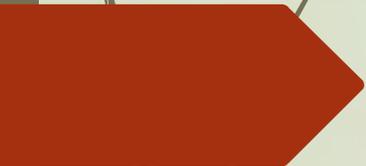


# Digitization within the food supply chain the impact of the pandemic



David Zilberman  
ARE Berkeley

Brandt forum CFAE November 2<sup>nd</sup> 2021

Thanks To Tom Reardon

# The threshold model of technology adoption

- ▶ Adoption of new technologies by individuals or firms is a multistage process
  - ▶ Start with awareness
  - ▶ Evaluation
  - ▶ Decision (considering profitability, riskiness, credit availability fit)
  - ▶ Reassessment
- ▶ Decision makers are heterogeneous
  - ▶ Some will be early adopter (Higher income curiosity special conditions)
- ▶ Dynamic process will affect adoption
  - ▶ learning by doing- lower cost overtime
  - ▶ Learning by using- better use over time
  - ▶ Network externalities

# Crisis trigger change

- ▶ Real option value of adoption – suggests that when a New technology is available – many will wait till the time is right
- ▶ They have a Critical level of a key variable – that will trigger adoption
  - ▶ High price of energy may lead to switch to fuel efficient car
  - ▶ High output price may lead to invest in high yield variety
- ▶ Adoption of technologies frequently is driven by crisis
  - ▶ Drought in 1976-8 more than doubled drip acreage in California
  - ▶ Drought in 1988-92 led to extensive use of irrigation scheduling and water trading
  - ▶ Drought in 2010s led to ground water registration and bigger investment in desalinization of water
- ▶ Pandemic is a crisis that led to increased digitization of food system every where

# Computers in Agriculture

- Slow adoption rates: only 25% in 1990, 2005 close to 75%.
- Early adopter characteristics:
  - larger, with multi-crop integrated operations
  - younger, more educated,
- Adoption enhanced recently by:
  - Lower cost, user friendliness
  - network externalities
  - “fun factors”
- Most adopters used word processing, billing, and business applications; much less use of managerial application.

# Digitization in agri-food started outside the farm gate

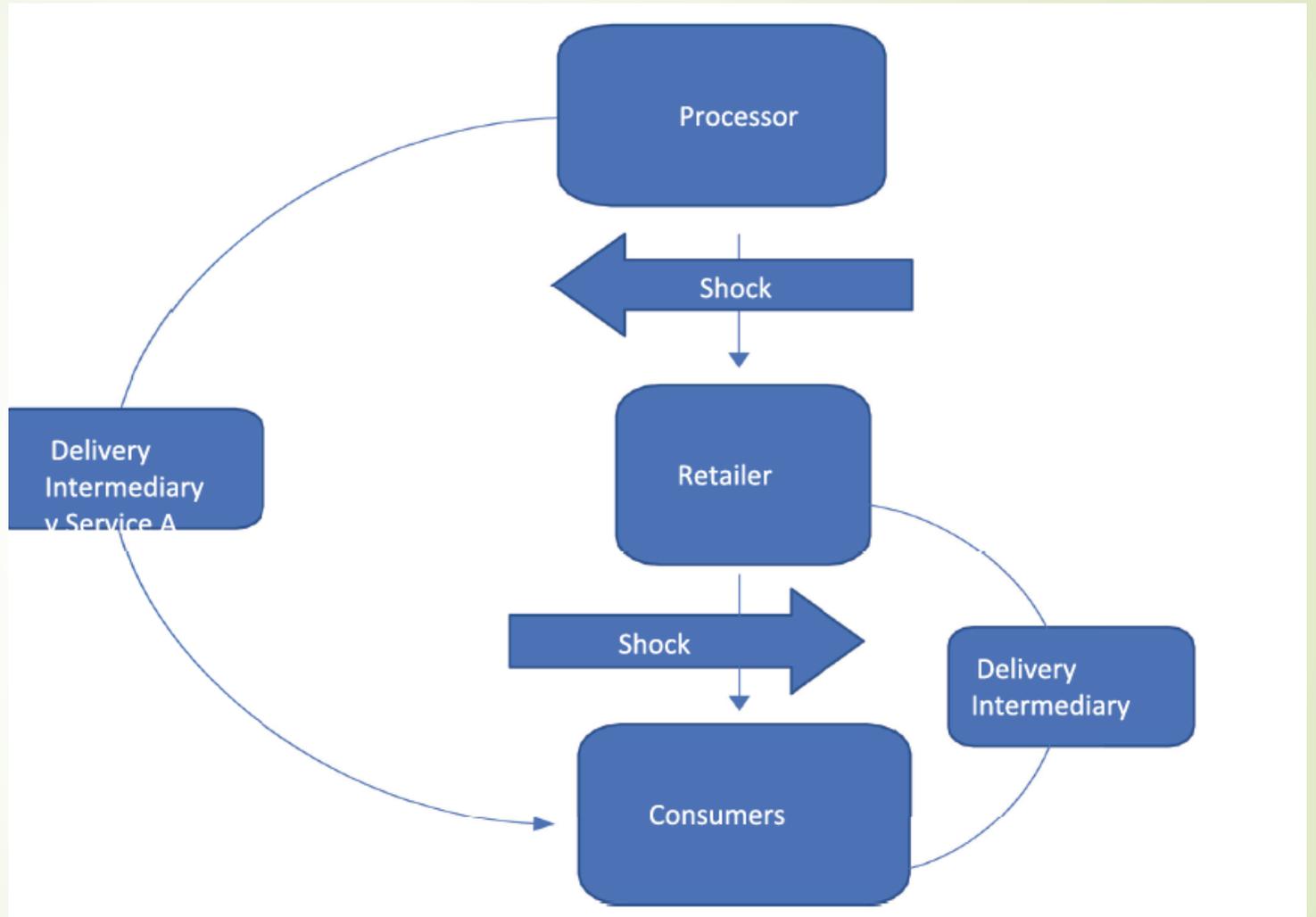
- ▶ Suppliers and buyers introduced automation
  - ▶ Billing
  - ▶ Inventory
  - ▶ Required farmers to adjust
- ▶ The advance of personal computer led to further automation
  - ▶ Banking transaction
  - ▶ Investment/finance
- ▶ Generational change led to further automation
- ▶ Small and middle-sized Farmers tended to rely on consultants/extension when it comes to management application
  - ▶ The IPM website of U of California responds to 60000 inquiries a day

# Regulation & new technologies enhance digitization

- ▶ Pesticides use requirement and labor protection laws led to automation and documentation of input use in California
- ▶ Precision agriculture – embodied in equipment (Yield monitoring etc.) led to adoption of precision technologies which tend to be user friendly
- ▶ Internet and cell phone enhanced information availability to producers through out the world
- ▶ Just in time inventory management software penetrated the agrifood system
  - ▶ Automation become a requirement working with big retailers and banks
- ▶ Increasing digitization enable improved traceability
  - ▶ Is likely to improve with block chain technology
  - ▶ Will allow increase product quality

## Shocks like the pandemic cause changes in supply chain

- Pivoting to new linkages between processor or retailer to consumers using delivery service



# Various forms of pivoting

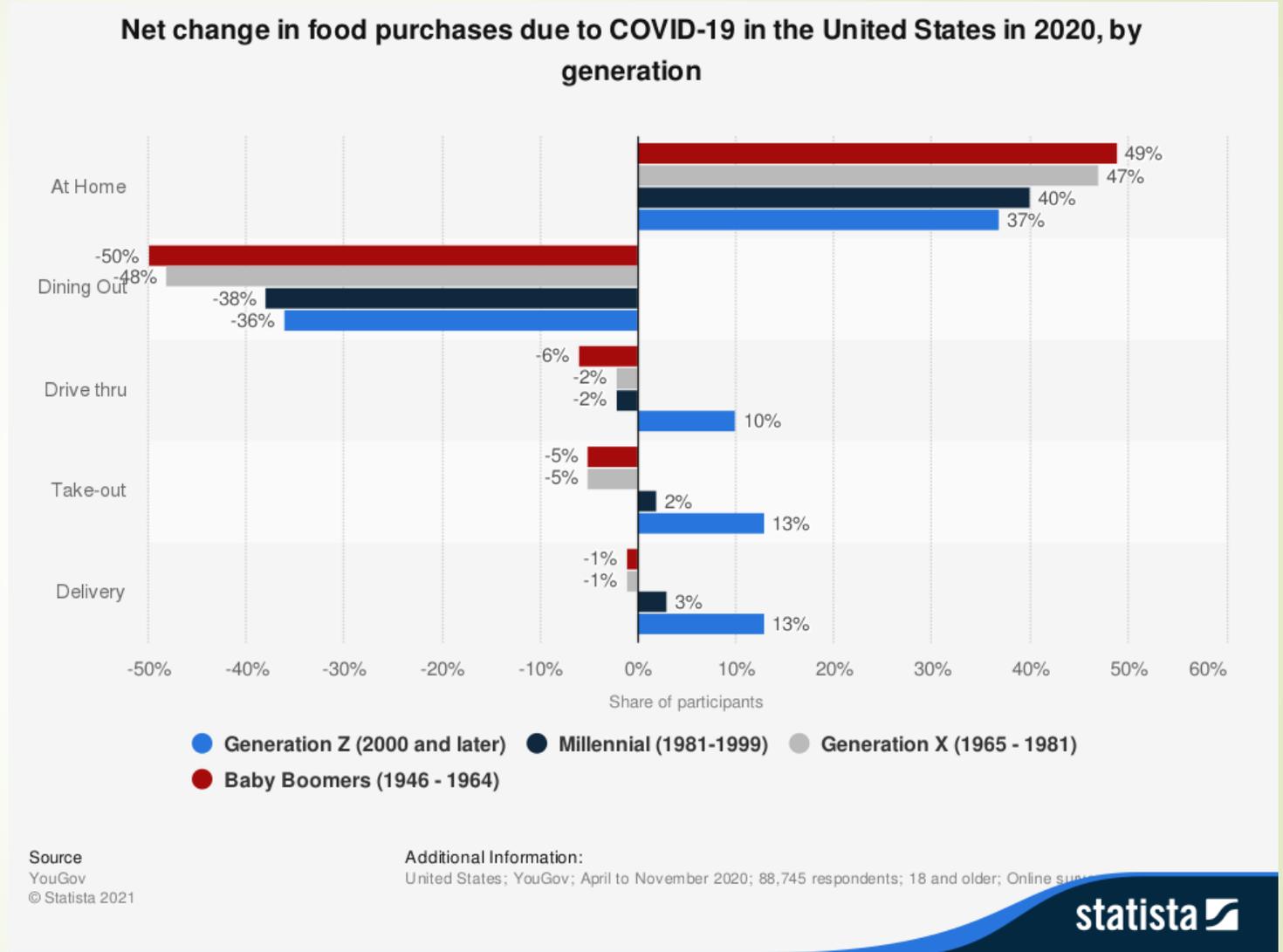
- ▶ Apps help farmers to connect to consumers during lock down- in India Israel among other
- ▶ CropSwap Los Angeles-based start-up launches new app connecting farmers and consumer During a time of the global pandemic,
- ▶ In northern Wisconsin, a farmers' collective said they are making thousands of dollars a week in a season when sales are normally zero
- ▶ By selling to people instead of restaurants, Illinois farmers said revenues are close to an all-time high.
- ▶ Hotels sell excess supply to food retailers
- ▶ Switching from producing spirits to making industrial-size vats of hand sanitizer didn't merely keep Santa Ana's Blinking Owl Distillery in business.
- ▶ How one grocery startup is putting a new spin on -, Opie Drive-Thru Grocery can fill on-the-spot orders in under two minutes. "Our job is to be like a train station."



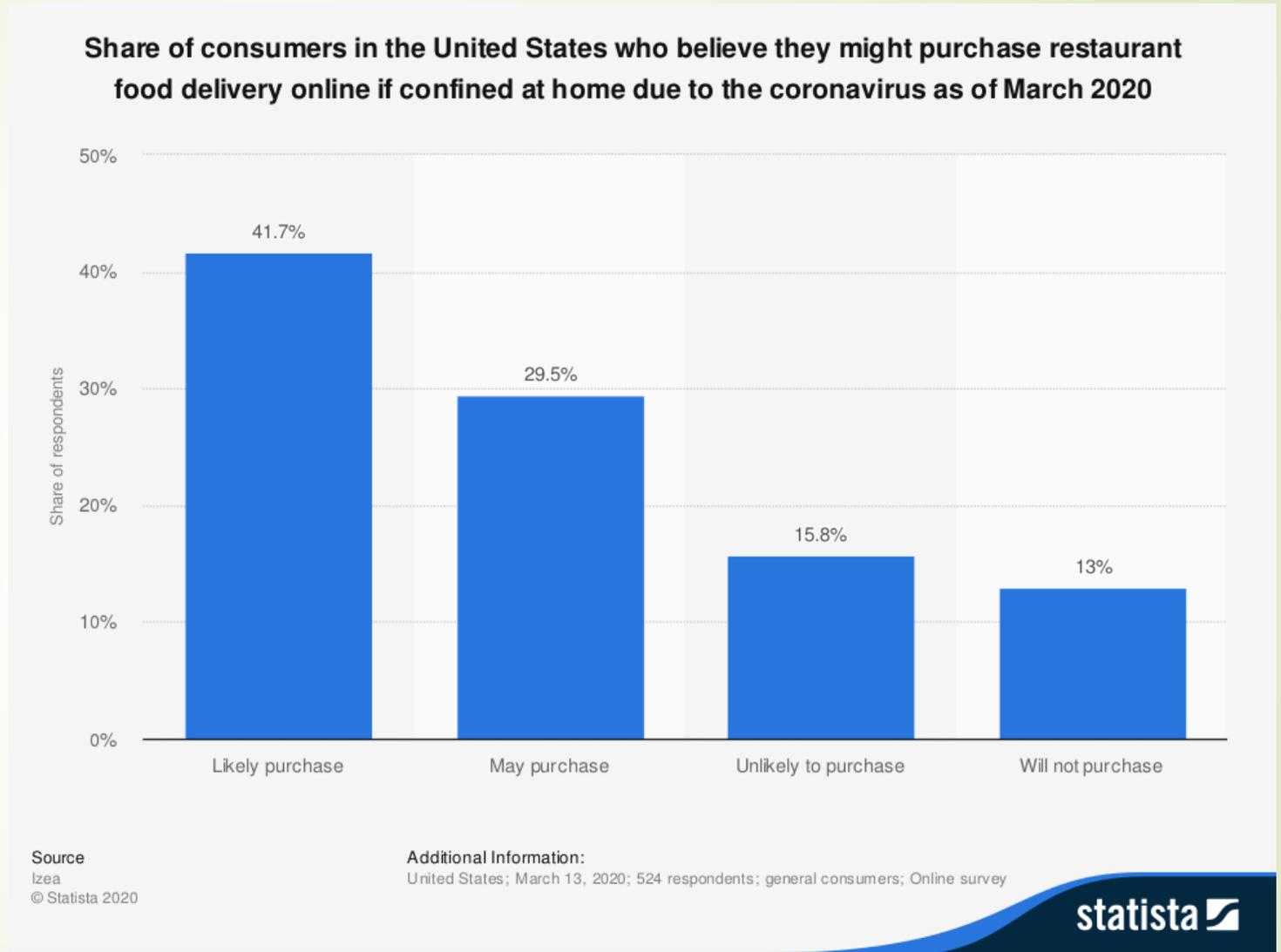
## The pandemic reversed the growing food consumption away from home

- Spending on Food away from Home surpassed spending on Food at home for the first time in 2010, increasing its share of total food spending from 44 percent (30 years prior) in 1987 to 50.2 percent in 2010.
- Restaurants, hotel etc. are becoming digitize- with some take home share
- However, the pandemic reduced purchase in restaurants-
  - Sit in restaurants lost business
  - Some pivoted to take out

# Decline in purchase of food in restaurants

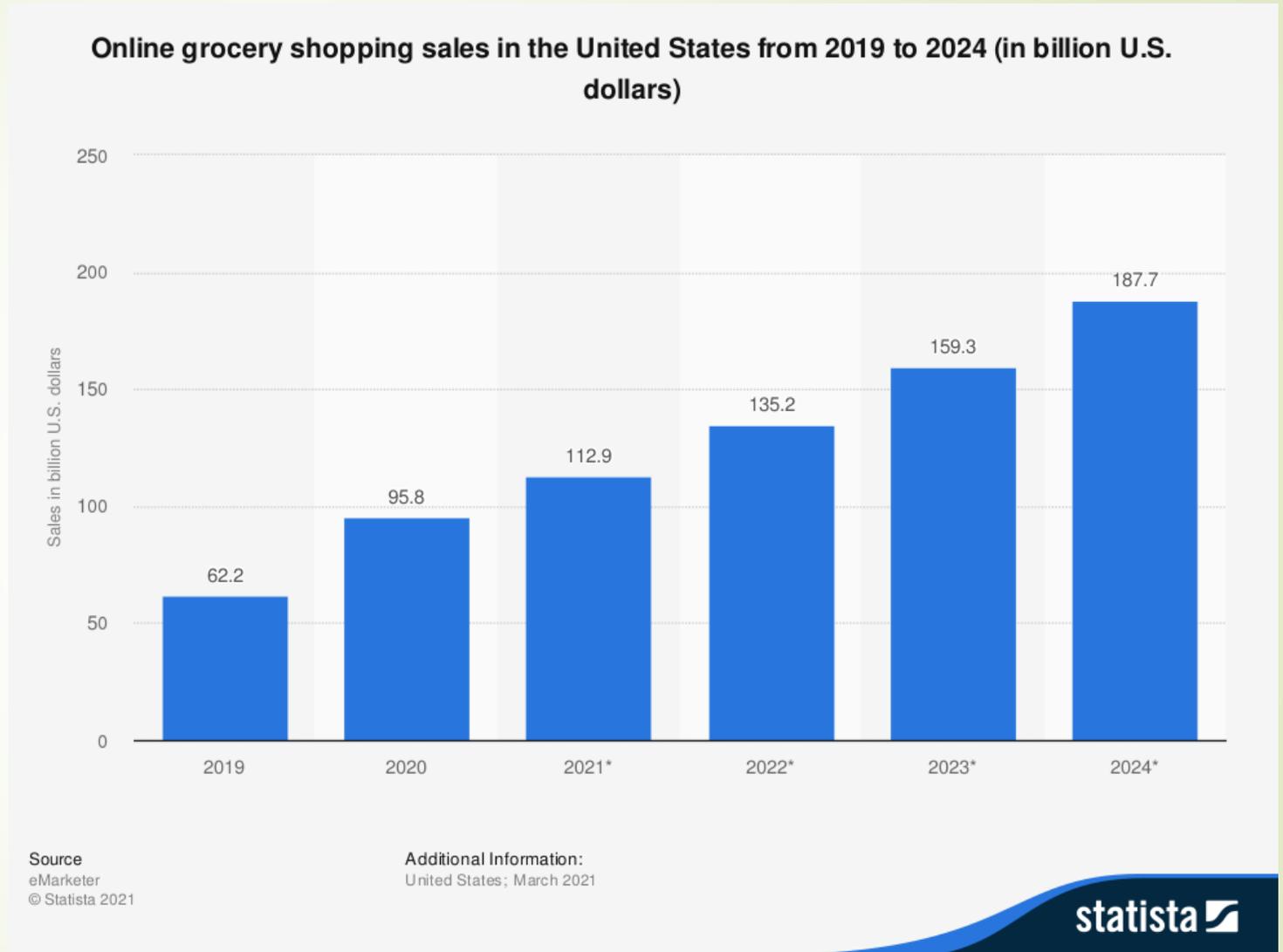


The pandemic increase desire for take-out on



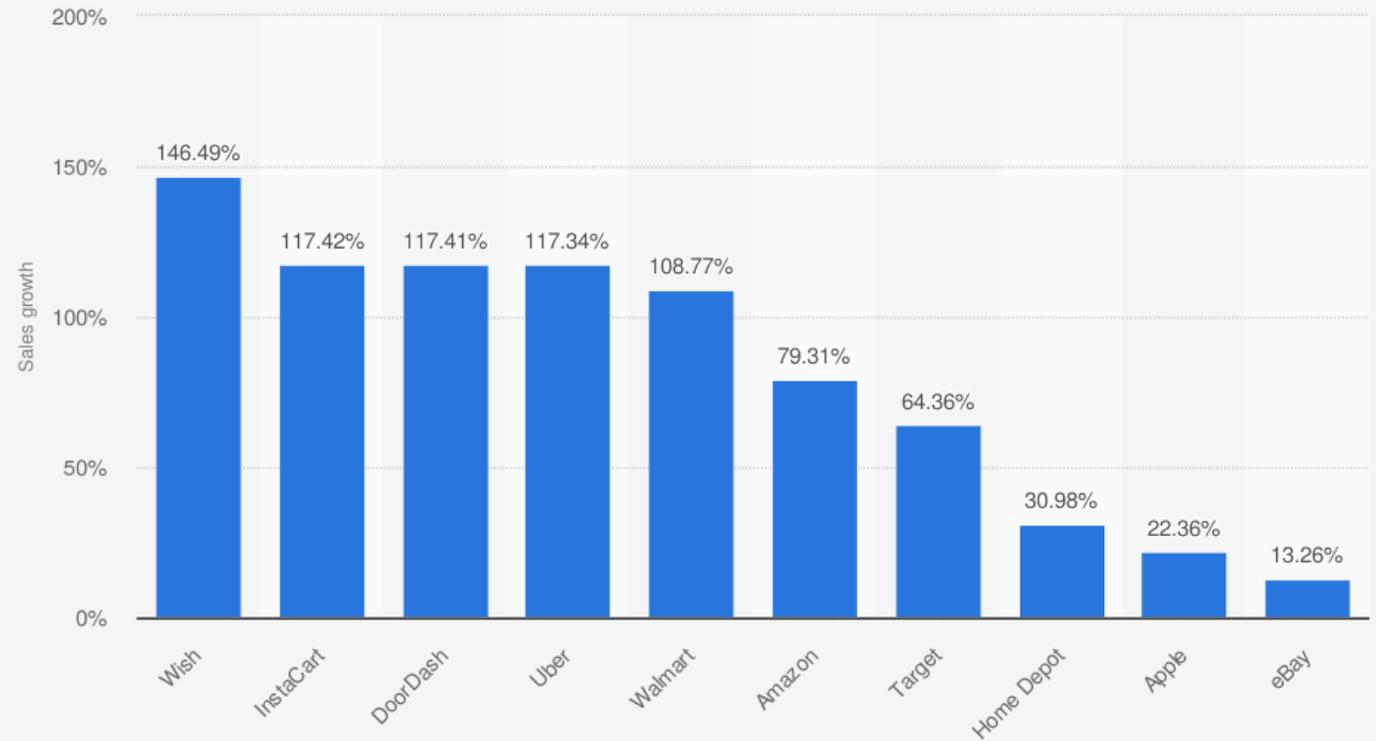
# Growing delivery to home

- Before the pandemic increased number of groceries in the US offered food delivery to home 31% in 2017/42% in 2018/ 51% in 2019- with modest use



The food delivery business grew fastest

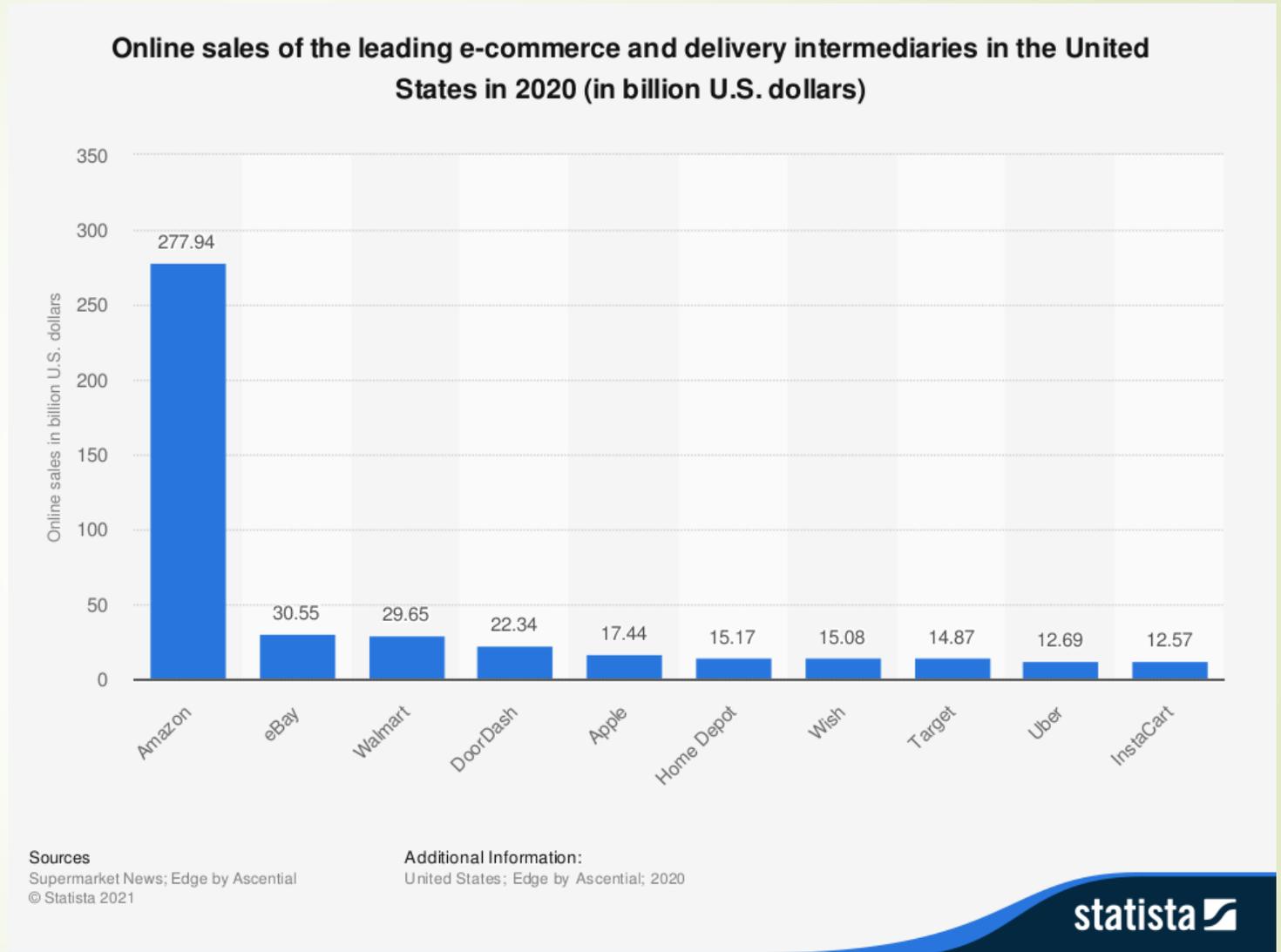
Sales growth of the leading e-commerce and delivery intermediaries in the United States from 2020 to 2025



Sources  
Supermarket News; Edge by Ascential  
© Statista 2021

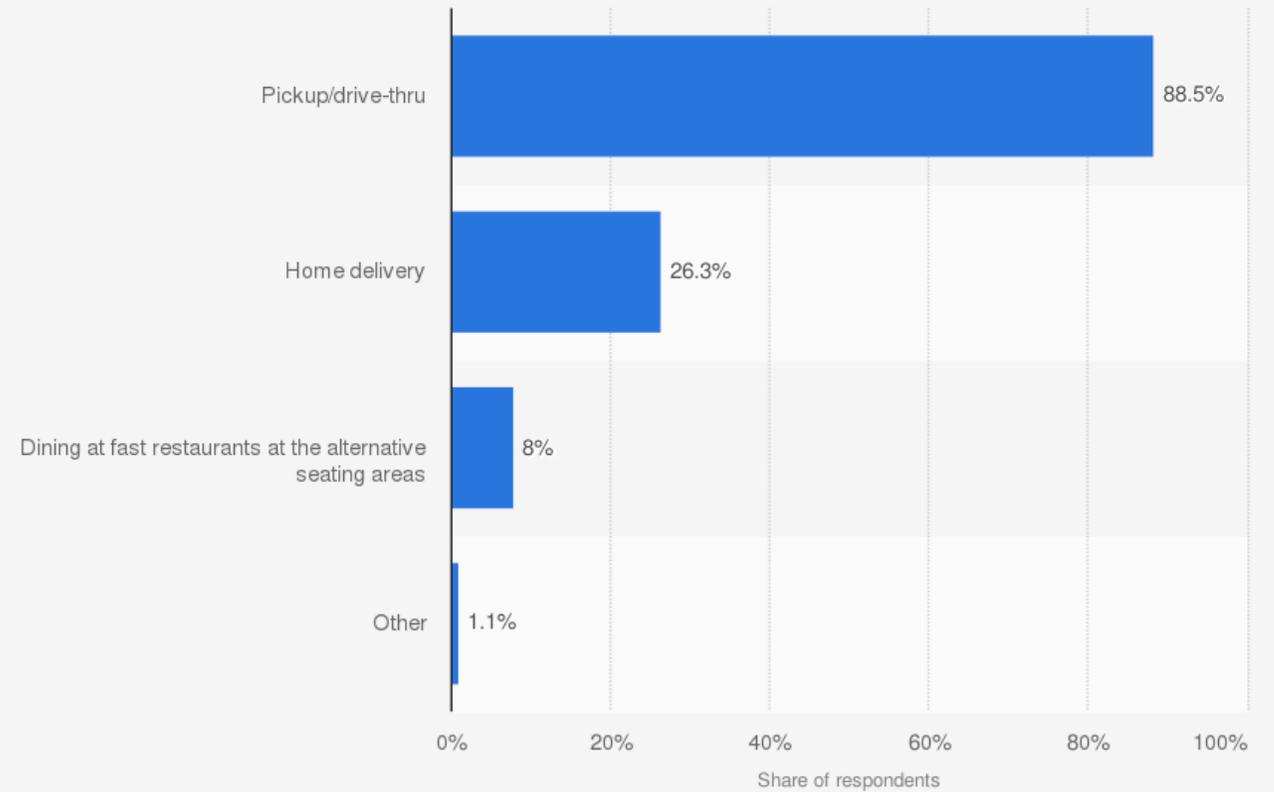
Additional Information:  
United States; Edge by Ascential; 2020

The pandemic led to high revenue to revenue to delivery sector



Home delivery was important even for fast food buyers

Most common method used by consumers to get fast food during the coronavirus pandemic (COVID-19) in the United States as of November 2020



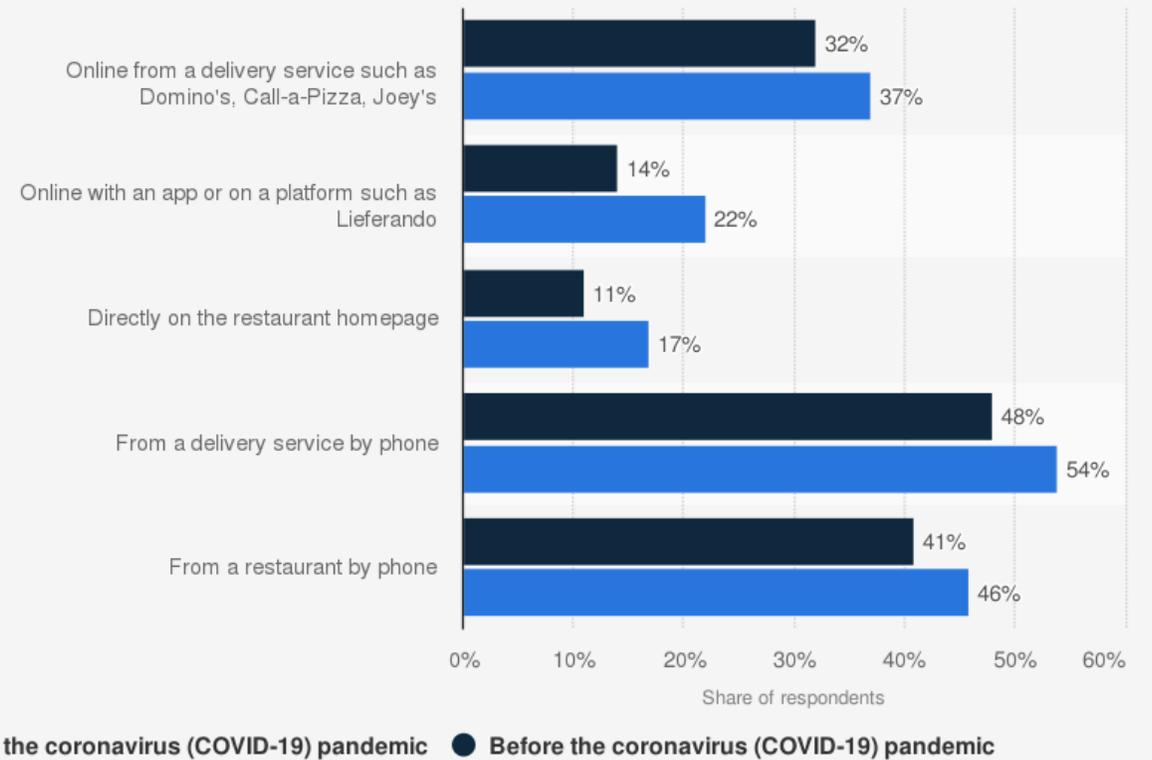
Source  
Segmanta  
© Statista 2021

Additional Information:

United States; Segmanta; 13 October to 6 November, 2020; 1,572 respondents; 14 years and older

# Home delivery increased in Europe

Have you ordered food to your home since the coronavirus (COVID-19) pandemic began?



Source  
Bitkom  
© Statista 2021

Additional Information:  
Germany; Bitkom Research; June 2020; 1,002 respondents; 16 years and older; Answering to 7

e-commerce  
upticks in  
yearly growth  
rates in  
various  
countries,  
comparing  
2019 with  
2020:

- ▶ Indonesia, 60% versus 120%,
- ▶ South Africa, 20% versus 100%;
- ▶ Brazil, 15% versus 100%;
- ▶ Mexico, 15% versus 80%;
- ▶ India, 30% versus 70%;
- ▶ Nigeria, 20% versus 50%;
- ▶ China, 10% versus 20%.
- ▶ Source Vardhan (2020) Euromonitor survey data /Reardon, Thomas, Amir Heiman, Liang Lu, Chandra SR Nuthalapati, Rob Vos, and David Zilberman. "'Pivoting" by food industry firms to cope with COVID-19 in developing regions: E-commerce and "co-pivoting" delivery intermediaries." *Agricultural Economics* 52, no. 3 (2021): 459-475.

- ▶ The pandemic has accelerated innovative efforts to develop and deploy the transformative power of digital technology to address these problems in ways that leapfrog past practices and traditional solutions.
- ▶ Emerging evidence from Asia and Africa suggests that digital technology holds promise to dramatically enhance smallholder productivity and incomes by increasing on-farm and off-farm efficiency, enhancing traceability, reducing vulnerability to counterfeit products, and improving farmers' access to output, input, and financial markets.
- ▶ The change is driven by the introduction of new forms of intermediation and the collection, use, and analysis of massive amounts of agriculture data to disrupt existing business models.
- ▶ New strategic partnerships between the public and private sectors are an essential component for reaping the positive impacts of digital technology and avoiding unintended and unwelcome secondary effects.

Digital  
technology  
and African  
smallholder  
agriculture:  
Implications for  
public policy.  
(Brookings)



The  
pandemic  
led to  
increased  
automation  
of food  
supply chains

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These changes required new investments and many changes are likely to stay

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The pandemic increased automation of production – in specialty crop and livestock - which will likely to continue

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Despite the criticisms US food system was proven to be resilient and met the pandemic challenge effectively

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Access to most advance internet throughout the country is essential for inclusion of rural America in fast moving digitization

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Internet accessibility is a global priority

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Computer literacy should be major priority to schools and extension