

# Annual Business Survey: Results of New Measures of Technology

Virtual Robotics Workshop

June 23, 2020

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# Annual Business Survey Overview

Employer component of total business ownership

Sponsored by the National Center for Science and Engineering Statistics (NCSES) within the National Science Foundation

Mandatory under Title 13 U.S.C.

Annual collection planned for years 2018 - 2022

Provides data on economic and demographic characteristics

# Methodology

Sample survey conducted on a firm basis

Large sample size of ~850,000 employer businesses in benchmark year (2018)

Smaller sample size annually of ~300,000 employer businesses (years 2019 – 2022)

Includes all nonfarm businesses filing IRS employer tax forms

Covers 20 NAICS industries

Excludes nonemployer businesses

# Content Design

**Designed to introduce new content each year based on topics of interest/relevance**

Innovation

Technology

Globalization

Finance

**Designed to keep core content each survey year**

Owner demographics (i.e. sex, ethnicity, race)

Research and development for microbusinesses (i.e. R&D activity, cost, and performance)

Business operating data (i.e. operation status, revenues, number of employees)

# Data Product Approach

Data collected via one collection instrument

Topics of interest to various sponsors, stakeholders, and users

Frequent releases via different avenues and timelines

# 2018 Data Availability

## First estimates released in September 2019

High level estimates on the number of minority-owned, women-owned, Hispanic-owned, and veteran-owned businesses

## Technology Statistics in January 2020

Estimates on digitization, cloud services, and new business technologies

## Detailed tables released in May 2020

Owner demographics by detailed geography, NAICS, employment and receipts size, and the number of years in business

Business characteristics

Additional owner characteristics

## Final Innovation, R&D, & Intellectual Property Estimates in May 2020

Detailed tables on R&D, innovation and technology to NCSES

NCSES will release tables via NSF website

## Final Tech Tables in June 2020

High-level tables on technology

Excel tables on ABS website

# 2018 Tech Tables

## Tech characteristics include:

Digital share of business activity, cloud service purchases, business technologies

## Tab levels include:

Tech characteristics by 3-digit NAICS for the United States and states

Tech characteristics by sex, ethnicity, race, and veteran status for the United States

Tech characteristics by employment size for the United States

# 2018 Tech Statistics

## Summary Statistics

	Observations	Mean Employment	Mean Age
Unweighted	514,000	94.11	17.05
Weighted	3,070,000	22.99	15.84

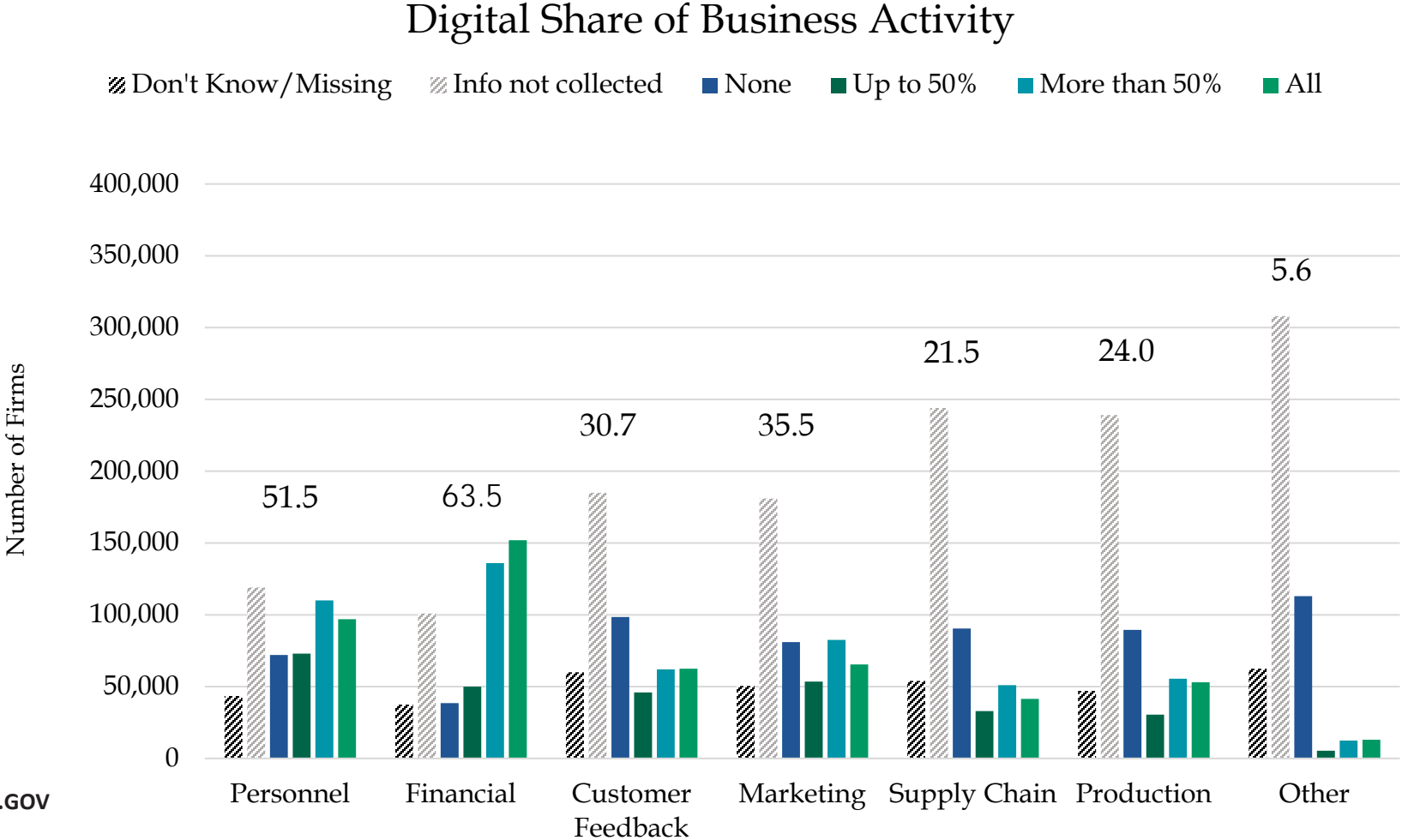
## Size Distribution

Employment	%	Weighted %	BDS
1 to 9	64	76	76
10 to 49	24	20	20
50 to 249	9	3	4
250 or more	3	1	1



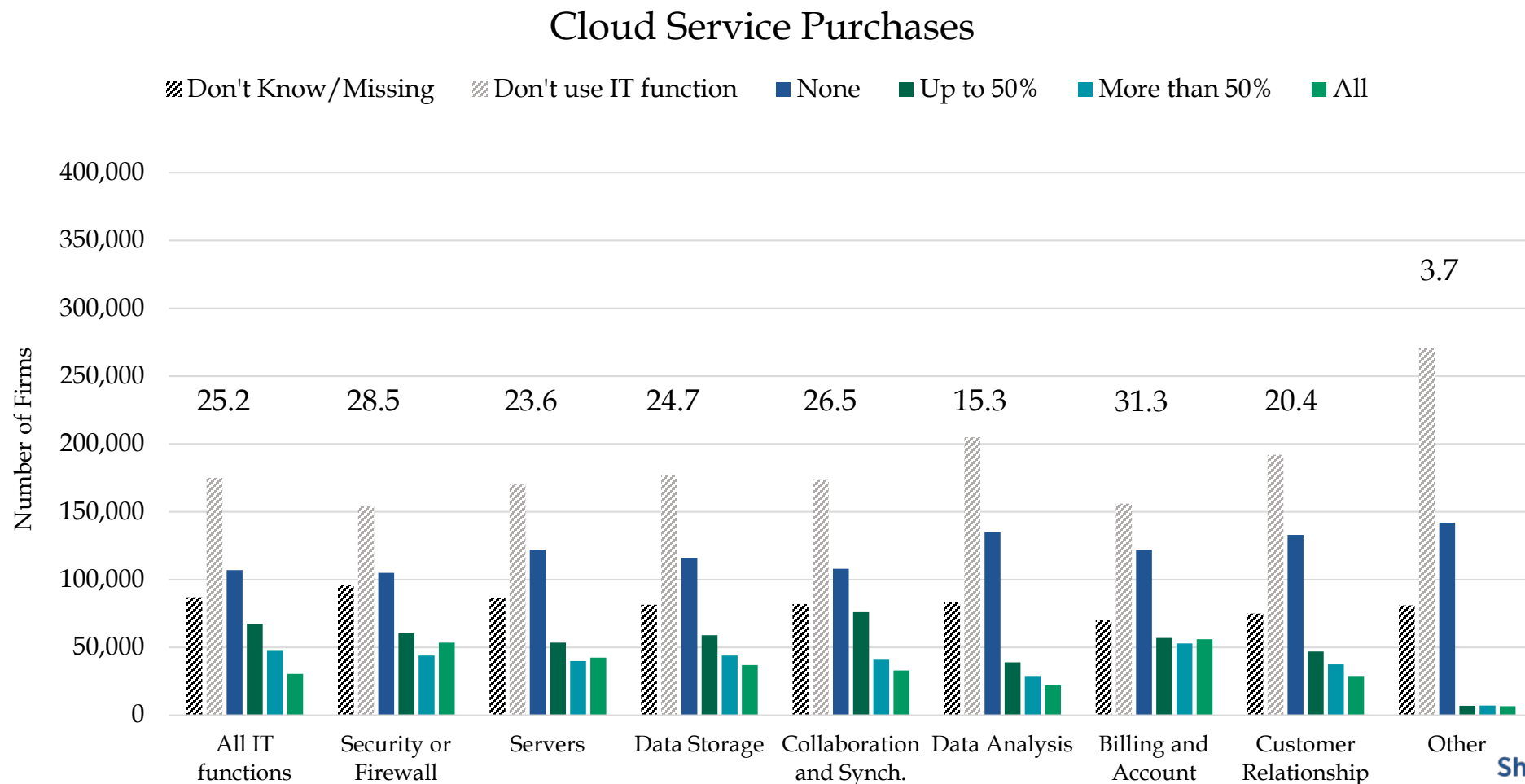
# Digital Share of Business Activity (Question 1)

In 2017, how much of each type of information was kept in digital format at this business?



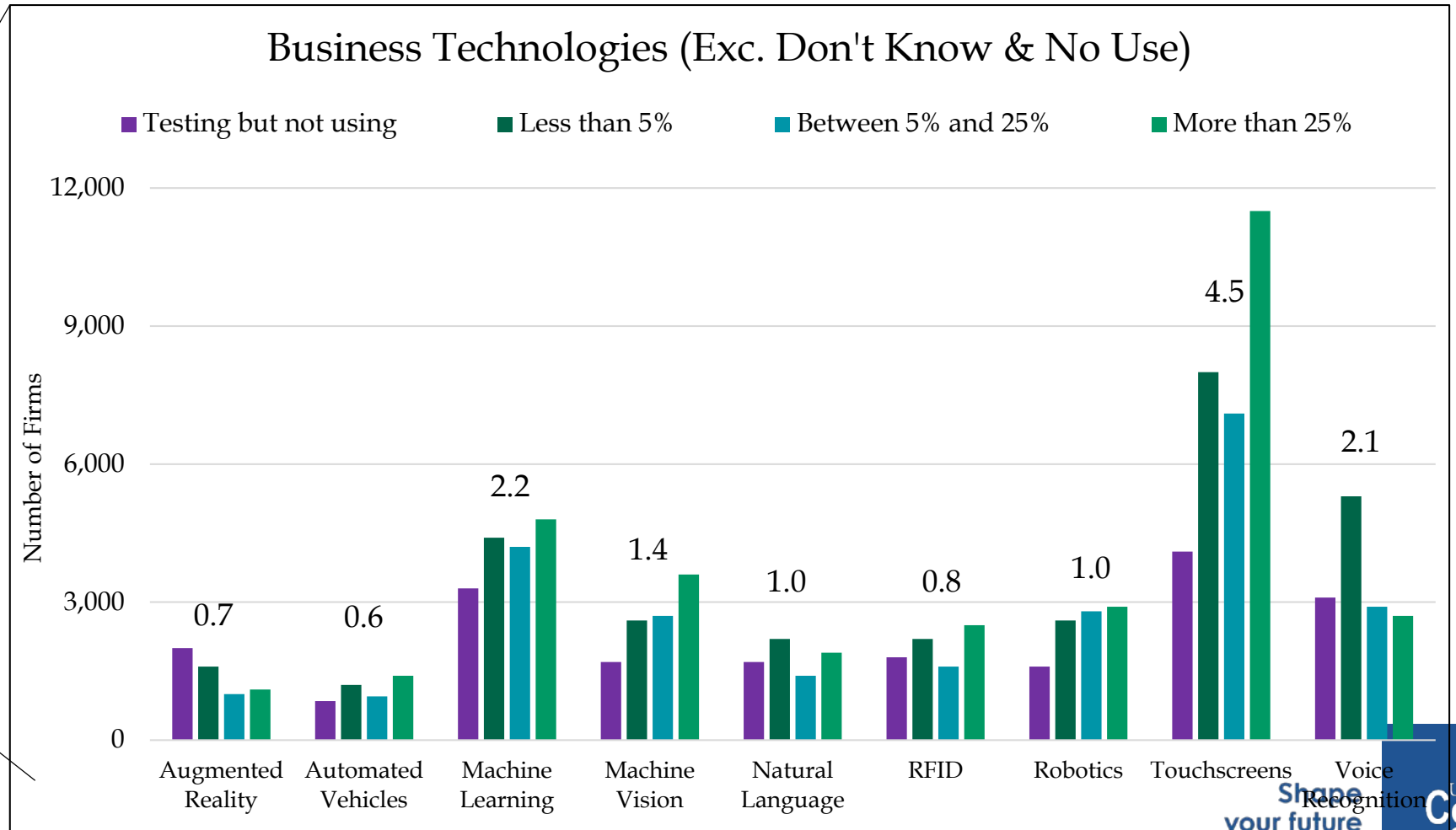
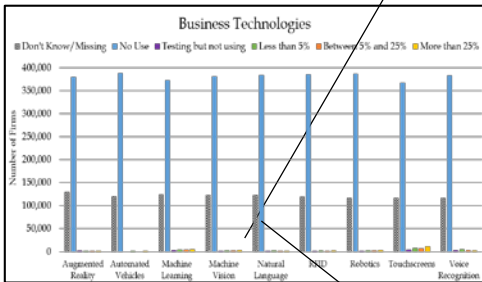
# Cloud Service Purchases (Question 2)

Considering the amount spent on each of these IT functions, how much was spent on cloud services?

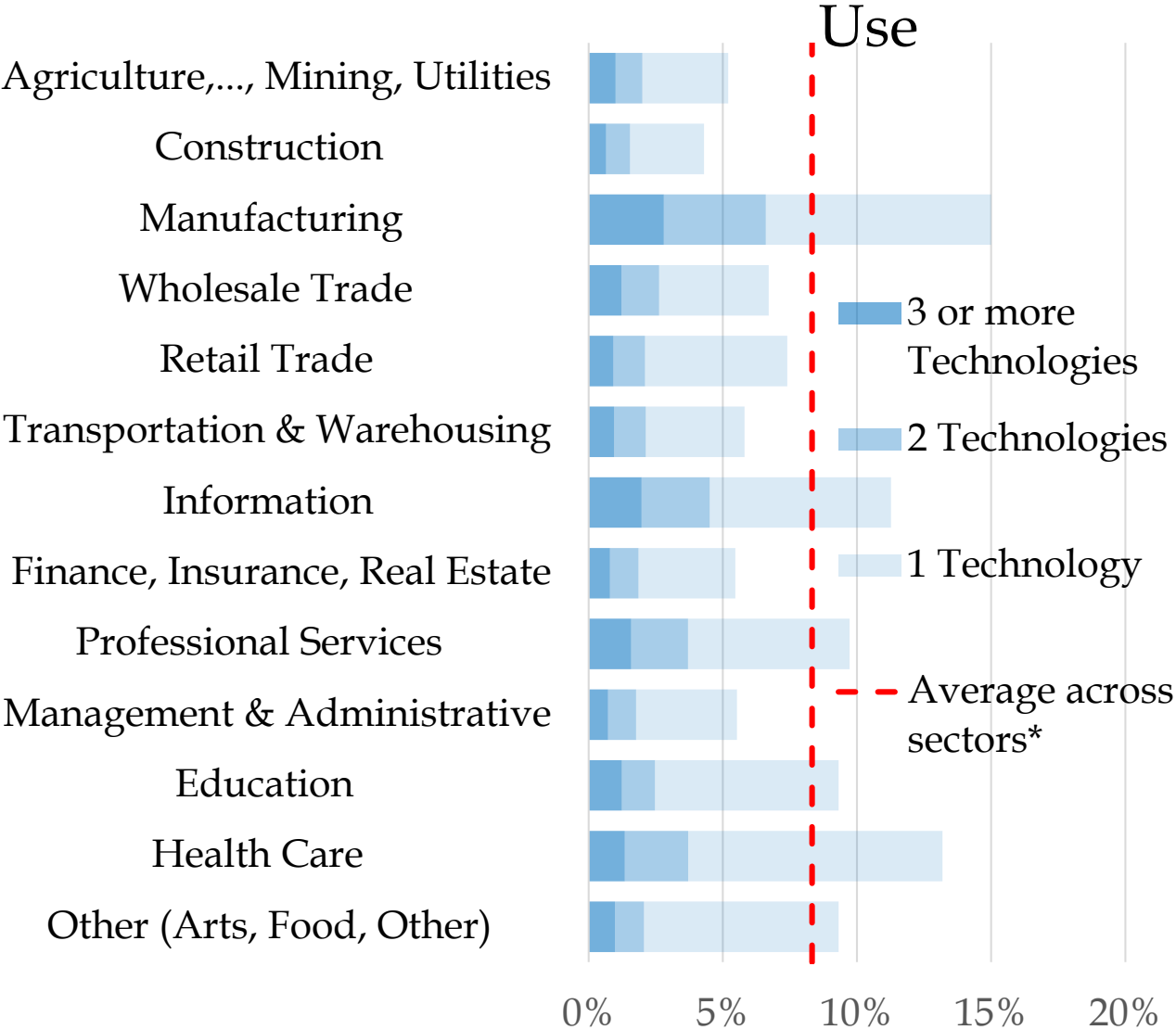


# Business Technologies (Question 3)

In 2017, to what extent did this business use the following technologies in producing goods or services?



# Diffusion by Sector – Business Technologies (Q3)



High sectoral variability in technology adoption, with Manufacturing, Information and Health Care being the lead adopters of new technologies

# Top Technologies by Sector

Sector	Business Technology		
	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>
<b>Agriculture, ..., Mining, Utilities</b>	Machine Learning	Touchscreens	Machine Vision
<b>Construction</b>	Touchscreens	Machine Learning	Voice Recognition
<b>Manufacturing</b>	Machine Learning	Robotics	Touchscreens
<b>Wholesale Trade</b>	Touchscreens	Machine Learning	RFID
<b>Retail Trade</b>	Touchscreens	Machine Learning	RFID
<b>Transportation &amp; Warehousing</b>	Touchscreens	Machine Learning	RFID
<b>Information</b>	Touchscreens	Machine Learning	Voice Recognition
<b>Finance, Insurance, Real Estate</b>	Touchscreens	Voice Recognition	Machine Learning
<b>Professional Services</b>	Voice Recognition	Touchscreens	Machine Learning
<b>Management &amp; Administrative</b>	Touchscreens	Machine Learning	Voice Recognition
<b>Education</b>	Touchscreens	Machine Learning	Voice Recognition
<b>Health Care</b>	Touchscreens	Voice Recognition	Machine Learning
<b>Other (Arts, Food, Other)</b>	Touchscreens	Machine Learning	Machine Vision

# Top 4-digit NAICS Use for Robotics and Automation

## Robotics

NAICS	Industry	Use Rate (%)
3363	Motor Vehicle Parts Manufacturing	0.171
3261	Plastics Product Manufacturing	0.164
3335	Metalworking Machinery Manufacturing	0.140
Mean (All Industries)		0.018

## Machine Vision

NAICS	Industry	Use Rate (%)
3344	Semiconductor and Other Electronic Component Manufacturing	0.133
3335	Metalworking Machinery Manufacturing	0.112
3363	Motor Vehicle Parts Manufacturing	0.095
Mean (All Industries)		0.021

## Machine Learning

NAICS	Industry	Use Rate (%)
3335	Metalworking Machinery Manufacturing	0.123
3327	Machine Shops; Turned Products; Screw, Nut and Bolt Manufacturing	0.118
5112	Software Publishers	0.103
Mean (All Industries)		0.033

# Diffusion of Technology is Skewed

- Digitization is widely adopted across all firms and sectors
- Cloud Service Purchases is less-widely adopted but for many different functions
- Latest business technologies are not widely adopted
  - Diffusion is highest among oldest and largest firms
  - Usage increases with size across all age categories

Size and Age Predictors for Business Technology Use

Age\Size	1 to 9 Employees		10 to 49 Employees		50 to 249 Employees		250 or More Employees	
0 to 5 years	0.08	(0.13)	0.14	(0.20)	0.15	(0.31)	0.16	(0.28)
6 to 10 years	0.07	(0.10)	0.13	(0.18)	0.16	(0.30)	0.16	(0.35)
11 to 20 years	0.06	(0.10)	0.13	(0.20)	0.16	(0.31)	0.19	(0.43)
21 or more years	0.06	(0.08)	0.11	(0.19)	0.19	(0.31)	0.25	(0.37)

# Worker Exposure to Business Technologies

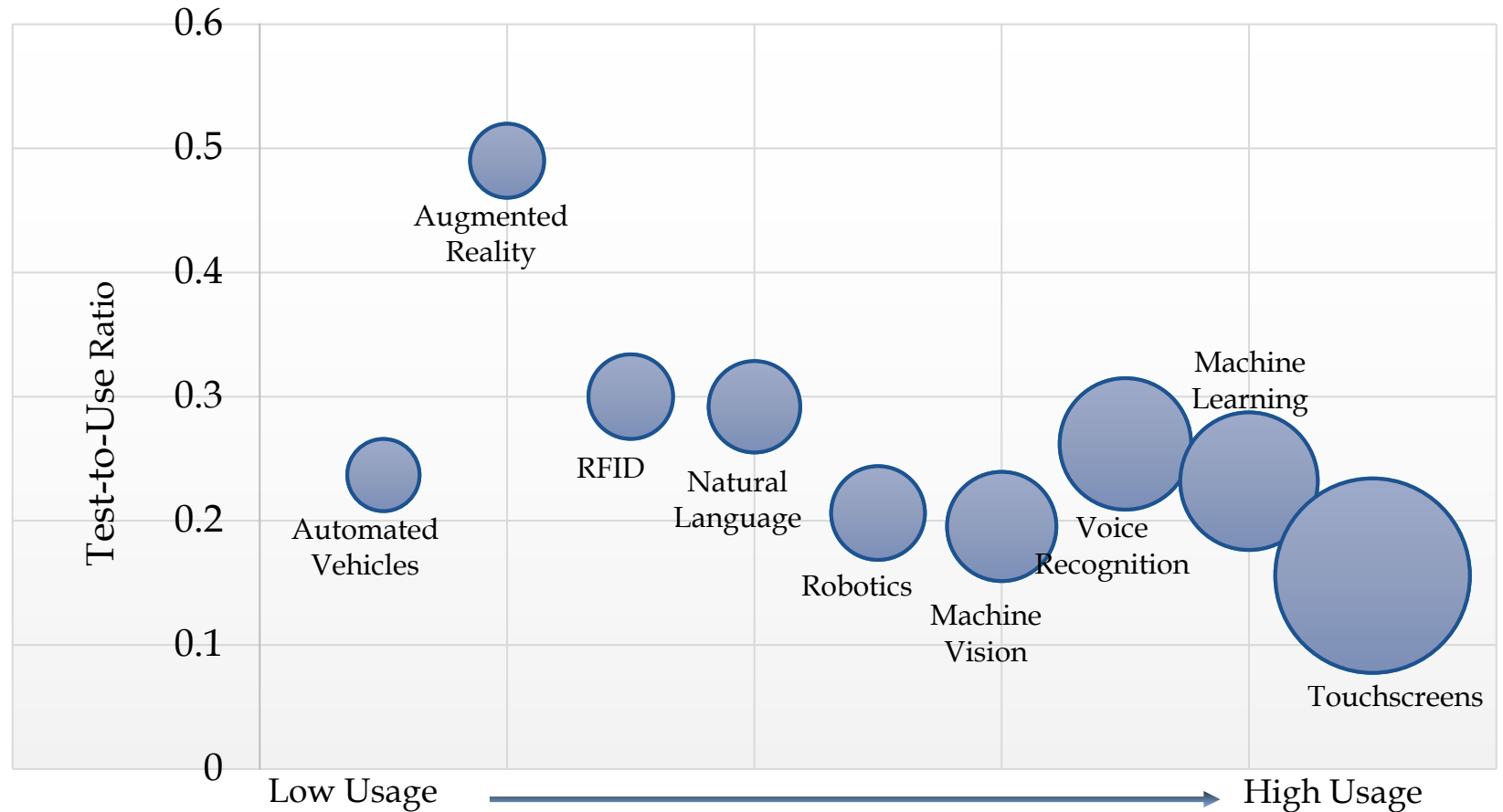
Business Technology	% Use (Survey- Weighted)	% Use (Employment- Weighted)	Difference Ratio
Touchscreens	4.5	13.2	3.0x
Machine Learning	2.2	5.4	2.4x
Voice Recognition	2.1	5.3	2.6x
Machine Vision	1.4	3.4	2.4x
Robotics	1.0	6.8	6.5x
Natural Language	1.0	3.5	3.5x
RFID	0.8	5.2	6.2x
Augmented Reality	0.7	1.3	2.1x
Automated Vehicles	0.6	1.6	2.6x

Low firm adoption does not necessarily mean that workers are not exposed to certain technologies



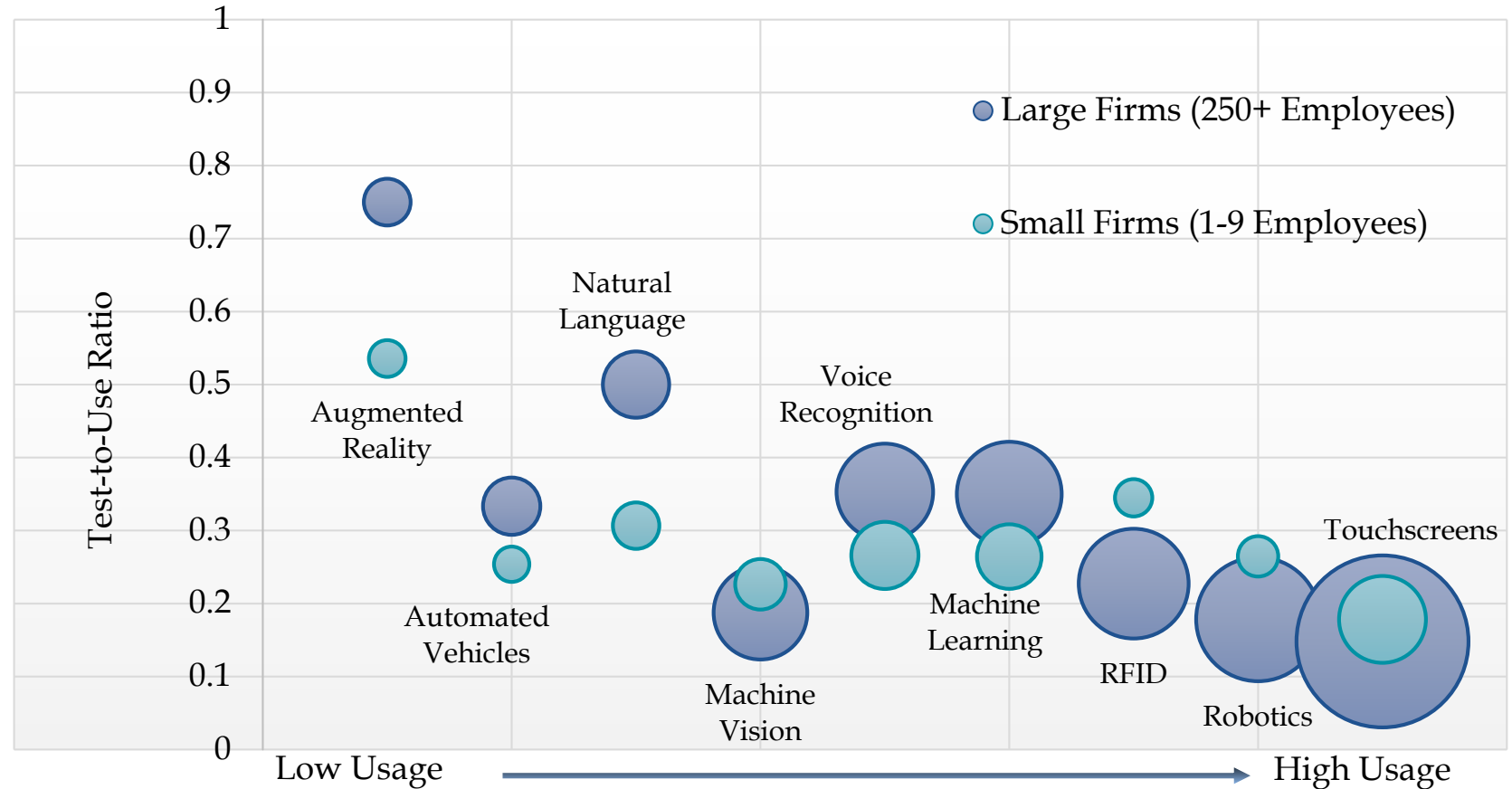
# Testing versus Use for Business Technologies

- Testing-to-Use ratios can help to explain how and why certain technologies get adopted and indicate future use of certain technologies



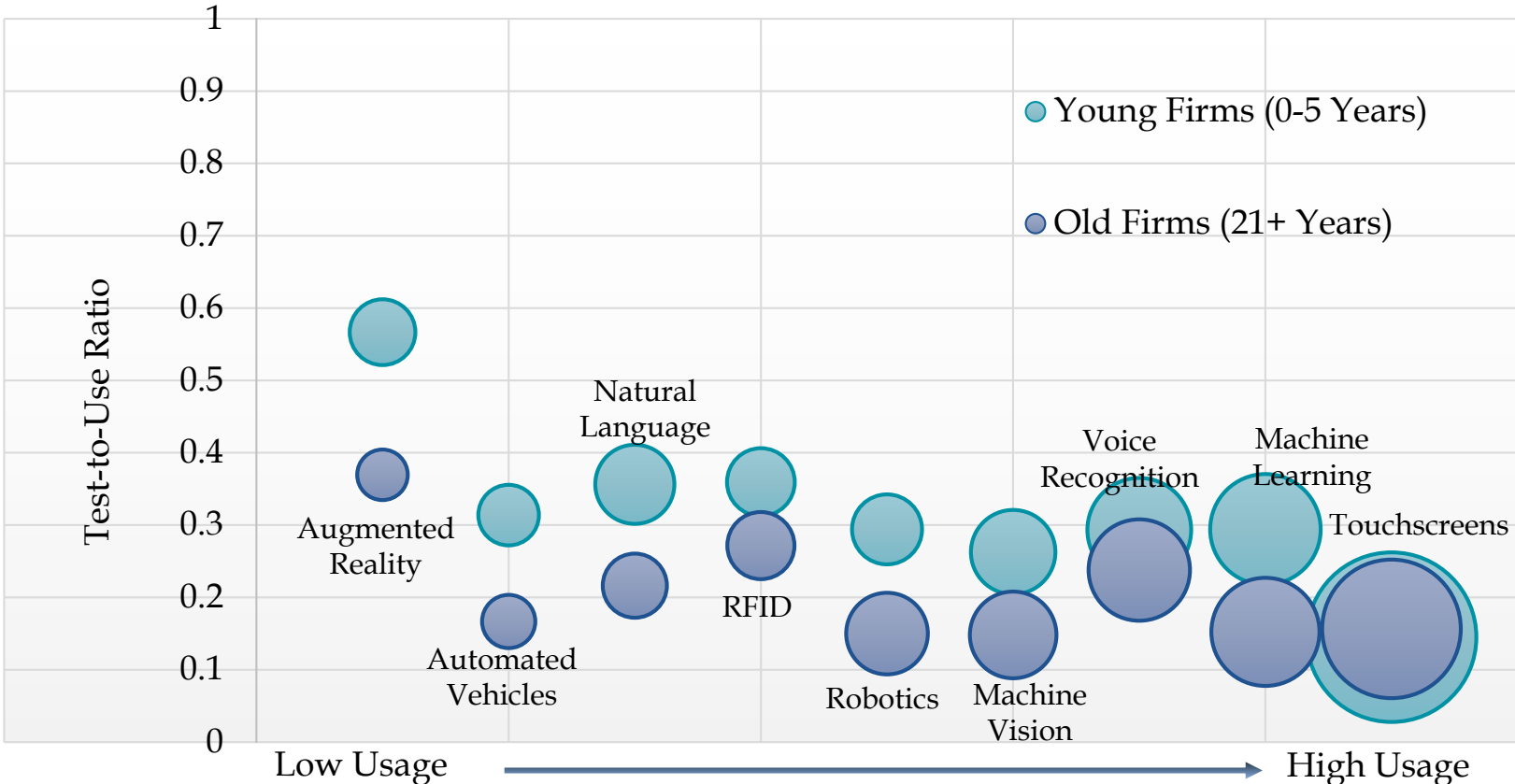
# Testing versus Use for Business Technologies – Large versus Small Firms

- Large firms lead small firms in both testing and use



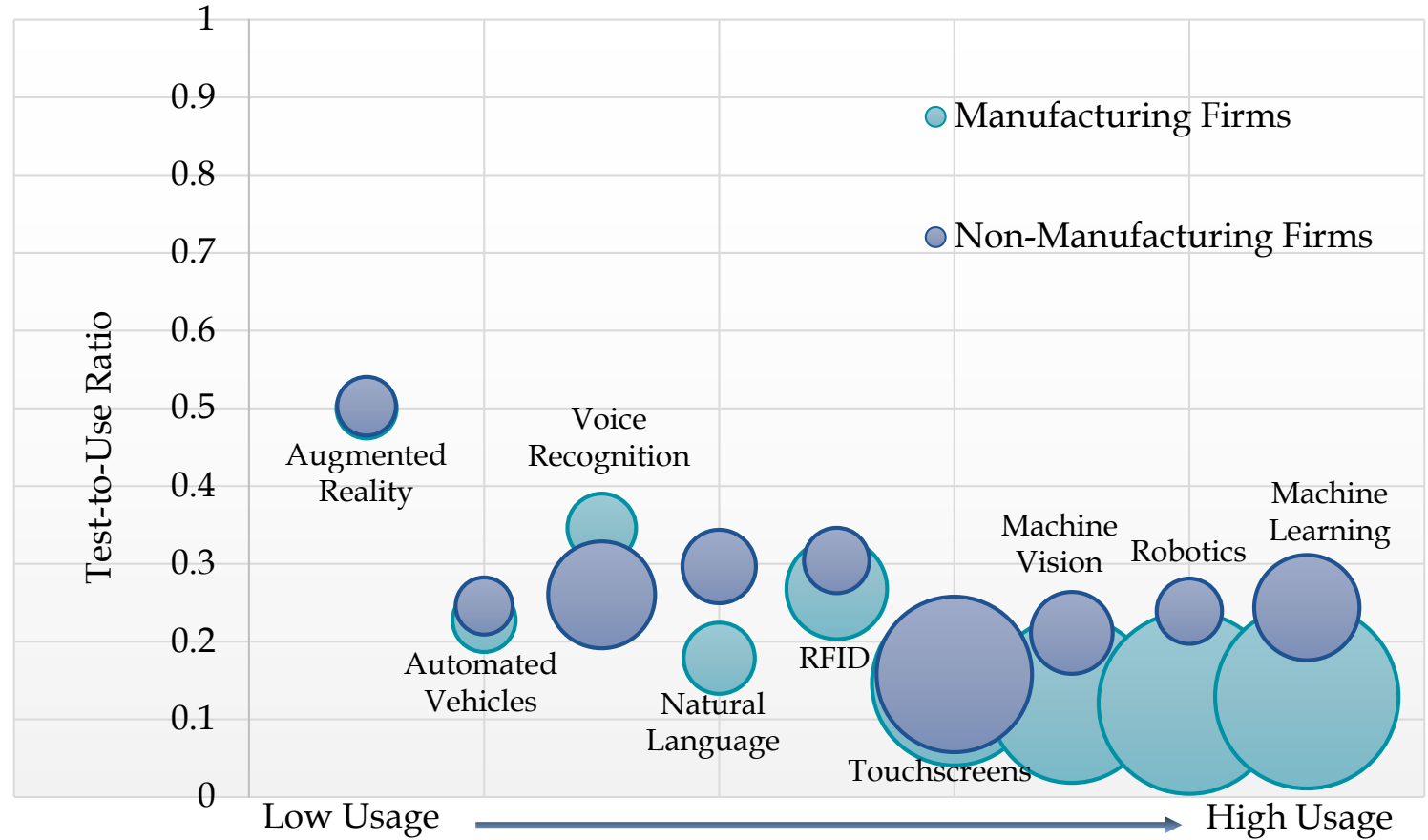
# Testing versus Use for Business Technologies – Old versus Young Firms

- Young firms perform more testing than older firms

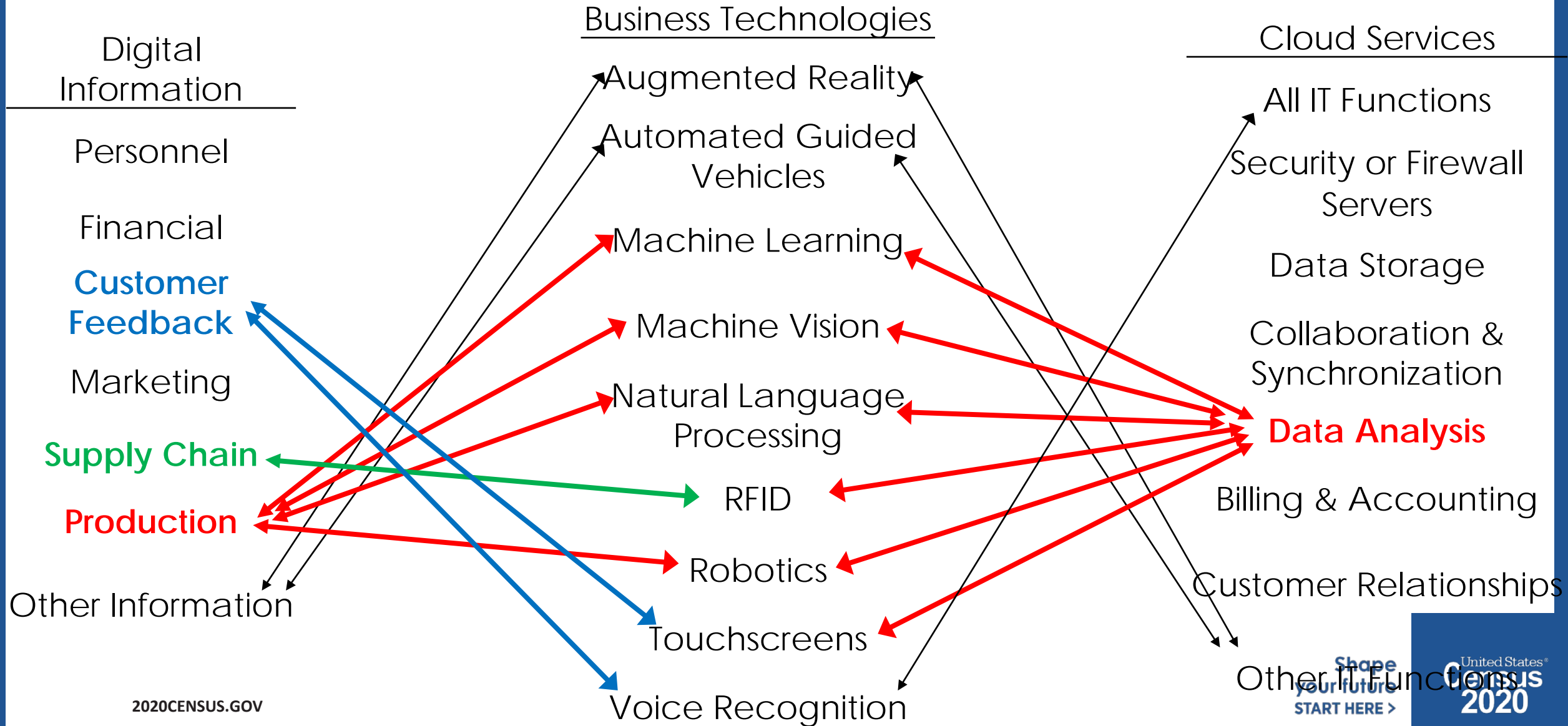


# Testing versus Use for Business Technologies – Manufacturing versus Non-Manufacturing

- Manufacturing firms have significantly higher usage rates of technologies associated with automation

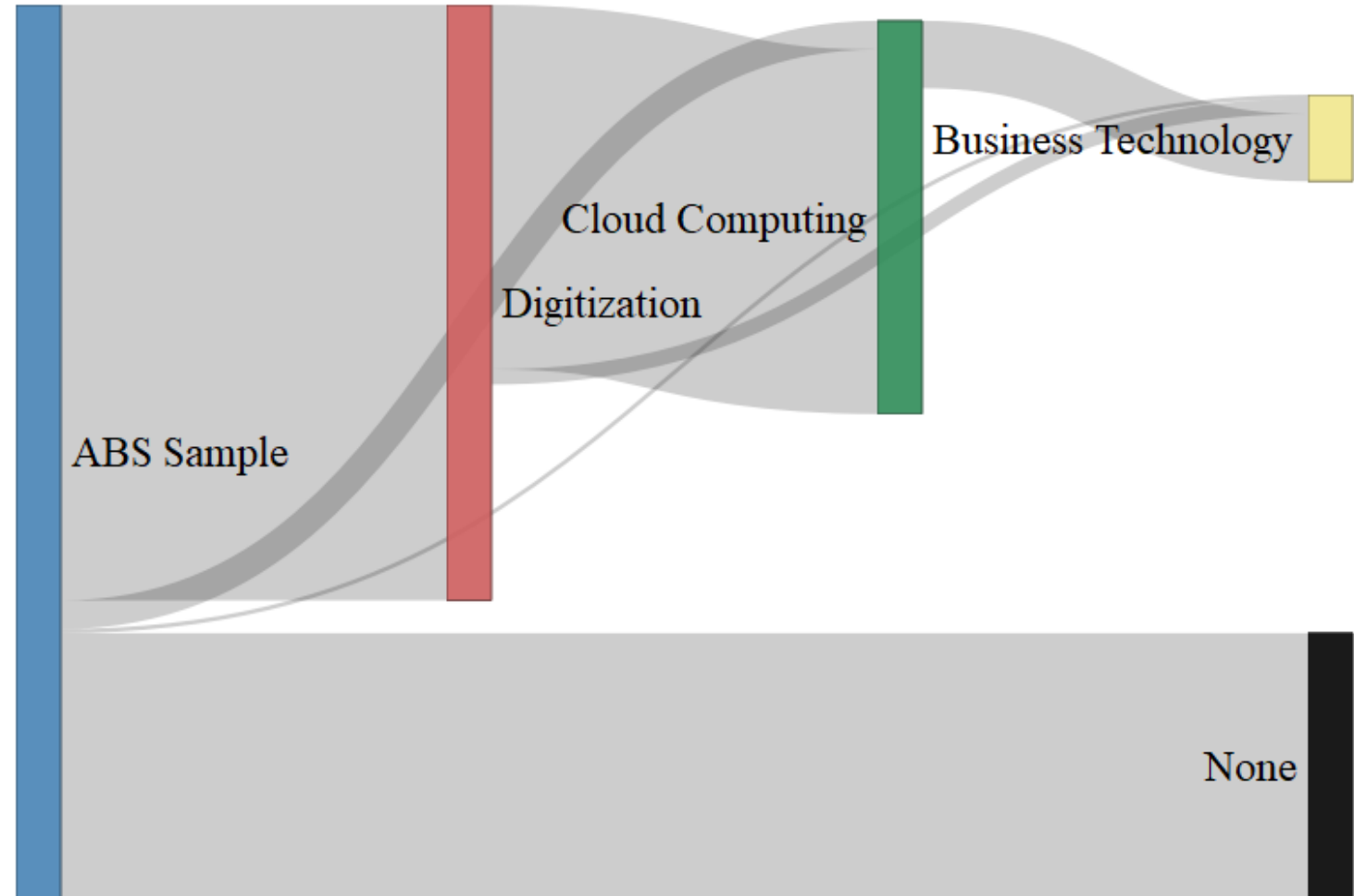


# Technological Complementarities

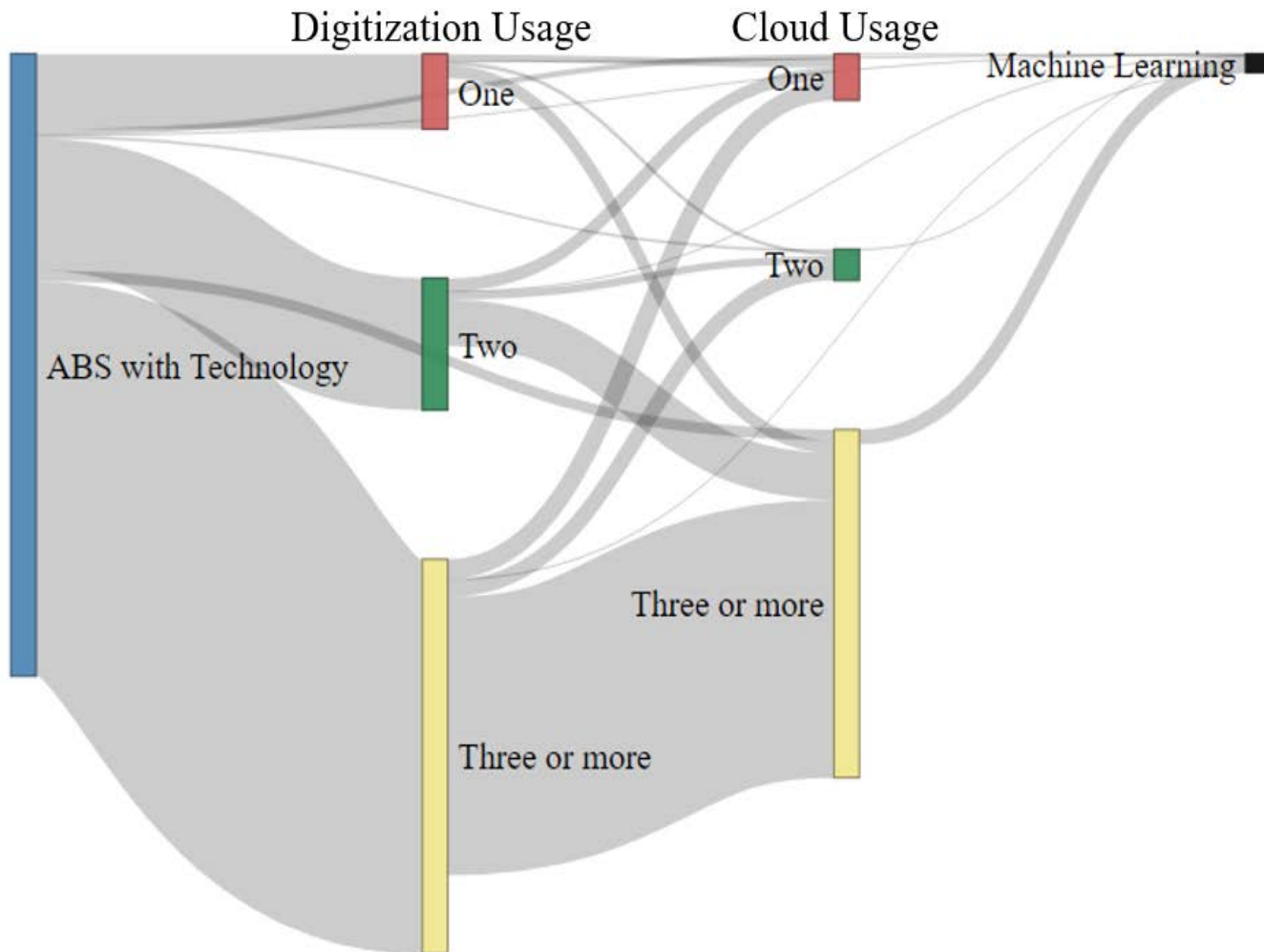


# Technological Hierarchies

- Certain technological capabilities need to be fulfilled before firms can adopt new technologies



# Technological Hierarchies – Machine Learning Example



- Certain business technology adoption requires wide-spread technology adoption
- Robotics and Machine Vision displays similar patterns

# Summary and Conclusions

- 2018 ABS Technology module reveals new information regarding firm-level technology adoption
  - Low and Skewed
    - Size and age are key determinants
- High variability in type and usage by sector, with manufacturing being a leading adopter of certain technologies
  - Machine Learning, Robotics and Machine Vision
- Technological Hierarchies – advanced technology adoption is highly dependent of adopting key infrastructure



# Future Plans for 2019 ABS

2019 processing (covering reference year 2018) – begins in June

Tech (automation) characteristics include:

- Production and Technology Based Goods and Services
- Motivation for Adoption and Utilization
- *Impact on Workforce and Worker Types*
- Factors Adversely Affecting Adoption and Utilization or Production

# Contact Info

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