



How Technology-Based Start-Ups Support U.S. Economic Growth

BY J. JOHN WU AND ROBERT D. ATKINSON | NOVEMBER 2017

Policymakers should focus on spurring high-growth, technology-based start-ups. These firms, by definition, seek to grow; they offer better-paying jobs; and they are almost always in export-based industries and help U.S. competitiveness.

EXECUTIVE SUMMARY

Technology-based start-ups have long been an important driver of America's economic growth and competitiveness. But while these firms provide outsized contributions to employment, innovation, exports, and productivity growth, many policymakers focus more broadly on helping all business start-ups without regard to type. Such a broad-based focus risks reducing overall economic growth for three key reasons. First, most owners of new non-tech-based firms have no intention of growing beyond just a few employees. Second, small, non-tech-based firms on average have much lower productivity and wage levels than technology-based start-ups. And third, most non-tech start-ups are in local-serving industries (e.g., retail) and as such create few or no net new jobs. As such, the focus of entrepreneurship policy should be squarely on spurring more technology-based start-ups.

Over the last few years a common narrative has emerged that new business formation is down and that this has been a significant contributing factor to the recent underperformance of the U.S. economy. There is a parallel narrative which holds that large technology firms are crushing technology-based start-ups, using their power to enter markets that start-ups otherwise would occupy. Therefore, a critical question for the future of the U.S. economy is the current state of technology-based start-ups. ITIF attempted to answer this question by examining data on more than 5 million firms in 10 technology-based industries from 2007 to 2016. As it turns out, neither claim is true.

While it is true that fewer “mom and pop” start-ups are forming—a trend policymakers should be largely indifferent to—technology-based start-ups have increased. But policymakers should not accept the recent increases in technology-based start-up activity as justification for inaction. Instead, they should promote policies that will help current and future technology-based start-ups emerge and scale into larger firms that will generate long-lasting, high-paying jobs, increase innovation and productivity, and improve the global competitiveness of the U.S. economy.

The number of technology-based start-ups increased 47 percent over the past decade, from 116,000 firms to 171,000 firms, and employment among these firms grew from 1.2 million to 1.5 million workers.

What Differentiates Technology-Based Start-Ups From Other Start-Ups?

Technology-based start-ups (firms 10 years old or younger in technology-based industries) are relatively few in number, yet they make an outsized contribution to the economy and embody different firm characteristics than typical start-ups (all other firms 10 years old or younger).

- Technology-based start-ups make up 2.8 percent of all U.S. firms.
- Start-ups in general make up 51 percent of all U.S. firms.

Firm Characteristics	Tech-Based Start-Ups	Typical Start-Ups
Examples of Businesses	Biotech, IT products or services	Restaurants, laundromats
Growth Path	Large potential for significant employment and revenue growth	Addition of few jobs in first few years, then bankruptcy
Job Creation	Tend to employ more high- and semi-skilled workers	Tend to employ more semi- and low-skilled workers
Wages	Pays more than twice the national median wage	Pays less than the national median wage
Job Multipliers	Creates up to five indirect jobs in other industries	Creates little to no net new jobs
R&D Investments	Invests heavily in R&D	Little to no R&D investment
Trade	Focused on trade with international markets	Sells predominately in local markets

Technology-Based Industries Provide Outsized Contributions to the Economy

ITIF analyzed 10 technology-based industries:

Manufacturing

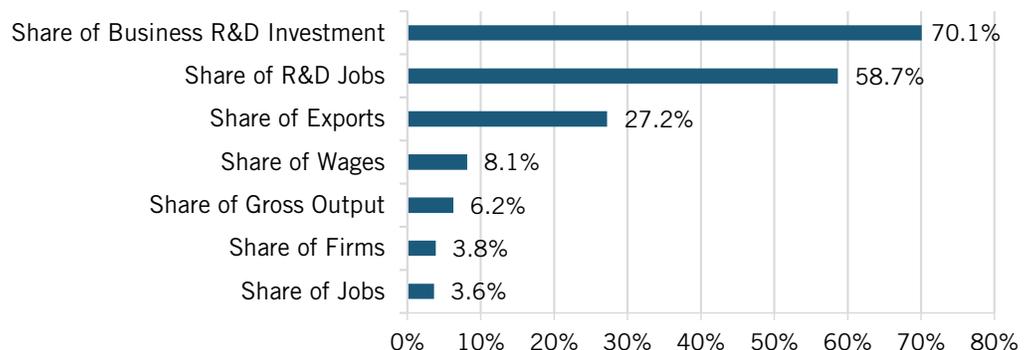
- Aerospace Parts & Products
- Computer and Electronics
- Pharmaceuticals and Medicine
- Medical Devices
- Semiconductor Components
- Semiconductor Machinery

Services

- Computer Systems and Design
- Data Processing
- Software Publishing
- Scientific R&D

Firms in technology-based industries (start-ups and older firms) make up 3.8 percent of all businesses, but provide proportionally much larger contributions to the economy.

Figure 1: The Ten Technology-Based Industries' Contributions to the U.S. Economy



Trends in Technology-Based Start-Ups, 2007–2016

Technology-based start-up activity grew over the past decade. Specifically:

- The total number of technology-based start-ups increased 47 percent, from 116,000 firms to 171,000 firms.
- Employment among technology-based start-ups increased 20 percent, from 1.2 million to 1.5 million workers.
- As a share of all technology-based employment, jobs in start-up firms increased from 31 percent to 33 percent.
- Technology-based start-ups account for a larger share of technology-based employment than typical start-ups' share of total economy employment (33 percent to 19 percent).

Although technology-based start-ups pay 2 percent less in wages than all businesses in technology-based industries, real earnings among these start-ups have grown rapidly.

- Real annual wages grew by 20 percent among technology-based start-ups, as compared to 17 percent across all technology-based firms.
- Technology-based start-ups pay more than twice the national average wage, and almost three times the average overall start-up wage.

Early-stage technology-based start-ups—those who have yet to develop market-ready revenue-generating products or services—are an important component of the innovation ecosystem because they are often engaged in the highest-risk, highest-reward kinds of innovations. Over the past decade, they have become a smaller share of the economy and have also shrunk in size.

- Early stage start-ups as a share of all technology-based firms decreased from 15 percent to 10 percent.
- Employment in early stage start-ups decreased from 160,000 workers to 100,000 workers, and from 4 percent to 2.2 percent of all workers in technology-based firms.
- The average early stage start-up size decreased from 11 workers to 4 workers, with a growing number of much smaller-sized computer systems and design service start-ups a main contributor to this decrease.

High-growth technology-based startups—firms that increase employment more than 25 percent year-over-year—are a major contributor to economy-wide net job creation.

- Approximately 6 percent of technology-based start-ups experience high employment growth annually.
- High-growth start-ups employ 100,000 workers on average; this figure is equivalent to one-eighth of new jobs added to the economy yearly.

More new technology-based firms were able to stay in business longer from 1998 to 2016, but increased competition in recent years has lowered firm survival rates.

- 78 percent of new technology-based firms survived past their first year in business; 41 percent survived through their fifth year.
- In recent years, both first-year and fifth-year survival rates have decreased slightly.
- Comparing firm survival rates in technology-based industries to firm survival rates in industries across the economy, first-year survivor rates are similar and fifth-year survival rates in technology-based industry are lower than in the overall economy by 6 percentage points.

There is a strong correlation of 0.75 between a state's level of technology-based start-up activity with ITIF's 2017 State New Economy Index overall score—an index where ITIF measures how well a state's economic structure fits the “new” economy.

Venture capital-backed (VC) start-ups offer high potential for significant growth—one major reason why private investors invest in such businesses.

- VC-backed firms make up 0.44 percent of all start-ups, but 11 percent of technology-based start-ups, with this share ranging from 3 percent for the aerospace industry to 30 percent for the medical devices industry.
- In 2016, of all technology-based VC-backed firms, 87 percent were start-ups, with this share ranging from 80 percent for the medical devices sector to 89 percent for the information technology sector.

Start-Up Highlights for Individual Technology-Based Industries

Taken as a whole, technology-based start-up activity is robust. But it differs from one tech-based industry to the next.

- Start-ups in the computer and electronics manufacturing industry increased 78 percent from 2007 to 2016, whereas start-ups in the medical devices industry decreased 43 percent.
- Start-ups in the pharmaceutical industry offered the highest wages (\$140,000), whereas start-ups in the semiconductor machinery industry offered the lowest wages (\$56,000).
- Given the long lead time to develop drugs and bring them to market, it is not surprising that the pharmaceutical industry had the highest share of start-ups still in their early stages (46 percent), as compared to the data processing industry, where just 5 percent of start-ups were in the early stage.
- From 2007 to 2016, semiconductor machinery start-ups accounted for the largest start-up share of high-growth firms (8.9 percent), as compared to the medical devices industry with the smallest start-up share of high-growth firms (5.3 percent).
- From 1998 to 2016, software publishers had the highest firm tenure (first-year survival rates of 90 percent, and fifth-year survival rates of 53 percent), as

compared to data processing firms that had the lowest firm tenure (first-year survival rates of 75 percent, and fifth-year survival rates of 36 percent).

Start-Up Activity at the State Level

States that are strongest in “new economy” indicators—such as having the highest numbers of knowledge workers, global exports, R&D, economic dynamism, and information technology adoption—also have much higher levels of technology-based start-up activity. There is a strong correlation of 0.75 between a state’s level of technology-based start-up activity and its overall score in ITIF’s 2017 *State New Economy Index*, which measures these economic foundation areas.

- The median state was home to 1,800 technology-based start-ups in 2016, with California having 30,000 technology-based start-ups and Wyoming 250.
- Technology-based start-ups made up 2.4 percent of all businesses in the median state—accounting for 4.7 percent of New Hampshire businesses—but only 1.4 percent of South Dakota businesses.
- Technology-based start-ups employed 16,700 workers in the median state, with the most in California (300,000 workers) and the fewest in Wyoming (1,300).
- Technology-based start-ups employed 0.9 percent of the median state’s workforce, with the highest share in Massachusetts (2.4 percent) and the lowest in Mississippi (0.5 percent).
- The average technology-based start-up in the median state employed 12 workers in 2016. Kansas had the highest average (28 workers), while Alaska had the lowest (6).

Start-Up Activity at the Congressional District Level

Technology-based start-up activity differs significantly by congressional district. But this does not mean that policymakers representing districts that have less technology-based start-up activity should ignore innovation policies. In fact, they should support policies that generate greater technology-based start-up activity, because more technology-based start-ups help the overall U.S. economy, likely leading to more money circulating into all congressional districts.

Technology-based start-ups make up 2.3 percent of all firms in the median congressional district. This translates to the median district containing 300 technology-based start-ups that employ 2,300 workers. The top 10 districts based on their firm share of technology-based start-ups include:

1. CA-17—16.1 percent (Silicon Valley).
2. VA-10—11.6 percent (just outside Washington, DC).
3. TX-02—8.9 percent (in and around Houston).
4. WA-01—8.3 percent (just outside Seattle).
5. VA-08—8.3 percent (Alexandria).
6. CA-14—8.2 percent (just outside San Francisco).

7. CA-49—8.1 percent (Hillsborough, just outside San Francisco).
8. CA-45—8.1 percent (Orange County).
9. MA-05—7.7 percent (just outside Boston).
10. TX-03—7.5 percent (Plano, just outside Dallas).

Policies Recommendations

All levels of government—local, state, and federal—should work to bolster technology-based start-ups by crafting policies in key areas that accomplish three main objectives:

1. Encourage individuals to create or join technology-based start-ups.
2. Increase survival and success rates of technology-based start-ups.
3. Enable technology-based start-ups to scale their growth faster and become larger.

Examples of such policies include:

Tax Reform

- Expand the rate of the Alternative Simplified Credit for research and development from 14 percent to at least 25 percent.
- Amend Section 469 of the tax code to permit passive investors to take advantage of the net operating losses and research tax credits of companies in which they invest.
- Amend Section 382 of the tax code to make it easier for small companies to carry net operating losses forward even as they continue to attract new investors.

Regulatory Reform

- Create an Office of Innovation Policy within the Office of Management and Budget to review the impact major regulations would have on future innovation.
- Charge the Small Business Administration's Office of Advocacy with focusing solely on advocating for and reviewing federal regulations that affect new firms in technology-based industries.

Science, Technology, Engineering, and Math (STEM) Skills

- Appropriate approximately \$325 million over five years for the National Science Foundation (NSF) to award prizes to colleges and universities that dramatically increase the rate at which freshmen STEM students graduate with STEM degrees, and that demonstrably sustain the increase.
- Shift more permanent resident slots away from family-based and other related immigration programs toward immigrant workers with advanced STEM skills.

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Technology Transfer

- Establish an automatic set-aside program that allocates a modest percentage of federal research budgets to technology-commercialization activities.
- Develop a proof-of-concept, or “Phase Zero,” individual and institutional grant award program within major federal research agencies at the national level.
- Direct the NSF to partner with the National Institute of Standards and Technology (NIST) to develop a metric for universities to report entrepreneurship and commercialization information annually.

ACKNOWLEDGMENTS

The authors wish to thank the following individuals for providing input to this report: Alex Key for his editorial assistance, Joe Kennedy for his policy suggestions, and Stephen Ezell for his comments. Any errors or omissions are the authors' alone.

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ABOUT ITIF

The Information Technology and Innovation Foundation (ITIF) is a nonprofit, nonpartisan research and educational institute focusing on the intersection of technological innovation and public policy. Recognized as one of the world's leading science and technology think tanks, ITIF's mission is to formulate and promote policy solutions that accelerate innovation and boost productivity to spur growth, opportunity, and progress.

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