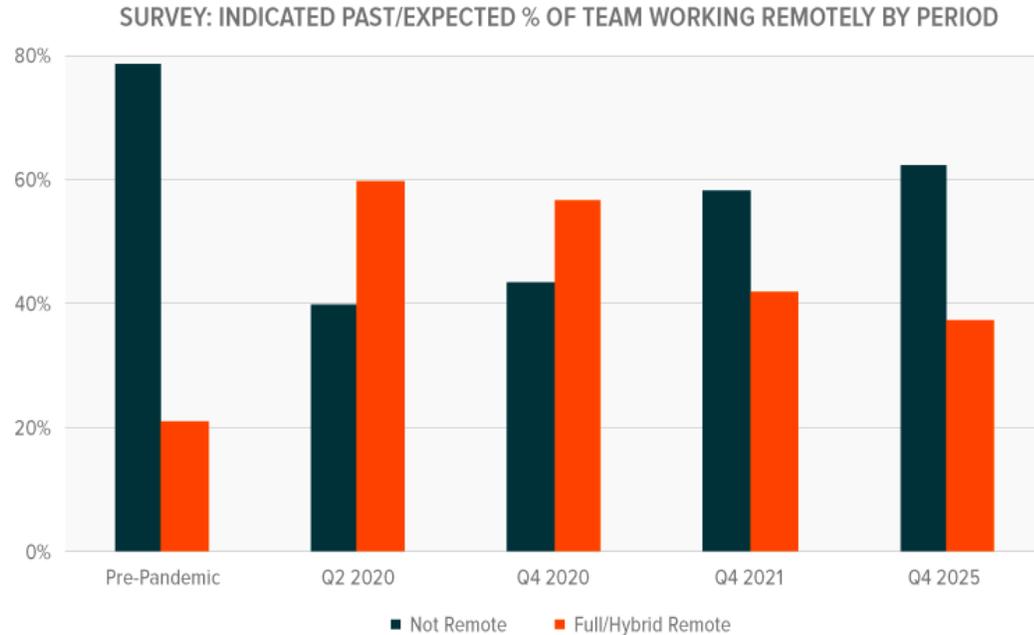


Note: \*2020 estimate including actual Q3 \$ & Q4 estimate.  
Source: Rock Health Funding Database, Sep 30, 2020.

## Cloud Computing: Work-From-Home is Here to Stay

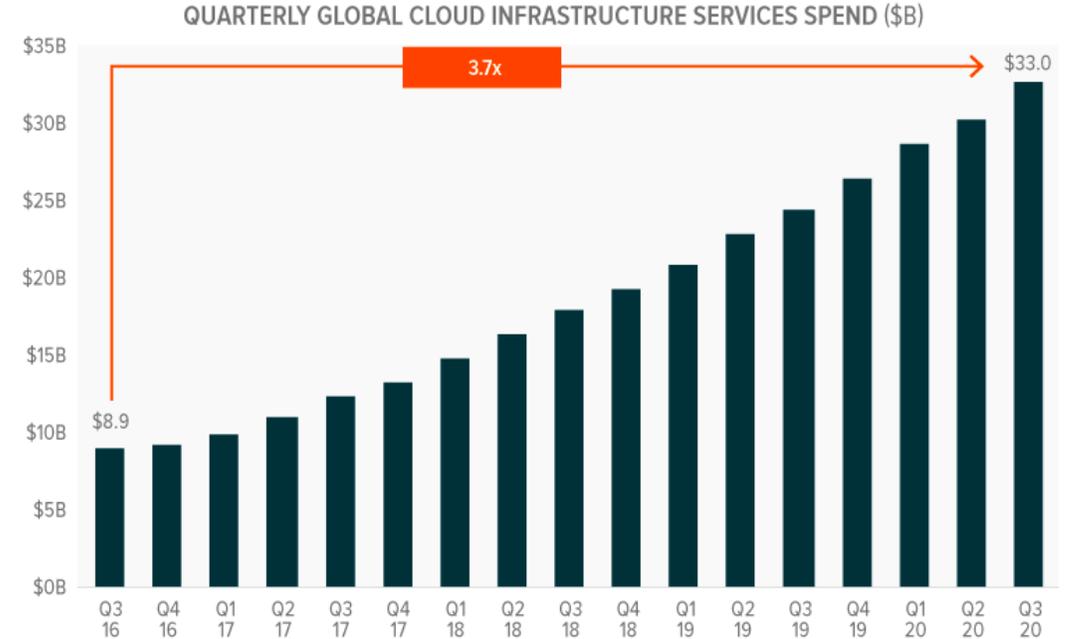
Cloud computing enabled 2020's successful work-from-home experiment. Through the cloud, at-home employees could virtually access their regular suite of applications and files and collaborate with their colleagues. We expect enterprises to further embrace cloud-based Software-as-a-Service (SaaS) with many employees still out of the office and organizations embracing remote work as part of the New Normal.

### REMOTE WORK PERSISTS ALMOST A YEAR INTO PANDEMIC; BUSINESSES EXPECT MORE REMOTE EMPLOYEES IN LONG-TERM



Note: N = 1,000 hiring managers surveyed from 10/21 - 11/7/20; Full/hybrid combined due to impact on cloud demand. Source: Global X ETFs, Upwork, Dec 2020.

### DIGITAL INFRASTRUCTURE SPEND CONTINUES TO INCREASE AS ENTERPRISES ANTICIPATE CONTINUED REMOTE WORK

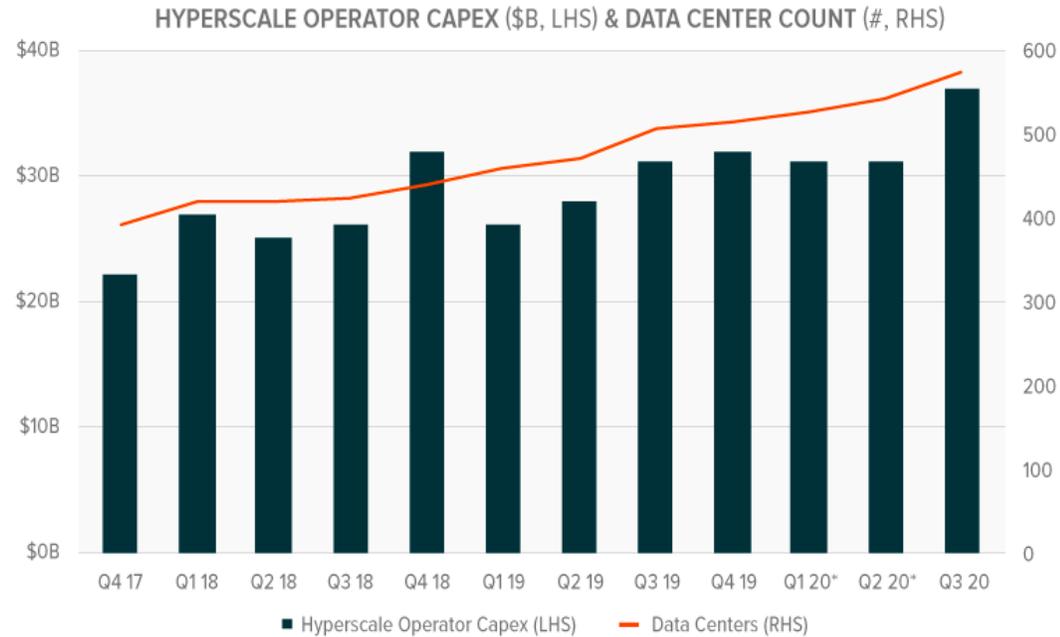


Note: Data is composite of GX analysis and initial data points drawn from quarterly SRG press releases (01/17 - 12/20). Source: Synergy Research Group, Global X ETFs, 2020.

## Data Centers & Digital Infrastructure: The Hardware Behind Digitalization

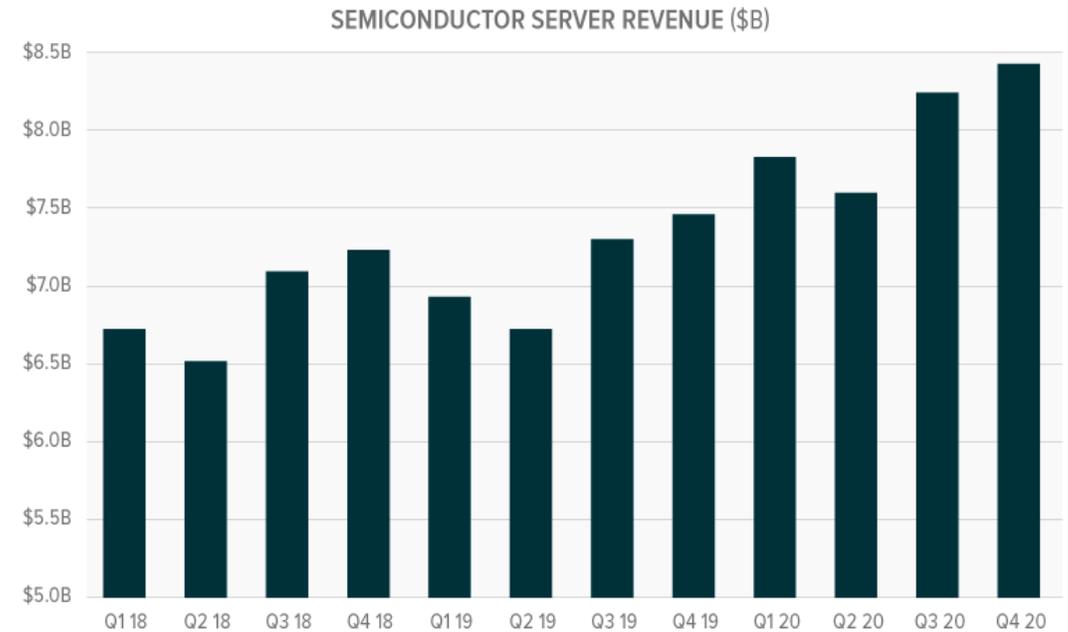
Increasing demand for cloud computing resources and the rapidly growing number of internet-connected devices are driving continued investment in data centers and digital infrastructure. As digitalization continues and technology advances, we expect cloud providers and network operators to increase their spend on necessary back-end hardware.

### HYPERSCALE CAPEX REACCELERATES IN ANTICIPATION OF FUTURE CLOUD COMPUTING DEMAND



Note: Data from quarterly Synergy Research Group press releases (02/18 - 12/20); \*Estimated from 1H 20 figure.  
Source: Synergy Research Group, Global X ETFs, Dec 2020.

### SEMI REVENUES FROM SERVER END-MARKETS SURGED AS WORK-FROM-HOME UPPED DEMAND FOR VIRTUAL STORE/COMPUTE

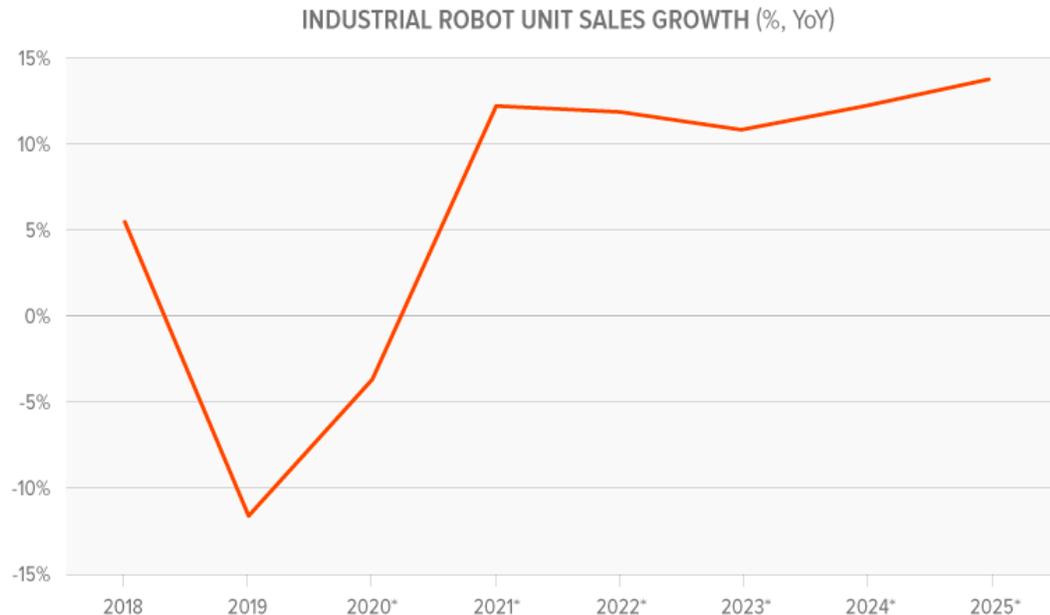


Note: Semi revenue reflects sum of server end market revenues.  
Source: Bloomberg, Global X ETFs, 2020.

## Robotics: Automation & Reshoring Point to Adoption

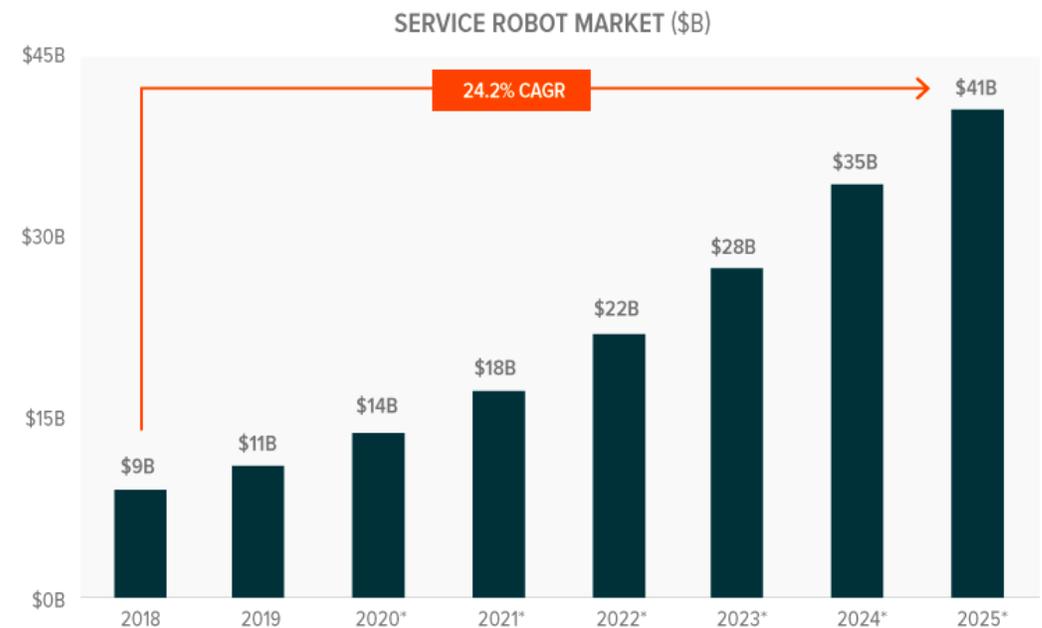
Robotics were critical to business continuity across a variety of sectors during the pandemic. In industrial settings, we expect adoption to continue at a strong pace as decisionmakers seek to limit supply chain risks through reshoring and improve safety and efficiency through automation. Service robots should also benefit from sanitation needs and demand in the health care sector.

### AFTERMATH 2019/20's GEOPOLITICAL/COVID-RELATED HEADWINDS, RESHORING/AUTOMATION DEMAND SHOULD REACCELERATE INDUSTRIAL ROBOT SALES



Note: N = 60k small businesses in US that use CardFlight software to accept digital payments.  
Source: Global X ETFs, Card Flight Small Business Report, Mar-Dec 2020.

### MARKET FOR PROFESSIONAL SERVICE ROBOTS EXPECTED TO EXPAND IN NEW NORMAL, DRIVEN BY DEMAND FOR MEDICAL, CLEANING, & LOGISTICS ROBOTS

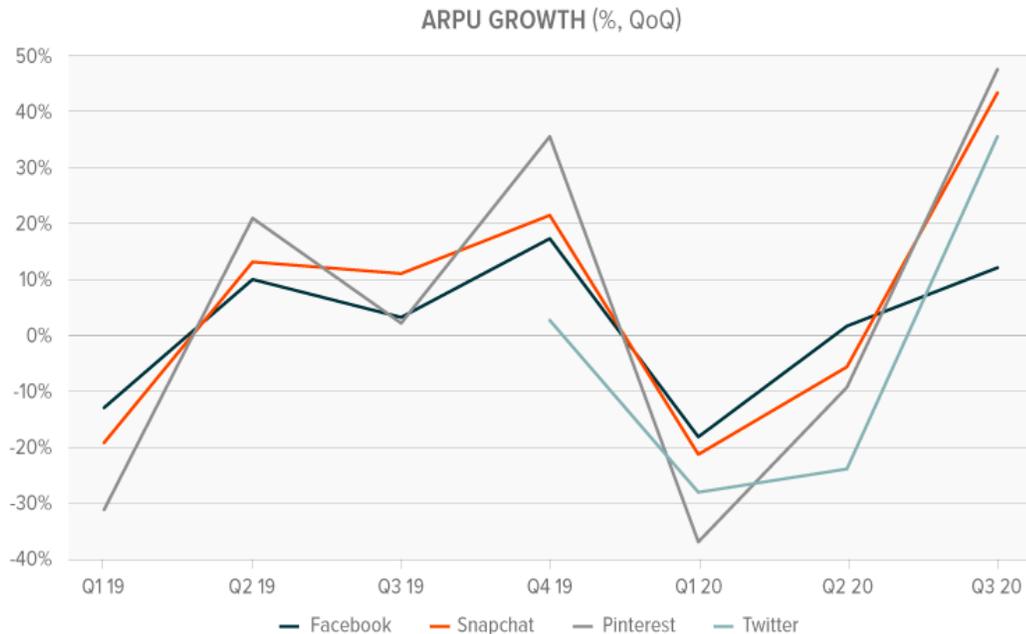


Note: 2017-2019 IFR reported; 2020-2025\* composite of in-house/ext. forecasts; CAGR = compound annual growth rate.  
Source: Global X ETFs, 2020; International Federation of Robotics, 2019-20; Loup Ventures, 2019.

## Social Media: New Monetization Strategies Fuel Recovery

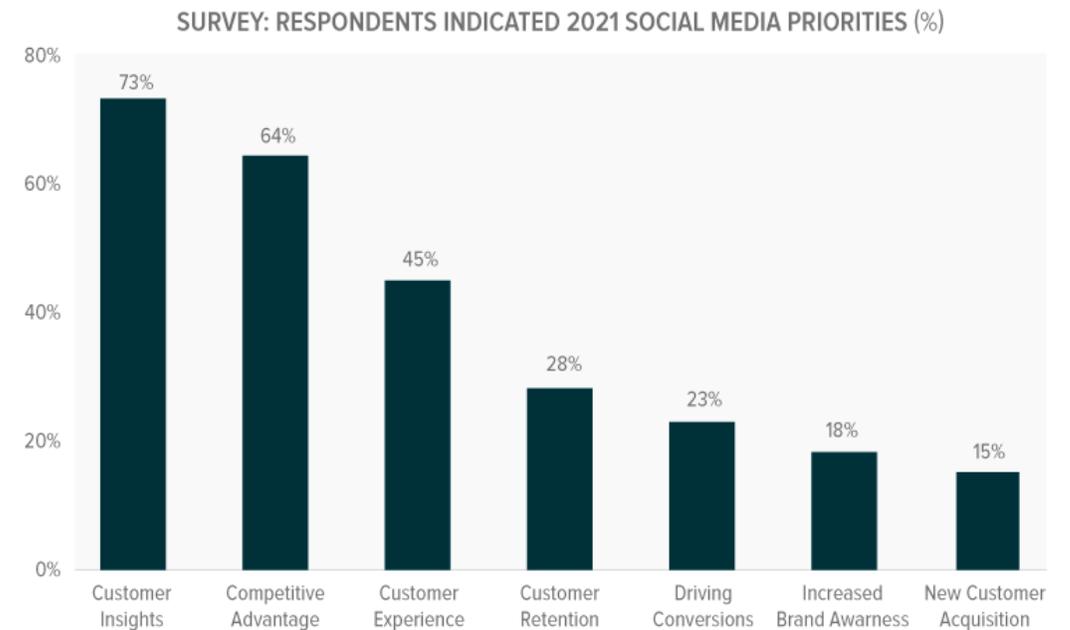
Social Media’s role in facilitating social interactions only became more important during the pandemic. Though decreased advertising spend reduced avg. revenue per user (ARPU) in Q1 & Q2, new monetization strategies and a spending recovery drove a successful Q3 for the largest social media platforms. We expect advertising revenues to increase in 2021 as businesses seek to recover from what was a difficult year for many.

### SOCIAL MEDIA ARPU GROWTH ACCELERATED AS PLATFORMS EXPANDED MONETIZATION EFFORTS, DIGITAL AD SPEND ROSE



Note: ARPU = Average Revenue Per User; QoQ = Quarter-over-Quarter.  
Source: Global X ETFs, Factset, Dec 2020.

### 2021 SOCIAL MEDIA MARKETING PRIOTITIES FOCUSED ON ACQUISITION AS BUSINESSES LOOK TO RECOVER FROM MUTED 2020



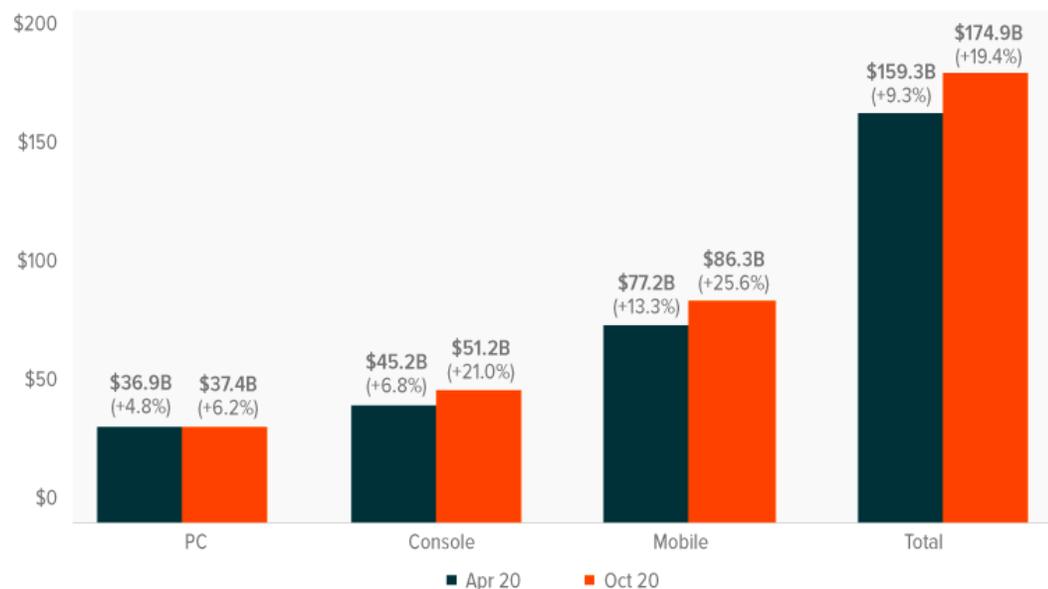
Note: Survey conducted by Hootsuite in Q3 2020, n = 9,279.  
Source: Hootsuite, 2020.

## Video Games & Esports: A New High Score

The pandemic offered many individuals newfound leisure time to explore Video Games & Esports. New video game consoles from Sony and Xbox and more robust cloud gaming offerings on Google’s Stadia and Amazon’s Luna could offer further tailwinds to this theme in 2021. We expect esports and streaming viewers and the convergence of social media and gaming to grow the share of entertainment dollars spent on gaming.

### UPDATED 2020 GAMES MARKET ESTIMATES REFLECT Q1 - Q3 PANDEMIC-DRIVEN STRENGTH, INCREASED END-OF-YEAR EXPECTATIONS

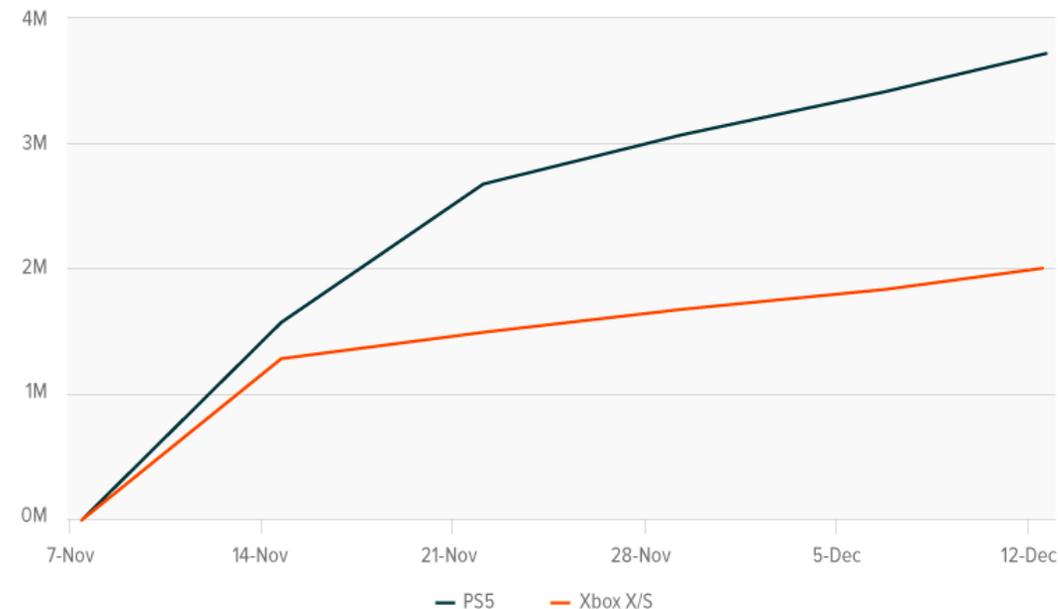
2020 GAMES MARKET APRIL/OCTOBER ESTIMATES BY SEGMENT (\$B; %, YoY)



Note: Apr 20 & Oct 20 reflect date of estimate publication; YoY = Year-over-Year.  
Source: Newzoo, Global X ETFs, 2020.

### NEXT-GEN GAMING CONSOLES LAUNCH, PS5 SALES LEAD XBOX THROUGH FIRST MONTH DESPITE SHORTAGES

CONSOLE UNIT SALES (#M)

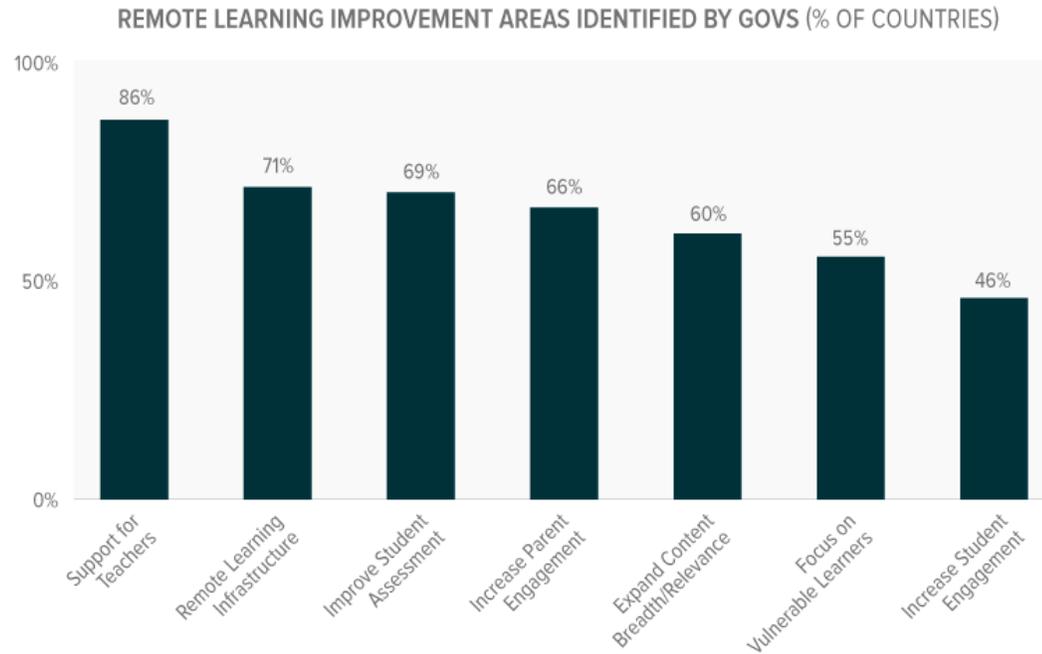


Source: VGChartz, Dec 2020.

## Education: Lessons Learned

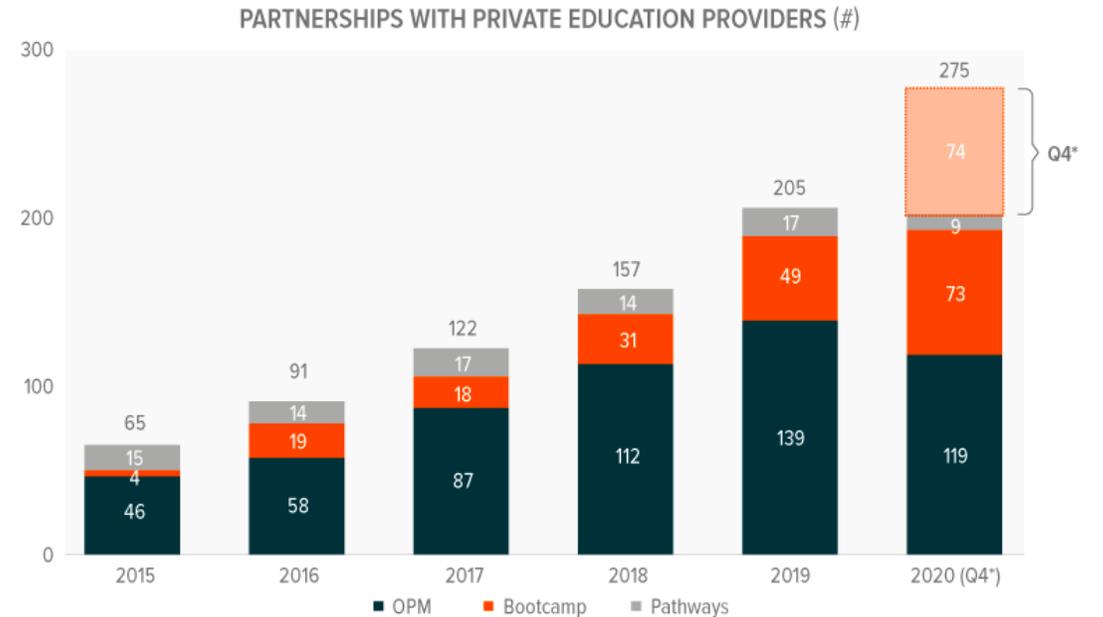
Faced with pandemic-induced closings, institutions partnered with private education providers and embraced digital technologies to continue educating their students. Though there were, and still are, growing pains, we expect the lessons of this year to translate into further opportunities in the sector.

### RESULTS OF 2020'S REMOTE LEARNING EXPERIMENT HIGHLIGHT OPPORTUNITIES FOR FUTURE EDTECH SOLUTIONS



Note: n = 134 reporting countries, reflects 8/28 - 9/22/20 reporting period.  
Source: Global X ETFs, UNICEF, Nov 2020.

### UNIVERSITY PARTNERSHIPS WITH PRIVATE (AND MOSTLY DIGITAL) EDUCATION PROVIDERS ACCELERATED DURING PANDEMIC



Note: OPM = online program manager, Bootcamp = short-form program, Pathways = international integration/recruiting;  
\*Estimated Q4 total across all categories.  
Source: HolonIQ, Oct 2020.

# U.S. Infrastructure Development: Major Legislation in 2021?

We expect to see progress on U.S. infrastructure legislation in 2021, driven by President-elect Biden’s intention of investing \$2T in infrastructure and cleantech. While a split government could present roadblocks, investment will likely go to building or retrofitting physical infrastructure; scaling cleantech for decarbonization efforts, and modernizing digital infrastructure related to broadband, 5G, data storage, and smart cities.

*President-elect Biden’s platform featured aggressive infrastructure investment as a key pillar of economic policy. His plan entails investment in...*

## Physical Infrastructure<sup>1</sup>

- Rebuilding & upgrading America’s highways, roads, & bridges through federal funding
- Revitalizing commerce-facilitating infrastructure like ports, waterways, & railways for passenger & freight
- Retrofitting 4M buildings, weatherizing 2M homes, & constructing 1.5M sustainable homes
- Replacing pipelines, sewers, & treatment plants & integrating water quality monitoring technologies



## CleanTech<sup>2</sup>

- Decarbonizing power sector by 2035 by investing in clean energy, smart grids, & stationary storage
- Reducing buildings emissions by 50% through investment in electrification & efficiency tech
- Electrifying the transportation sector by investing in 500K charging stations & restoring EV tax credits
- Reduce manufacturing emissions by investing in electrification, carbon capture & clean energy



## Digital Infrastructure<sup>3</sup>

- Using federal funding to expand access to broadband in rural areas
- Supporting municipality-owned networks and making federal telecom resources available
- Working with the FCC to increase the number of broadband providers
- Supporting smart city rollout by funding innovative urban planning strategies & smart city technologies



Sources: 1. JoeBiden.com, “Infrastructure Plan,” 2020.; 2. JoeBiden.com, “Clean Energy,” 2020.; 3. JoeBiden.com, “Infrastructure Plan,” 2020.

## Q4 2020 Thematic Research Highlights

See our latest research on thematic investing for more information on these powerful trends, or visit [globalxetfs.com/research](https://globalxetfs.com/research)

- [Four Companies Leading the Rise of Lithium & Battery Technology](#)
- [Four Companies at the Center of the Telemedicine & Digital Health Revolution](#)
- [How a Biden Presidency & COVID-19 Could Impact Infrastructure Development](#)
- [The Value of Data in a Digital World](#)
- [Introducing the Global X Emerging Markets Internet & E-commerce ETF \(EWEB\)](#)
- [Introducing the Global X CleanTech ETF \(CTEC\)](#)
- [Introducing the Global X Data Center REITs & Digital Infrastructure ETF \(VPN\)](#)
- [Connected Tech's Role in Combatting COVID-19](#)
- [Webinar Replay: How Disruptive Technologies are Enabling the Re-Opening Economy](#)
- [Thematic ETF Report: Q3 2020](#)
- [Disruptive Technologies Are Enabling the Re-Opening Economy](#)
- [Introducing the Global X China Biotech Innovation ETF \(CHB\)](#)
- [E-commerce: Entering the Next Wave of Growth](#)

You can also follow us on twitter:

- [\*\*@JayJacobsCFA\*\*](#)
- [\*\*@ALittle\\_gx\*\*](#)
- [\*\*@PPalandrani\\_gx\*\*](#)



## Global X Thematic Growth ETF Suite

Global X has 23 ETFs designed to target companies that may benefit from disruptive structural changes in technology and innovation, people and demographics, and the physical environment, in addition to 1 multi-theme, single-ticker ETF<sup>1</sup>. To see individual ETF holdings across the Global X Thematic Growth Suite, click the below links:

### Disruptive Technology

[Global X Social Media ETF \(SOCL\)](#)

[Global X Lithium & Battery Tech ETF \(LIT\)](#)

[Global X FinTech ETF \(FINX\)](#)

[Global X Internet of Things ETF \(SNSR\)](#)

[Global X Autonomous & Electric Vehicles ETF \(DRIV\)](#)

[Global X Future Analytics Tech ETF \(AIQ\)](#)

[Global X Cloud Computing ETF \(CLOU\)](#)

[Global X Robotics & Artificial Intelligence ETF \(BOTZ\)](#)

[Global X Video Games & Esports ETF \(HERO\)](#)

[Global X Cybersecurity ETF \(BUG\)](#)

[Global X Data Center REITs & Digital Infrastructure ETF \(VPN\)](#)

### Multi-Theme

[Global X Thematic Growth ETF \(GXTG\)](#)

### People & Demographics

[Global X Millennials Thematic ETF \(MILN\)](#)

[Global X Longevity Thematic ETF \(LNGR\)](#)

[Global X Health & Wellness Thematic ETF \(BFIT\)](#)

[Global X E-commerce ETF \(EBIZ\)](#)

[Global X Cannabis ETF \(POTX\)](#)

[Global X Genomics & Biotechnology ETF \(GNOM\)](#)

[Global X Education ETF \(EDUT\)](#)

[Global X Telemedicine & Digital Health ETF \(EDOC\)](#)

[Global X Emerging Markets Internet & E-commerce ETF \(EWEB\)](#)

[Global X China Biotech Innovation ETF \(CHB\)](#)

### Physical Environment

[Global X U.S. Infrastructure Development ETF \(PAVE\)](#)

[Global X CleanTech ETF \(CTEC\)](#)

<sup>1</sup>As of 12/24/2020

## Risk Information

Investing involves risk, including the possible loss of principal. There is no guarantee the strategies discussed will be successful. International investments may involve risk of capital loss from unfavorable fluctuation in currency values, from differences in generally accepted accounting principles or from economic or political instability in other nations. Emerging markets involve heightened risks related to the same factors as well as increased volatility and lower trading volume. Narrowly focused investments may be subject to higher volatility. The investable universe for thematic ETFs may be limited. The funds are non-diversified.

Video Game and Esports and Cybersecurity Companies are subject to risks associated with additional regulatory oversight with regard to privacy/cybersecurity concerns, shifting consumer preferences, and potential licensing challenges. Declining or fluctuating subscription renewal rates for products/services or the loss or impairment of intellectual property rights could adversely affect profits. Thematic companies may have limited product lines, markets, financial resources or personnel. They typically engage in significant amounts of spending on research and development, capital expenditures and mergers and acquisitions.

The risks related to investing in cloud computing companies include disruption in service caused by hardware or software failure, interruptions or delays in service by third-party data center hosting facilities and maintenance providers, security breaches involving certain private, sensitive, proprietary and confidential information managed and transmitted by cloud computing companies, and privacy concerns and laws, evolving Internet regulation and other foreign or domestic regulations that may limit or otherwise affect the operations of such companies. Education companies may be affected by changes in demographics and consumer demands, and government regulations, programs and policies. Data Center REITs and Digital Infrastructure Companies are subject to risks associated with the real estate market, changes in demand for wireless infrastructure and connectivity, rapid product obsolescence, government regulations, and external risks including natural disasters and cyberattacks.

CleanTech Companies typically face intense competition, short product lifecycles and potentially rapid product obsolescence. These companies may be significantly affected by fluctuations in energy prices and in the supply and demand of renewable energy, tax incentives, subsidies and other governmental regulations and policies. There are additional risks associated with investing in lithium and the lithium mining industry.

Investing in securities engaged in the social media industry include disruption in service caused by hardware or software failure; interruptions or delays in service by third-parties; security breaches involving certain private, sensitive, proprietary and confidential information managed and transmitted by social media companies; and privacy concerns and laws, evolving Internet regulation and other foreign or domestic regulations that may limit or otherwise affect the operations of such companies. Investment in the biotechnology, Health Care and sectors can be affected by government regulations, rapid product obsolescence, intense industry competition and loss or impairment of patents or intellectual property rights.

Information Technology companies can be affected by rapid product obsolescence, and intense industry competition. Risks include disruption in service caused by hardware or software failure; interruptions or delays in service by third-parties; security breaches involving certain private, sensitive, proprietary and confidential information managed and transmitted; and privacy concerns and laws, evolving Internet regulation and other foreign or domestic regulations that may limit or otherwise affect the operations.

The cannabis industry is a very young, fast evolving industry with increased exposure to the risks associated with changes in applicable laws (including increased regulation, other rule changes, and related federal and state enforcement activities), as well as market developments, which may cause businesses to contract or close suddenly and negatively impact the value of securities held by the Fund. Cannabis Companies are subject to various laws and regulations that may differ at the state/local, federal and international level. These laws and regulations may significantly affect a Cannabis Company's ability to secure financing and traditional banking services, impact the market for cannabis business sales and services, and set limitations on cannabis use, production, transportation, export and storage. The possession, use and importation of marijuana remains illegal under U.S. federal law. Federal law criminalizing the use of marijuana remains enforceable notwithstanding state laws that legalize its use for medicinal and recreational purposes. This conflict creates volatility and risk for all Cannabis Companies, and any stepped-up enforcement of marijuana laws by the federal government could adversely affect the value of the Fund's investments.

---

## Risk Information

Investments in infrastructure-related companies have greater exposure to the potential adverse economic, regulatory, political and other changes affecting such entities. Investment in infrastructure-related companies are subject to various risks including governmental regulations, high interest costs associated with capital construction programs, costs associated with compliance and changes in environmental regulation, economic slowdown and excess capacity, competition from other providers of services and other factors.

***Carefully consider the Funds' investment objectives, risk factors, charges, and expenses before investing. This and additional information can be found in the Funds' summary or full prospectus, which may be obtained by calling 1.888.493.8631, or by visiting [globalxetfs.com](http://globalxetfs.com). Please read the prospectus carefully before investing.***

Global X Management Company LLC serves as an advisor to Global X Funds. The Funds are distributed by SEI Investments Distribution Co. (SIDCO), which is not affiliated with Global X Management Company LLC or Mirae Asset Global Investments.

This information is not intended to be individual or personalized investment or tax advice and should not be used for trading purposes. Please consult a financial advisor or tax professional for more information regarding your investment and/or tax situation.