

## Technology Industry Report

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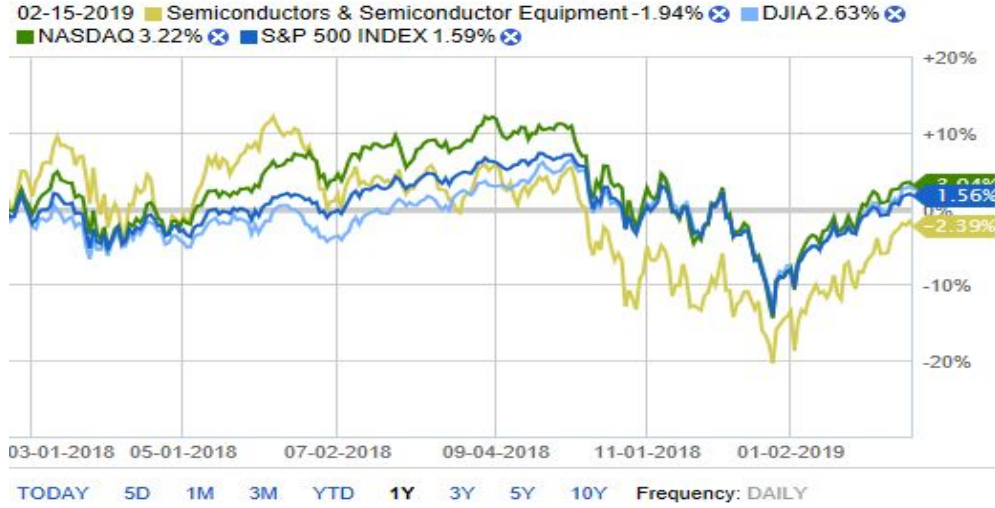
### Overview

The Technology Sector consists of companies involved in researching, developing, or distributing technological goods and services. This report divides the technology sector into four industries: Semiconductor, Internet, Hardware, and Software. Semiconductors cover products related to the electronics market. Internet covers companies providing accessibility of the Internet or services through the Internet. Both software and hardware are distinct features contributing to the functionality of computers.

### Semiconductor

#### General Description

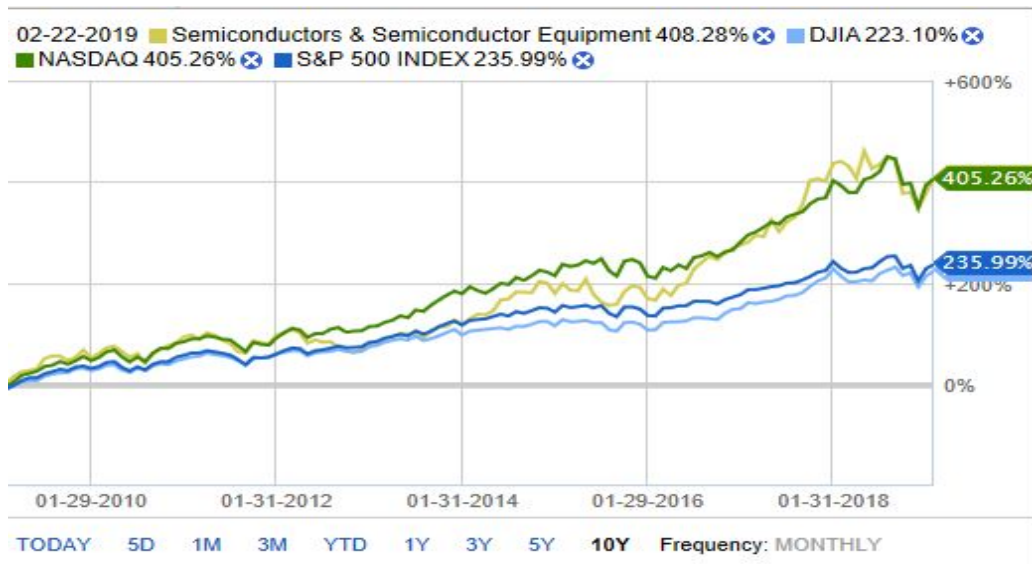
The Semiconductor Industry concerns the production of small and efficient chips that enable the processing abilities of electronics. The industry has a combined market cap of \$1.39 Trillion. It currently has a total revenue of \$19.7 billion and is projected to grow to \$21.4 billion in the next 5 years. It has also been experiencing an upward trend in sales, and in 2019, reached \$483.72 billion in sales. The Semiconductor industry as a whole experiences high market concentration due to high barriers of entry in which smaller firms are unable to compete against larger firms due to high equipment and operating costs. The Semiconductor industry has been lagging behind the major indices (S&P 500, Dow, Nasdaq) as shown in its negative growth of -2.39% while the other indices experienced positive growth in the last year. However, the Semiconductor industry has been a leading performer over the past five to ten years as seen through its higher growth at 123.72% in the past five years and 405.26% growth in the past ten years.



Semiconductor Industry Growth in the last year vs growth in S&P 500, Dow, and Nasdaq  
 Source: Fidelity



Semiconductor Industry growth in the last 5 years vs. growth in S&P 500, Dow, and Nasdaq  
 Source: Fidelity



Semiconductor Industry growth in the last 10 years vs. growth in S&P 500, Dow, and Nasdaq  
Source: Fidelity

### Two Main Categories

Semiconductor Machinery manufacturing makes equipments such as wafer processing equipment, wafer packaging equipment and ion implanters that produce semiconductors. The industry has grown significantly since the last 5 years due to increased demand in technologies requiring the use of semiconductors such as the electronics market.

Semiconductor and Circuit Manufacturing creates the core components of electronics and products ranging from devices to systems (e.g. computers, cell phones and TVs) that enable services (e.g. internet providers, telecommunications and broadcasting services). There has been an increasing focus on wide bandgap semiconductors that are smaller, faster and more efficient than their silicon counterparts. Greater demand for industry products in smart grid, smart vehicle and Internet of Things (IoT) technology have all contributed to revenue growth in this industry.

### Other Sub-Categories

Memory involves the creation of memory chips that computers use to store data and transfer information. The consolidation of this market drives prices down such

that only a few companies achieving economies of scale are able to survive. Examples of companies in this category are Toshiba, Samsung and NEC.

Microprocessors focuses on creating central processing units. Companies that dominate this category are Intel and Advanced Micro Devices.

Commodity Integrated Circuit creates the “standard chips” used for routine processing purposes and is largely dominated by Asian chip manufacturers. The small profit margins of this industry make it highly competitive and difficult to enter.

Complex SOC (system on a chip) involves creating an integrated circuit chip to handle an entire system and targets the growing demand for products with new features but priced for lower.

## Key Players

The key players in the semiconductor industry are Intel, Micron Technology, and Qualcomm Inc. These three companies are all based in the United States. Intel has recently named Robert Swan the new CEO. He previously served as the interim CEO and before he was the Chief Financial Officer. He is very experienced in the field and has held various high level management positions in different companies. In the upcoming year, Intel will launch a new modem called the XMM 7660. It has also developed a new processor called “Ice Lake” for the notebook computer market which is booming. It has also been working on developing processors for 5G wireless access and edge computing. Recently, Intel broke a 5G deal with China that was meant to expand Intel’s market base in China because of growing United States concerns over trade with China. The December 2018 Q4 earnings for Intel was \$18, 657 million. It experienced a 9.41% increase in annual growth.

Micron Technology is an American company based in Idaho that has multiple subsidiaries which deal with the design and production semiconductors and other technology related products. It has recently developed a high bandwidth memory chip that can be used for artificial intelligence applications. This will create new growth opportunities for artificial intelligence. This year the company also developed the world’s first one terabyte micro SD card to satisfy the need of consumers for more mobile storage. The December 2018 Q4 earnings for Micron

Technology was \$7.931 billion. It experienced a 16.32% annual growth.

Qualcomm Inc. is a semiconductor and telecommunications company that manufactures chips used for wireless technologies and gains a big portion of its revenue from patent licensing operations. It has been working on developing 5G processors, the next biggest development in the mobile industry. It has actually created the first mobile platform with integrated 5G. Qualcomm Snapdragon SOC is also the best processor in the industry. The December 2018 Q4 earnings for Qualcomm Inc. was \$5.8 billion. It experienced an annual growth rate of - 2%.

## Valuation

The Semiconductor industry has an earnings per share (EPS) of \$0.10. It experienced a high EPS growth of 103.70% which indicates huge profits earned in the past year and future growth potential. The P/S ratio is \$1.99, which suggests that investors are paying \$1.99 per \$1 of the industry's sales. The high P/E ratio at \$50.10 implies that investors are expecting significant growth in the industry while its low PEG ratio at \$0.77 suggests continued high EPS growth in the future. However, the low return on equity at 1.48% signifies the industry's poor management and inefficiency at turning equity into profit. The healthy debt to equity ratio at \$0.30 show that companies in this industry tend to not overborrow and are at less risk of defaulting on their loans. Lastly, the low EV/EBITDA at 8.46 demonstrates that investors are paying less for the stocks in this industry.

## Trends

There are different kinds of trends in the semiconductor industry in terms of macroeconomic drivers, regulations and policy, and major developments. One of the biggest macroeconomic drivers is the diversity of endmarket applications. There has also been a great increase in technological products and innovations. Lastly, trade regulations have played a big role in this industry. International trade regulations will be very important to consider because some of the largest companies such as Samsung Electronics are from Korea and other international places. In terms of regulations and policy, there is a greater emphasis on the importance of protecting internet protocol. The Semiconductor Industry Association also developed a Semiconductors 8 Point Policy Plan 'to build America's innovation economy. This will cause an increase in domestic production of semiconductors and the need to protect internet protocol will create more demand. Furthermore, there have been major developments in artificial intelligence, IoT, Autonomous Vehicles, 5G, and AR/VR technologies which all

require advanced semiconductors. All of the developments lead to an innovative product line which will be beneficial for the technology industry because as the semiconductors become more powerful, they can allow for better performing products which will create growth within the industry.

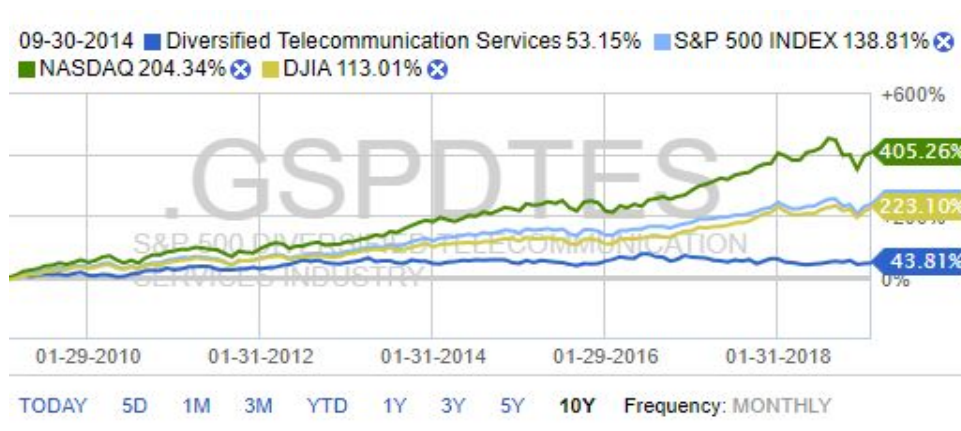
## Internet

### General Description

The Internet industry has a wide variety of products and services. It includes the traditional type of industry players such as network providers as well as search engines, retailers and travel services that rely on the internet as a platform. The industry is very capital intensive as the companies need heavy investment in R&D to remain competitive. The main growth in the industry has been related to artificial intelligence and cloud computing.

Internet Service Providers (ISPs) provide internet access and other services related to internet connectivity such as web hosting, web page designing, hardware or software consulting. It has a market cap of \$1.11 trillion and a revenue of 114.6 billion. ISPs consist of operators that lease out networks and support the internet infrastructure of other companies. ISPs also include wireless internet and VoIP services (voice over internet protocol). ISPs face a moderate level of market concentration in which there are several large companies dominating the industry but that the presence of many smaller companies has increased competition in the industry. Because the internet is starting to be perceived as a necessity rather than a luxury, there has been an increase in demand for internet services which has enabled ISPs to experience growth in revenue. The growing government support for network expansion, the addition of US broadband connections and expansion in rural markets has also contributed to increased revenue; however, profit margins are expected to decline. The expansion of cloud computing in which data is stored and accessed through the internet is creating much of the increase in demand for dedicated internet access services (sold at a higher margin) than typical internet access. A recent challenge that ISPs have been facing is increased internet traffic which has caused ISPs to control bandwidth and impose data caps. Such actions have resulted in controversy and debates over net neutrality and open internet. Overall, ISPs have been lagging behind all the major indices (S&P 500, Dow,

NASDAQ). It has experienced a 43.81% growth in the past 10 years whereas the other indices experienced growth of more than 100%.



ISP growth in the past year vs growth in S&P 500, Dow, and Nasdaq

Source: Fidelity

Internet Publishing and Broadcasting (IPB) provide news, music and video through internet. It has a market cap of \$1.47 trillion and a revenue of 124.7 billion. Companies falling under this category generate revenue by selling advertising space, subscriptions, intellectual property licensing, and selling user information to third parties. IPB has experienced a 13.7% annual growth in past 13-18 years and 14.1% annual growth in the last 18-23 years. It faces a high market share concentration in which four of the largest companies control 84.9% revenue. Like ISPs, increased usage of the internet has driven up its sales and revenue. One key driver to this growth is the growing presence of mobile internet connections. The industry, however, faces the challenge of becoming oversaturated from its recent slowdown in user base growth. This is because almost everyone uses the internet which provides IPB companies fewer opportunities to expand their client base. However, advertising on the internet can generate large revenue for IPB companies and become the main factor driving the industry's growth. Altogether, IPB has been lagging behind all the major indices (S&P 500, Dow, NASDAQ) as seen by its negative growth at -5.02% this past year.



IPB growth in the past year vs growth in S&P 500, Dow, and Nasdaq

Source: Fidelity

## Key Players

There are four key players in the industry: Apple, Amazon, Microsoft, and Google. In the following, I will introduce recent R&D and changes in management for each company.

Apple is a multinational technology company that develop and sell consumer electronics and softwares. On Feb 21, 2018, Apple cooperated with Goldman Sachs to launch a jointly created credit card in sync with the iPhone. On Feb 16, 2019, Apple hired ex-Microsoft exec Sam Jadallah to upgrade its smart home business. Its revenue of fiscal 2019 first quarter is \$84,310 million, and its revenue increased from 229,234.00 million to 265,595.00 million from 2017 to 2018. The annual growth Apple experienced in 2018 is 15.86%.

Amazon.com is a technology company that focuses on e-commerce and artificial intelligence. Amazon China is planning to merge with a Chinese e-commerce company Kaola for larger economies of scale. It has also recently announced that it is abandoning its HQ2 plan in New York. The revenue of fiscal 2018 fourth quarter is \$72.4 billion, and its annual growth in 2018 is 30.93%.

Microsoft is a technology company that focuses on developing and selling softwares and electronics. Recently, Exxon Mobil Corp and Microsoft are cooperating to employ cloud technology in the U.S. oil producers' shale operations. As for its company management, Microsoft employees protested working for the company to supply augmented reality headsets for the U.S. Army for future



battlefield last week. The revenue of fiscal 2018 fourth quarter is \$32.471B billion. The annual growth of 2018 is 15.83%.

Google is the world’s largest search engine company. Google is going to soon launch a “Netflix for game” service and it will release its new hardware for this streaming game product. Recently, Google is also planning to acquire a small start-up cloud migration company Aloomo to boost its cloud business. The revenue of fiscal 2018 fourth quarter is \$39.28 billion. The annual growth of 2018 is 23.42% increase.

All these companies are leaders in the internet industry and specialize in different fields. For example, Google focuses more on search engine and Amazon focuses more on retail. Their stock price increase per share has also manifested their leading positions in the industry, as shown in the chart below.

	2019	2018	2017	2016	2015
Apple	10.12%	-5.39%	48.48%	12.48%	-3.02%
Amazon	8.63%	28.43%	55.96%	10.95%	117.78%
Microsoft	9.25%	20.80%	40.72%	15.07%	22.70%
Google(GOOG)	6.85%	-0.80%	32.93%	1.86%	46.61%
Google(GOOG)	7.22%	-1.03%	35.58%	1.71%	44.16%

Data source: Macrotrends

## Valuation

The Internet industry has a P/E ratio of \$24.02 which lies within the \$20-25 range of the average P/E ratio of the overall market. This shows that the Internet industry as a whole is neither undervalued or overvalued; however, the high PEG ratio at \$1.30 suggests that the industry may become overvalued in the future. Its high return on equity at 21.31% implies that the industry operates under efficient management. Its high price to sales ratio at \$6.56 signifies that investors are paying \$6.56 per \$1 of the industry’s sales. The higher than average EBITDA at 22.80% suggests that the Internet industry is more capital intensive and borrows heavily to invest in newer technology. IPB has an earnings per share of \$25.86 while ISPs have an earnings per share of \$2.69. The EPS growth of Internet Publishing and Broadcasting at 81.28% demonstrates tremendous profits and strong growth potential whereas

ISPs struggled to make large profits as shown through its low EPS growth of -14.22% EPS.

## Trends

After discussing the key players and their performances, the major drivers and restrictions are also prominent. There are several macroeconomic drivers of the industry growth. First, as people have higher income level, the access to internet has gradually become a necessity rather than a luxury. Moreover, with the advent of smartphones, internet traffic volume has increased significantly with significantly increased mobile internet connections. In addition, the high percentage of services done online has also promoted the development of the Internet industry. While these macroeconomic conditions facilitate the growth of the Internet industry, there are also regulations and policies. The first major regulation is “Net Neutrality”, which gives all internet users equal access to all lawful contents without giving preferential treatments to any sites or services. Another important policy is “Cyber Intelligence Sharing And Protection Act (CISPA)”, which grants U.S. government the right to investigate cyber threats and ensure the security of networks against cyberattacks. There are also some major developments in the industry. The first is cloud computing, which allows people to store and retrieve information online very easily. The major product is Google Drive. Artificial Intelligence also plays a very important role. Products like Siri and Google Home improve the quality of people’s lives.

## Hardware

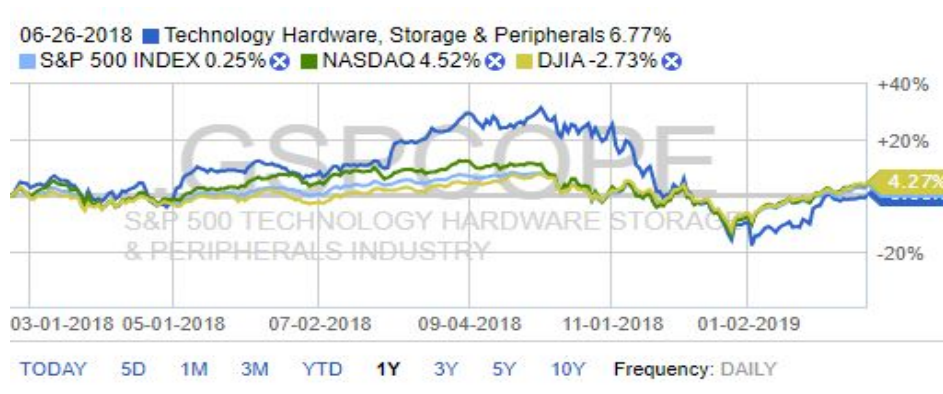
### General Description

The hardware industry has a broad range of products and is also a vital aspect of the technology sector.. This includes desktop computers, laptops, monitors, and keyboards; peripherals such as printers and scanners; and industrial devices such as Webcams, ATM machines, and storage devices. Multipurpose handheld communication devices (smartphones and tablets) are a rapidly growing part of the industry as they allow for multiple uses within one device. It also offers desktops, printers, wireless routers, and external hard drives among a variety of items. These products are used widely across various industries from finance to engineering. These products are vital to the daily operations of these firms: recording

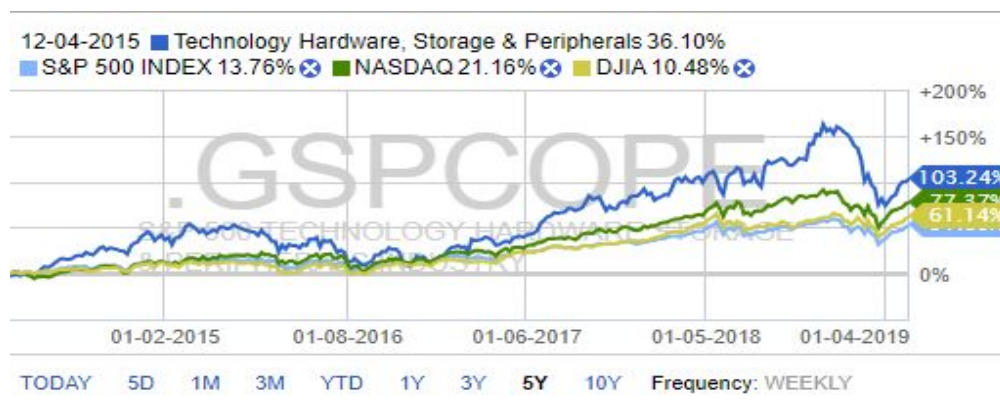
transactions and day to day functions. This technology not only helps industries across the nation but also helps raise the standard of living of the country.

Recently, the popularity of tablets and smartphones have stolen market shares for hardware, forcing manufactures to cut prices and lower production costs by outsourcing; this is a threat to the overall industry. Additionally, rising income levels is contributing to increasing demand but the competition in the sector has limited the profit making potential of manufacturers.

The combined market cap of the industry is 1.04 trillion and the average revenue has declined to 270.7 billion. Overall, the hardware industry has a moderate market concentration. The top four players account for 40.6% of the industry revenue while the top seven players account for 52.1% of the industry. By increasing outsourcing, production costs can be lowered and improve profits.



Hardware growth in the past year vs growth in S&P 500, Dow, and Nasdaq  
Source: Fidelity



Hardware growth in the last 5 years vs growth in S&P 500, Dow, and Nasdaq  
Source: Fidelity

## Key Players

The three main key players in the hardware industry are Apple, Samsung Vendor Group, and Alphabet.

Apple's research and development exceeded 3 billion in 2018 and many new products are expected to launch in the next year including an Apple credit card, AirPods 2 and HomePod. Recently Apple's Senior Vice President of Retail, Angela Ahrendts who was the highest paid Apple executive stepped down from her position. Recent headlines include comparisons of their products with those of Microsoft's and having an "innovation problem." But many of Apple's products such as the Apple watch has been tremendously beneficial for people as it has detected numerous health problems in advance. Apple's earning per share was 4.18 and increased their earnings by 7.46%.

Samsung Vendor Group has numerous new products launching this year as well, from the Galaxy S10: Foldable Phone to a TV Line. Recent headlines for Samsung include the innovative approach Samsung takes with their products including the new foldable phone which can increase the number of consumers for the company. Samsung's earnings per share was 5.82 and had a 5.5% increase in earnings.

Google is launching various new products from "Netflix for games" to the highly anticipated Pixel Four. In recent headlines, Google has been mostly in the news for their employees suing the company for their rights and winning, and helped the employees who held stock options in the company. Google's earnings per share was 12.77 and had a 19% increase in earnings.

Apple, Samsung, and Google are leaders in the hardware industry. Apple is the most valuable company in the world, with a 16.01% 5 year growth rate compared to the industry's 12.10%. Samsung's earning per share growth matched that of the industry's at 12.10%. Google's five year earnings per share was higher than that of the industry's with a 19.6% increase compared to the industry's 18.99%.

## Valuation

The Hardware Industry has an EPS of \$9.67. Its high EPS Growth of 146.67% indicates high profits and future potential growth. However, its high debt to equity ratio at \$99.43 indicates that the industry tends to borrow heavily to invest in R&D, and its high P/S ratio at \$2.92 suggests that investors are paying \$2.92 per \$1 of the industry's sales. It's slightly lower P/E ratio at \$15.09 signifies that the industry is slightly undervalued and consists of stocks in which their actual value is slightly

lower than their market price, and its low PEG ratio at \$0.1028 suggests continued high EPS growth in the future. The industry's positive return on equity at 30.33% indicates efficient management, and its EBITDA at 24.72% shows the industry's efforts to keep operating expenses low.

## Trends

The trade war currently occurring with China is detrimental to the technological industry as potential rise in tariffs decreases consumption of products abroad as the products become too expensive to purchase overseas. Many people will also sell off their stock as the trade war worsens. Another macroeconomic driver in the industry is decreasing unemployment as the industry offers more job opportunities and expanded employment by 13,500 jobs.

A main issue faced by tech companies is data privacy. Many people demand to have their data secure and have their privacy when using everyday technology. However, many people like to utilize these features such as Google Maps. Thus, companies are all trying to solve this issue by trying to maintain their customer's privacy while also letting them enjoy the features.

Another issue is Antitrust Laws which lawmakers want to enact to even the playing field for smaller tech companies. The tech giants have the money and resources to collect data on other firms and with antitrust laws it can aid the development of smaller firms in the industry.

The technological industry continues to develop everyday. A few major developments include 3-D Metal Printing, smart cities, and translation earbuds. 3-D Metal Printing can transform the manufacturing industry as this trend can help mass produce many products. Smart Cities are focused on providing a sustainable lifestyle while also increasing the standard of living. The successful development of this can change future cities. Translation earbuds such as Babel Fish Earbuds can help reduce communication barriers as they translate through the earbuds in an instant.

## Software

### General Description

The software industry includes application systems as well as software for business and consumer use. The combined market cap is 2.68 trillion and the average revenue is \$250.4 billion. The industry also includes software services, such as training, documentation, consulting and data recovery. The products and services offered in the industry are important to society, as it contributes to advancement and is now used on a day to day basis for all firms and all people. The products offered by the software industry provides companies and laborers to be more efficient as the software is doing much of the dry work for them. While the software industry has been growing significantly in the last few years, both in terms of sales and appeal to customers, the industry is still on the rise in popularity in other breakthroughs including Artificial Intelligence and Blockchain Technology.

The overall industry revenue is expected to increase due to increased demand for software at both the business and consumer level; this increases competition through incentivizing entrants and existing players to capture larger shares of the profits. Recent opportunities include the growing involvement of predictive analytics, artificial intelligence, and cloud computing as well as increased demand for security software). However, ongoing threats include software piracy, ongoing litigation and an expensive workforce,

The industry has a medium market concentration and has been a leading performing. It has been performing better than all the major indices in the past one year to five years. Most notably, it has been consistently performing better than NASDAQ (a major index that consists mainly of technology stocks). Therefore, this shows that Software is one of the leading industries in the technology sector.



Software growth in the past year vs growth in S&P 500, Dow, and Nasdaq  
Source: Fidelity



Software growth in the last 5 years vs growth in S&P 500, Dow, and Nasdaq  
Source: Fidelity

### Key Players

Alphabet is one of the largest software companies with a market cap of \$773.66 Billion. It currently has an Internal Research & Development going on in the company's cloud computing division. In addition, Google announced in November it was replacing its head of Cloud, Diane Greene, with former Oracle executive Thomas Kurian. In recent headlines, Alphabet has announced an intent to acquire Alooka. It has also been forming partnerships and collaborating with other companies for their products. Examples of this include Hyatt Hotels Corporation Collaboration with Google Assistants Pilot, as well as a development partnership between Sporttotal.TV and Google Cloud. In 2018 Alphabet delivered strong revenue growth, up 19% year over year to \$136.8 billion, and up 22% for the fourth quarter to \$39.3 billion. Alphabet is an average performer/leader in the industry. In the last 5 years the software industry has been up 161.24% whereas Alphabet has only been up by 85.48%.

Microsoft is one of the largest software companies with a market cap of \$851.39 Billion. It currently has an Internal Research & Development going on in Azure, Microsoft's Cloud Platform, IoT, and Cloud gaming. In recent headlines, Microsoft has partnered with Accenture to launch Accenture Microsoft Business Group. Microsoft has also recently acquired Citrus Data. In addition, Microsoft is partnering with Walgreens Boots Alliance to establish a Strategic Partnership that will Transform Health Care Delivery. In Q4 2018 Revenue for Microsoft was \$30.1 billion and increased 17%, while Operating income was \$10.4 billion and increased 35%. Revenue for the fiscal year of 2018 has increased \$2.6 billion or 12% where as Operating income increased \$993 million or 15%. Microsoft is a leader in the industry. In the last 5 years the software industry has been up 161.24% whereas Microsoft has been up by 194.98%.

Facebook is one of the largest software companies with a market cap of \$462.03 Billion. It currently has Internal Research & Development going on in Virtual Reality, as they plan to invest \$3 Billion in the next decade. In recent headlines, companies such as Tiger Global Management has been removing stake in Facebook, and Facebook has also been coming in the headlines for hefty fines due to privacy leaks. Facebook is also trying to expand as it recently acquired a blockchain company as well. In 2018 Facebook delivered strong revenue growth, up 38% year over year up 30% for the fourth quarter. Facebook is an average performer/leader in the industry. In the last 5 years the software industry has been up 161.24% whereas Facebook has only been up by 141.30%.

## Valuation Metrics

The Software Industry has an EPS of \$2.76. Its extremely high P/S ratio at \$6.68 shows that investors are paying \$6.68 per \$1 of the industry's sales, and its high P/E ratio at \$54.28 indicates that the industry is overvalued. Meanwhile, its high EPS growth at 194.01% indicates high profits and future growth potential, and its positive return on equity at 26.86% suggests efficient management. The industry's high debt to equity at \$53.39 suggests frequent borrowing to invest in R&D; however, its strong EBITDA at 27.92% suggests the industry's efforts to keep operating costs low.



## Trends

Macroeconomic drivers that can affect this industry include rising interest rates, employment and exchange rates. Rising interest rates can affect this industry as many of the software companies take on debt to finance the company or expand. Rising interest rates can cause a problem for the many companies in the industry that have debt issues. In addition, unemployment can affect this industry as consumers will not have money to invest in the stocks of software companies. Lastly, exchange rates can affect this industry as many of these companies operate abroad and heavily outsource and thus are affected by the exchange rates. Regulations include improving data protection and privacy as well as the cloud act, which compels companies to, if warranted, release data to the United States government. Major developments in this industry include developments in Artificial Intelligence, Cloud Computing, and Blockchain Technology.

## Conclusion

Overall, the technology sector has huge growth potential. As technology becomes increasingly present in our lives, companies in the technology sector will continue to experience growth in market share. The accessibility and convenience of cloud computing make it an especially promising opportunity for companies involved in the internet and software industry. Therefore, we may see significant growth in software and internet companies as they race to exploit the growing demand for more cloud based products. Companies in semiconductors and hardware also show promising signs of growth in the future. Heavy investments in artificial intelligence require the involvement of all industries in the technology sector, especially companies in the hardware and semiconductor industry which provide the structure for creating this smarter and more efficient technology. Therefore, it is likely that the semiconductor and hardware industry will also experience significant growth in the future.

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