

How to use the pandemic and recession to build a better bioeconomy research and innovation system

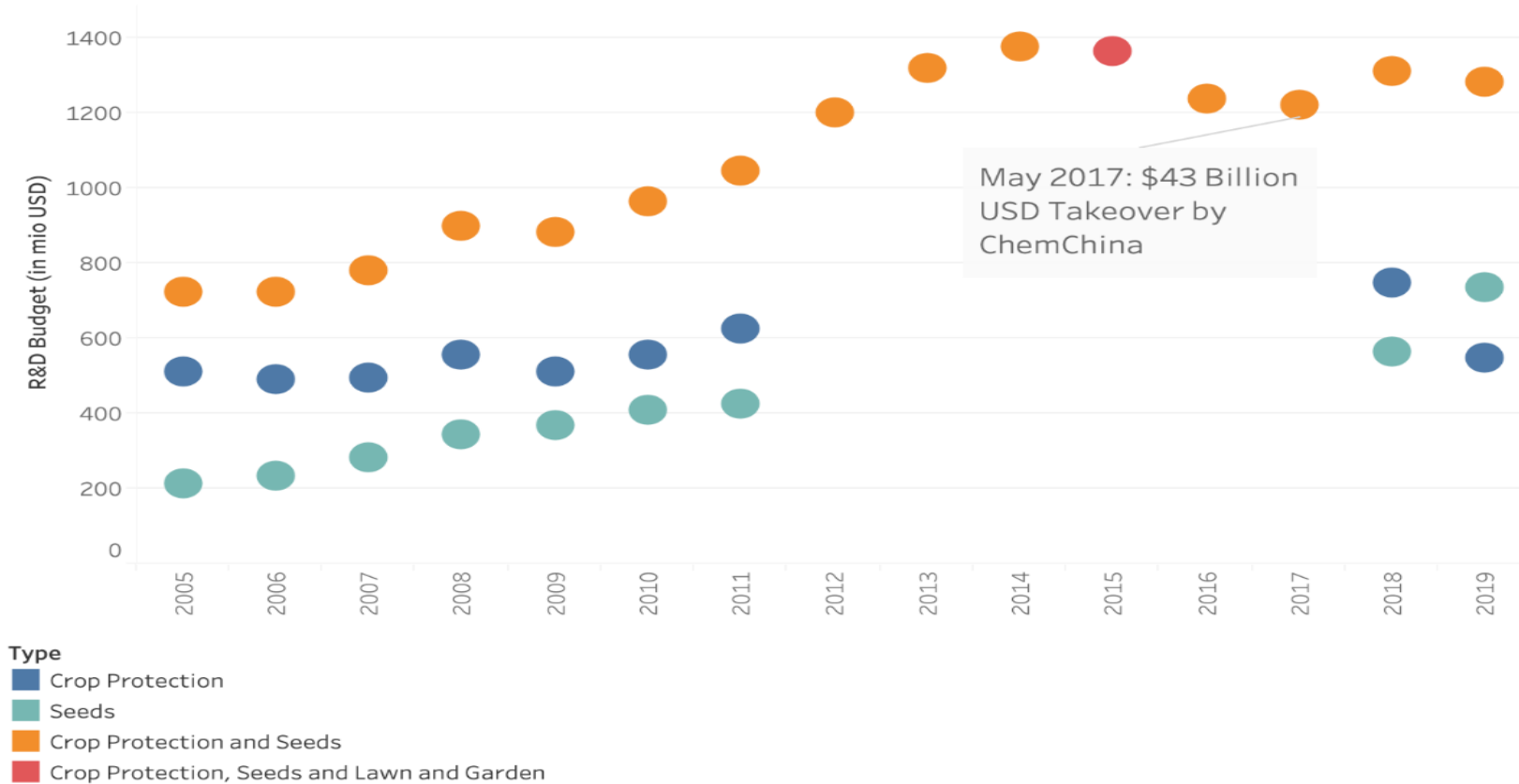
Carl Pray

Major source of bioeconomy innovation is Private R&D

- Private R&D of global multinationals up or down recently
 - Crop research - mixed
 - Corteva \$1.4 billion 2017 to \$1.1 billion 2019
 - Bayer \$2.3 billion 2018 to \$2.6 billion 2019
 - Syngenta down from 2015 (next slide)
 - Machinery research – up
 - John Deere \$1.4 billion 2017 to \$1.8 billion 2019
 - Veterinary research – up
 - Zoetis \$ 0.38 billion 2017 to \$ 0.46 billion 2019
 - Boehringer Ingelheim animal health \$ 0.42 billion 2017 to \$ 0.47 billion 2019
 - Biofuel R&D down even before oil prices collapsed
- Some evidence that small private venture capital for agricultural innovation was declining
 - “Q1-2020 investment levels were around \$550 million, which is far below the ~\$1 billion raised in the first quarter of the past two years”
 - “We will likely see a Covid-19 induced investment pullback” Seana Day AgFunder.com June 2020

Syngenta – slight decline during take over

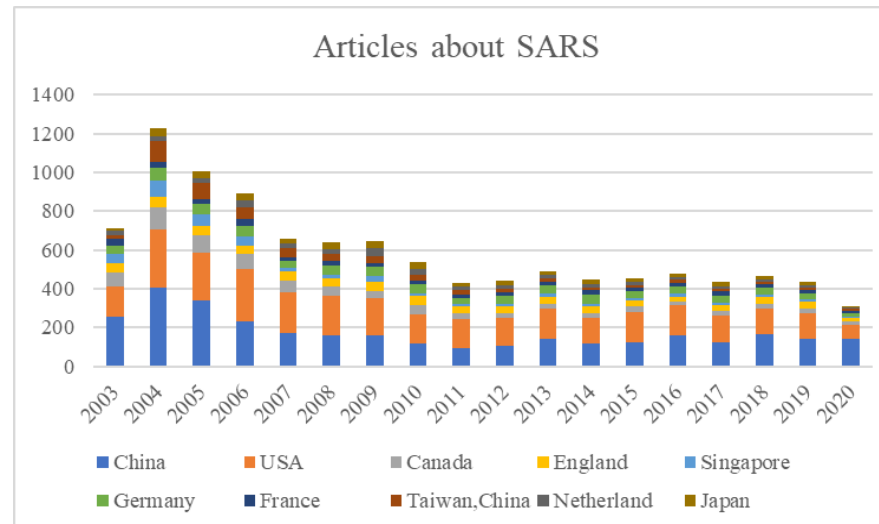
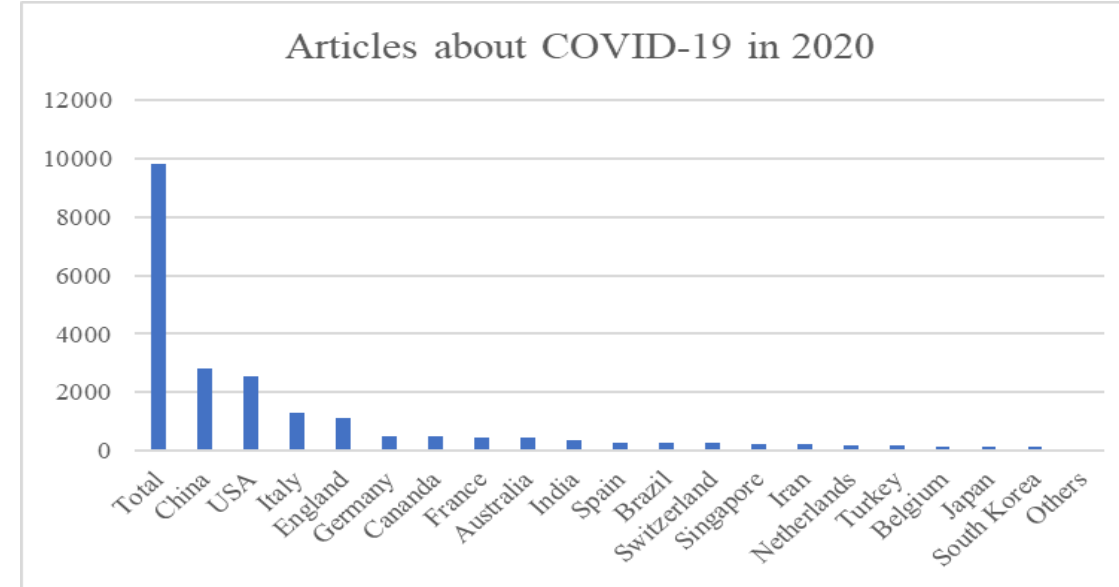
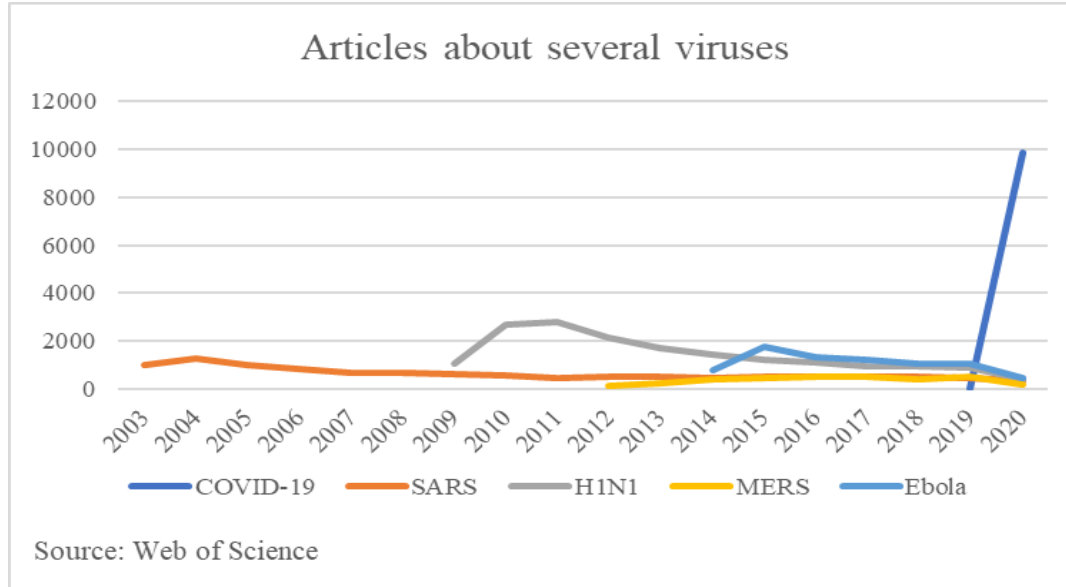
Annual R&D Budget: Syngenta Corporation
(Source: Annual Financial Reports)



Factors influencing bioeconomy research and innovation

- Opportunities to innovate
 - Science and innovation in related sectors of economy such as medical research and information technology
 - Public sector R&D
- Demand for innovations
 - Value of the bioeconomy as reflected by prices of crops, livestock, biomass
 - Input shortages – agricultural labor, water,
 - Specific crises – pandemics of zoonotic diseases, plant disease and droughts/floods, etc.
 - Demands for sustainability and environmental services
- Other policies to support innovation: regulations, intellectual property rights

Pandemic creating R&D opportunities: Publications on Zoonotic diseases



Advances in science and technology are creating opportunities

- Spillovers from medical research to agricultural and energy research
 - Livestock disease prevention and control
 - Viruses in maize in East Africa
- Rapid advances in genomics that have increased productivity of plant and livestock research
- New biological tools – CRISPR, transgenic plants
- Advances in information technology and investments in IT infrastructure
 - Machinery companies like John Deere, Mahindra, YTO expand their own R&D and purchase small firms
 - IBM, AliBaba, Google joining agricultural input firms to develop farm management tools

Will economic recession will produce declines government expenditure on innovation infrastructure

- Decline in government research?
 - Major declines projected in global GDP
 - Government medical research to fight covid-19 is increasing shifting resources from agriculture
 - Agricultural research already declining in some places before covid 19: USDA \$3.5 billion 2019 to \$3.3 billion 2021 (projected)
- Public sector research could increase – national competitiveness and self-sufficiency
 - Chinese agricultural research expenditure continues to expand rapidly
 - Indian pressure for expansion
 - Germany \$ 0.7 billion 2018 to \$1.0 billion 2020
 - EU Bioeconomy research Euros 10 billion

Demand for bioeconomy innovation

- Covid 19 research still growing globally and new “G4” Swine Flu Viruses in China
 - Plant pests and disease – locust epidemic and fall army worm in Africa.
- Pandemic disruptions of food supply chains increase demand for vegetable-based meat and e-commerce
- Pandemic highlighted growing shortages of agricultural labor increasing demand for mechanization
- Agricultural prices and oil prices currently flat or declining reduces demand for innovation
- Demands for resources like water and environmental services

Regulatory and policy changes that governments are making to stimulate bioeconomy growth

- CRISPR in America Transgenic technology in China, India, the Americas
- New models of public private partnerships in search for covid-19 vaccines, cures, tests.
- Government procurement of innovations

Government and foundations role in building back better

- Invest in basic biological research and applied research where appropriability of benefits from innovation is weak
- Changing public research priorities to zoonotic disease and the “One health” human, animals, plants and environment health.
- Encouraging public private partnerships
- Regulatory changes to reduce costs of innovation