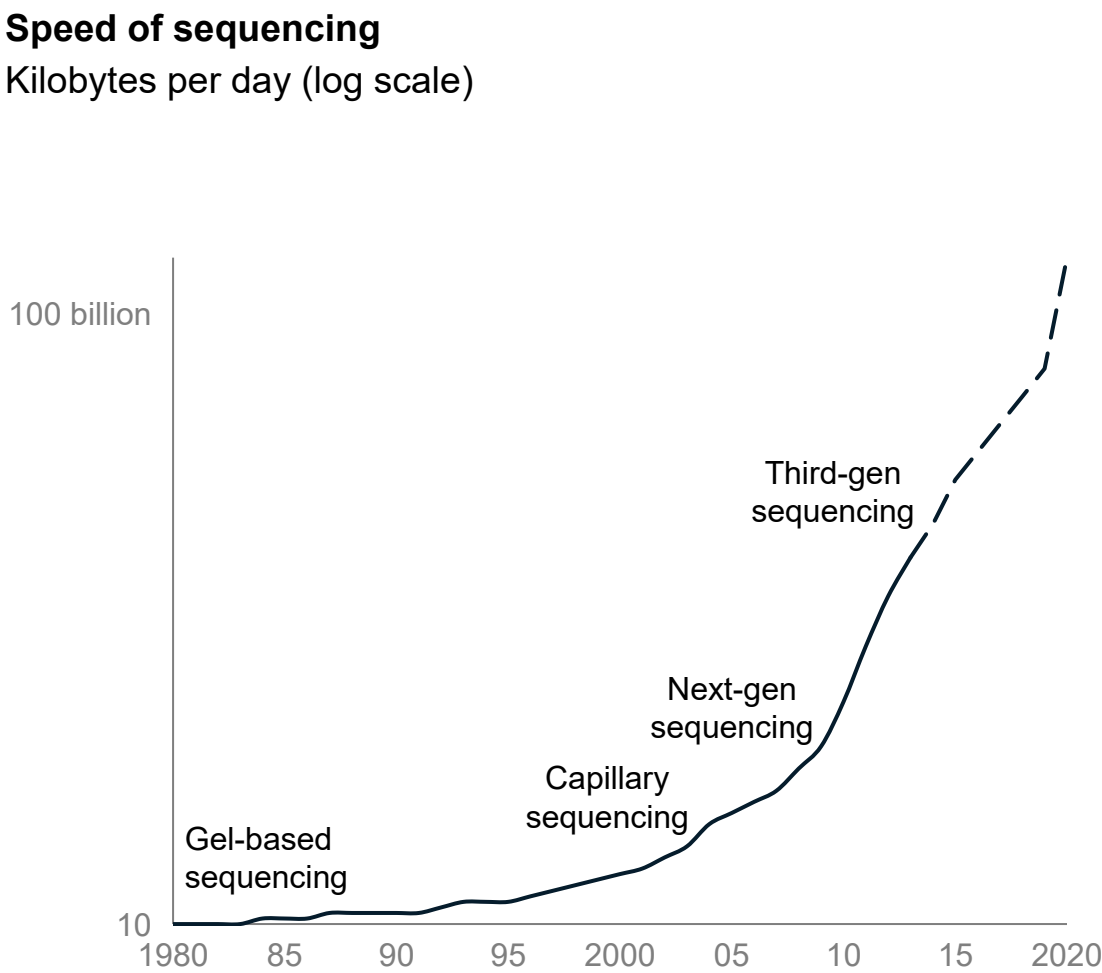
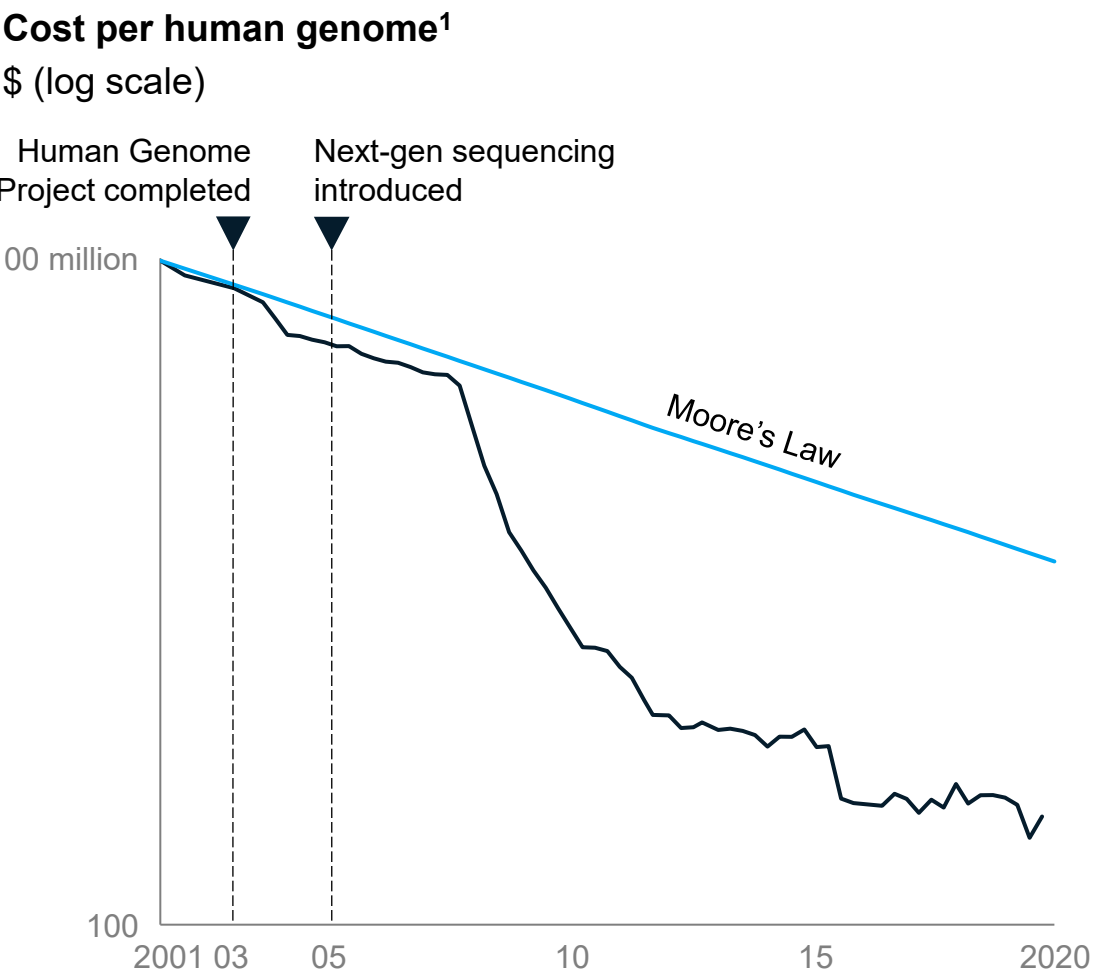


The Bio Revolution

Innovations transforming economies, societies,
and our lives

November 2021

The convergence of advances in biology and computing underpin the Bio Revolution



1. Data do not capture all costs associated with genome sequencing and include only production-related costs (labor, instruments, informatics, data submission).

Innovations are creating five new potentially transformative capabilities

- 1** Biology-based production improving performance and sustainability
- 2** More control and precision to target actions
- 3** Increased ability to engineer and reprogram organisms
- 4** Higher R&D productivity enabled by automation and AI
- 5** Growing potential in biomachine interfaces and computing





60%

of physical inputs to the global economy could be produced using biological means




45%

of world's disease burden could be addressed with bio innovations



30%


of private sector R&D spend could be impacted by biology





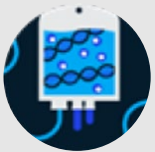


7-9%

of annual man-made GHG emissions could be reduced by 2040 to 2050

The Bio Revolution will have significant impact in multiple domains


 Example applications **XX** Annual direct economic impact in 2030—40





Human health and performance 



Health optimization Gene drives Gene therapies Drug development and delivery


\$0.5—1.3T
(35%)

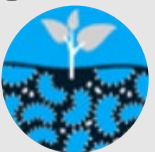

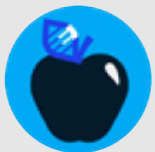
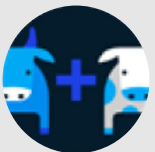
Consumer products and services 



DTC genetic testing Microbiome beauty products Genetically engineered pets Personalized nutrition


\$0.2—0.8T
(19%)

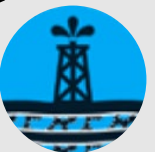


Agriculture, aquaculture, and food 



Selective breeding Genetic engineering Plant-based protein Soil microbiome data

\$0.8—1.2T
(36%)

Materials, chemicals, and energy 



Bioroutes for fabrics Biopolymers Microbial resource extraction

\$0.2—0.3T
(8%)

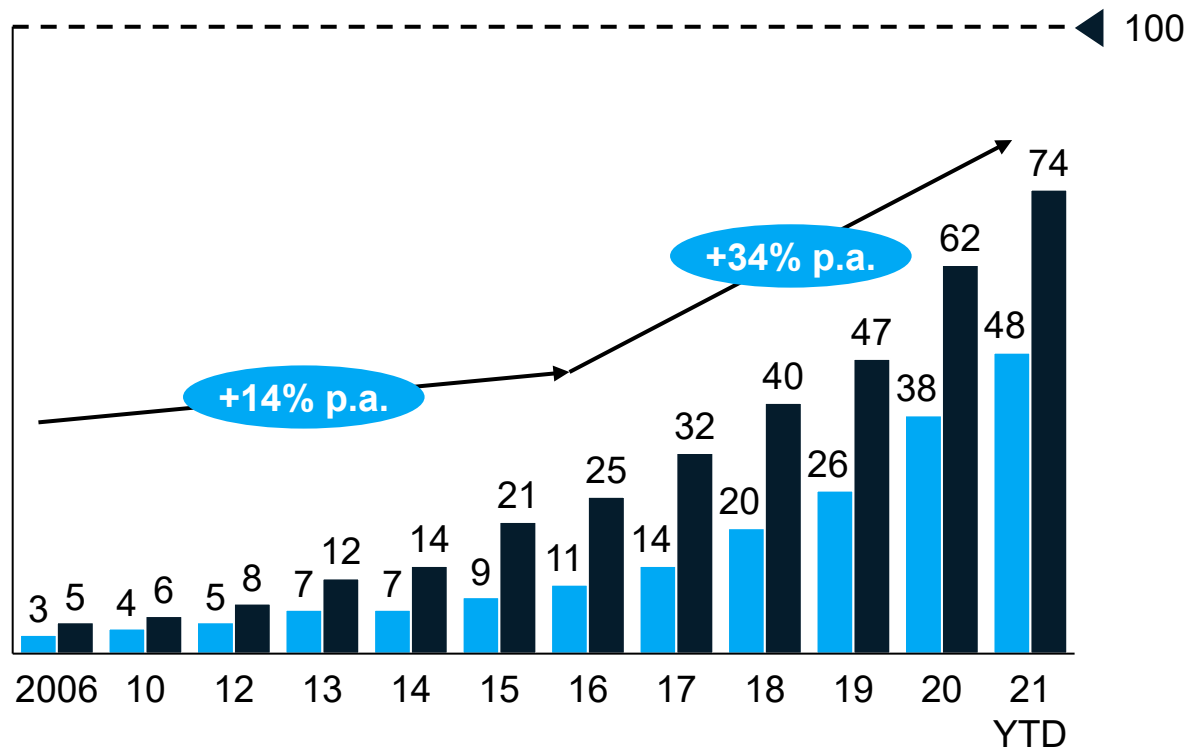
We sized 400+ applications, which added up to \$2-4T of annual direct economic potential within the next 10 to 20 years

Note: Percentages based on the midpoint of annual direct economic potential for each domain

Commitments to reduce Scope 3 greenhouse-gas emissions are accelerating

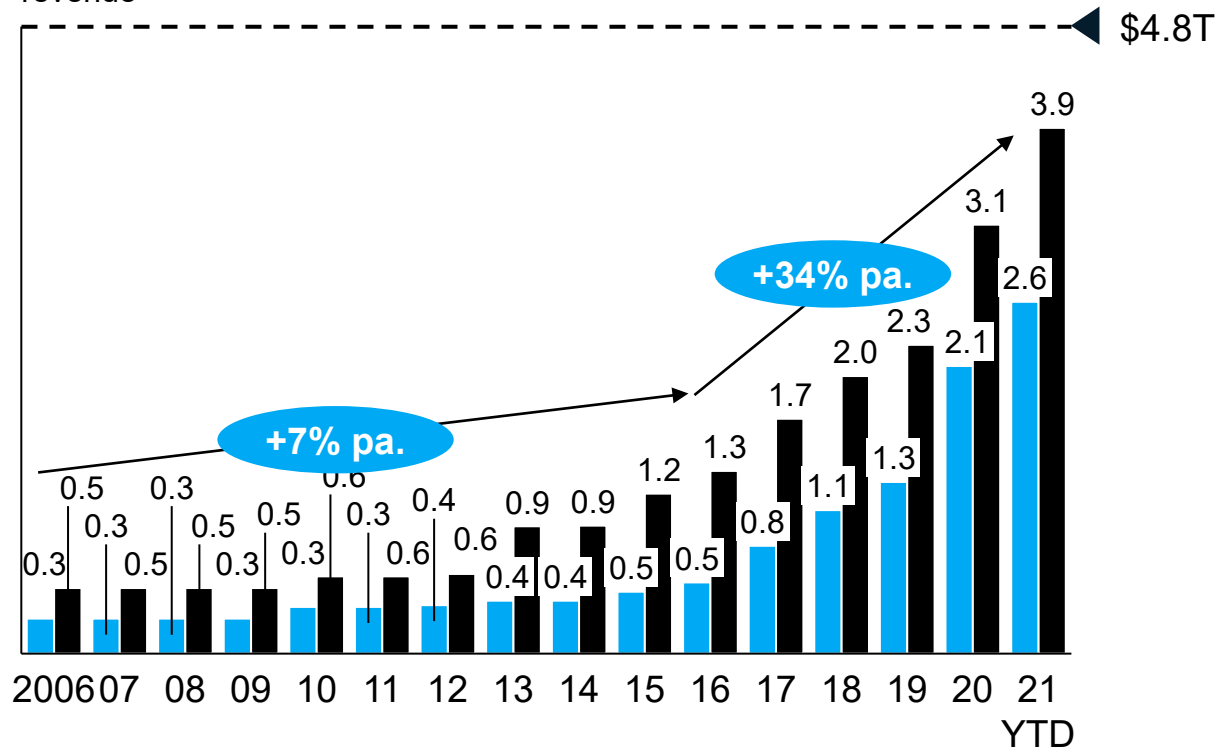
Companies with emissions reduction commitments, number of top companies across end markets¹

100% = 100 companies¹ ■ Scopes 1, 2, and 3² ■ Scopes 1 and/or 2 only



Cumulative 2019 revenue with associated commitments, \$ trillions across end markets³

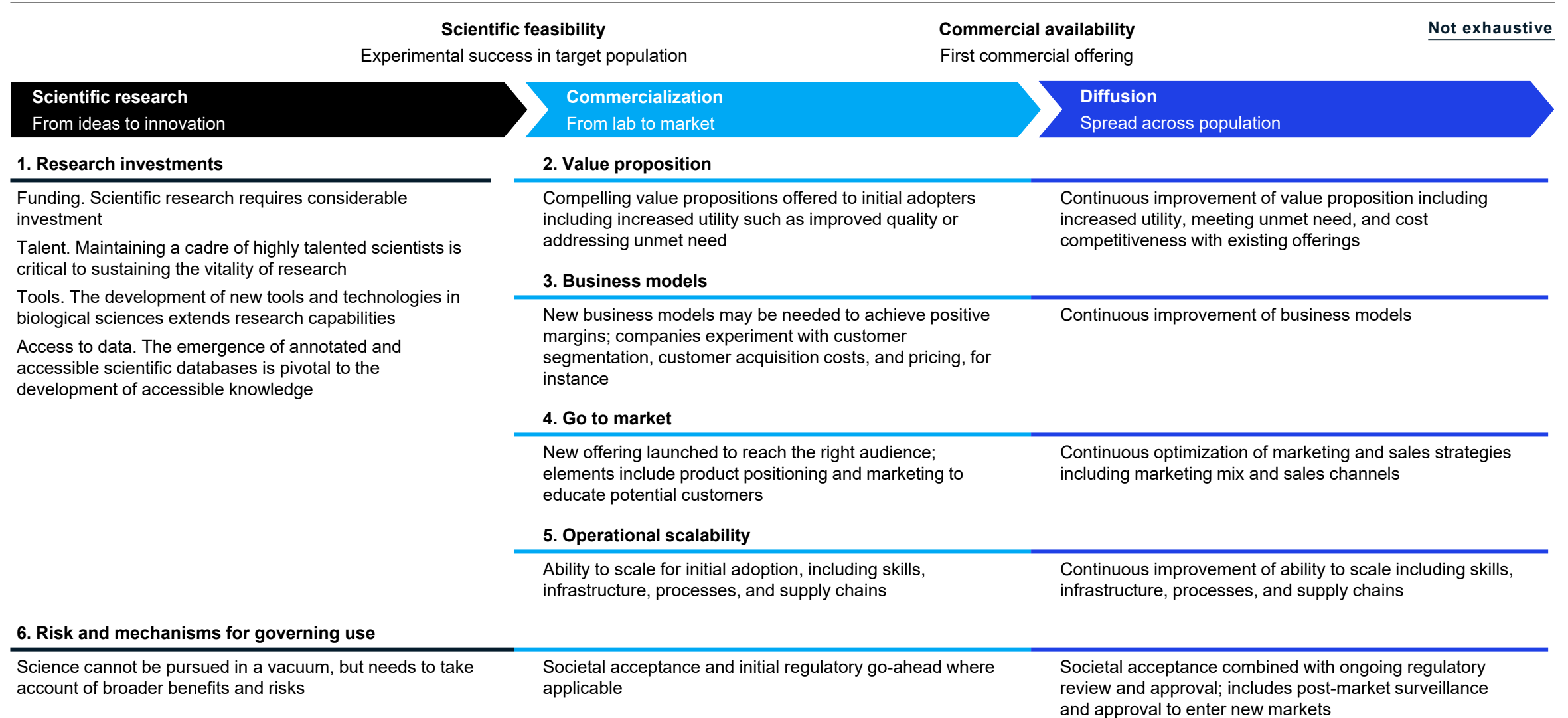
100% = \$4.8T 2019 revenue ■ Scopes 1, 2, and 3² ■ Scopes 1 and/or 2 only



1. Top 20 companies by 2019 global revenue in each of five end markets: apparel, automotive, electronics, fast-moving consumer goods (food, home, and personal care), and packaging.
2. Scope 1 covers direct emissions from owned or controlled sources, including emissions from the combustion of fuel and vehicles. Scope 2 covers indirect emissions from the generation of purchased electricity, steam, heating, and cooling. Scope 3 emissions are not directly owned by the company but cover all other indirect emissions that occur in a company's value chain.
3. Sum of 2019 revenue associated with top 20 companies across end markets

Six factors affect the pace and extent at which bio innovations are adopted

Stages of adoption and milestones



McKinsey Global Institute



<https://www.mckinsey.com/biorev/>