



The Economic and Fiscal Contribution that
Data Centers Make to Virginia



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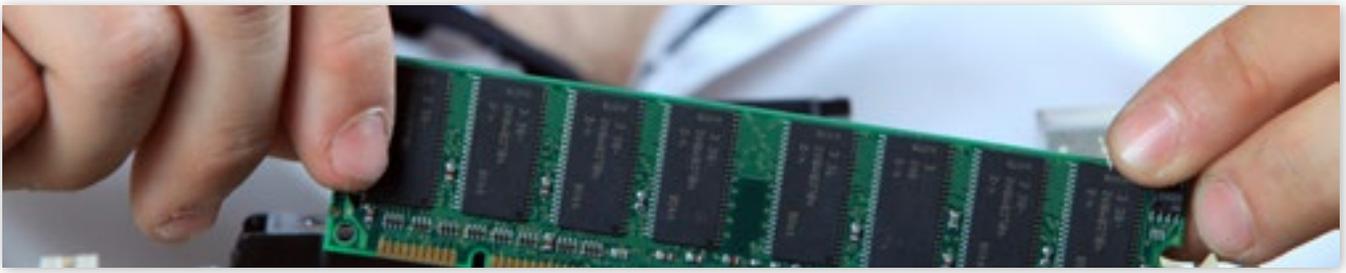
EXECUTIVE SUMMARY

In this report, we quantify the economic and fiscal contributions that data centers make to Virginia. The principal findings from that analysis are as follows:

- 1) The technology sector is the driving force for economic development in the modern economy. Data centers are part of the core infrastructure that supports that technology sector and as a result, it is not an exaggeration to say that they constitute the backbone of the modern economy.**

- 2) Data centers make a large contribution to Virginia's economy. In 2016, this industry was responsible for directly and indirectly supporting approximately 43,275 jobs, \$3.2 billion in labor income, and \$10.2 billion in economic output in Virginia.**

- 3) Although much of this impact is concentrated in Northern Virginia, it is increasingly spreading to other regions of the state. In 2016, data centers were responsible for directly and indirectly supporting approximately:**
 - 3,677 jobs, \$212.0 million in labor income, and \$843.2 million in economic output in Central Virginia.
 - 3,547 jobs, \$202.2 million in labor income, and \$797.2 million in economic output in Hampton Roads.
 - 1,601 jobs, \$64.5 million in labor income, and \$269.4 million in economic output in Southern Virginia.
 - 354 jobs, \$14.8 million in labor income, and \$68.6 million in economic output in Southwest Virginia.
 - 563 jobs, \$27.2 million in labor income, and \$115.3 million in economic output in the Shenandoah Valley.



4) This regional expansion of economic activity will likely be accelerated by the new MAREA and BRUSA cable landings in Virginia Beach:

- The newly constructed MAREA cable landing in Virginia Beach is the first subsea fiber-optic cable connection in the Mid-Atlantic, and the highest capacity subsea cable linking the U.S to Europe.
- The soon to be completed BRUSA cable landing in Virginia Beach will be the first subsea fiber-optic cable connection between the Mid-Atlantic and South America.
- The MAREA and BRUSA cable landings have already begun generating data center development in Virginia Beach. NxtVn has announce plans to build a \$1.5 to \$2.0 billion data center park in Virginia Beach that is expected to attract companies, such as Snapchat, IBM, and Uber, seeking high-capacity connections from the U.S. to Europe. In addition, Globalinx Data Centers has announced plans to build a 10,750 square foot colocation data center facility in Virginia Beach and envisions eventually expanding that investment to encompass 150,000 square feet of colocation data center space.

5) Data centers are a high-performance industry:

- In 2016, they paid a statewide average private sector weekly wage of \$2,336 – more than twice the statewide average of \$1,044 across all private sector industries.
- Over the last five years, data centers have experienced employment and wage growth that is four-times the average across all private sector industries in Virginia.

6) Data centers are a significant driver of capital investment:

- Since 2009, statewide capital investment by data centers has averaged \$1.6 billion a year.
- In 2016, data centers made \$2.6 billion in capital investments in Virginia and that investment was responsible for supporting approximately 4,617 jobs, \$254.3 million in labor income, and \$670.0 million in economic output in the state's construction industry.



7) Data centers drive human capital investment:

- Data centers aid in developing the human capital necessary to support a thriving technology industry ecosystem.
- The pool of workers that data centers employ also feed the talent pipeline for other high-wage/high-growth industries, such as Architecture and Engineering; Computer System Design; Management of Companies and Enterprises; Management, Scientific, and Technical Consulting; Scientific Research and Development; and Telecommunications.

8) Data centers drive energy innovation:

- Because of their substantial energy needs, data centers have emerged as one of the driving forces in energy efficiency and the development of renewable energy resources.
- Whereas in 2015 renewable energy did not materially contribute to electricity generation in Virginia, today Dominion Energy has more than 744-megawatts of solar generation capacity that is either operational or under development and 580-megawatts of that capacity is directly attributable to partnerships with leading data center companies.

9) Data centers strengthen local economies:

- Because data centers are very capital-intensive, they have a disproportionate impact on local property tax revenue, while making minimal demands on local services.
- Based on data from Loudoun County and Prince William County, this combination provides a greater than 8-to-1 benefit to cost ratio, enables these localities to draw \$13.4 million a year less from the state general fund for school budgets, and reduces local property tax rates from what otherwise would be required to fund county operations.



10) Data centers strengthen and diversify the state economy:

- Virginia has traditionally out-performed the national economy, but now generally under-performs the national economy.
- Much of that decline can be traced to Virginia's over-dependence on an increasingly cash-strapped federal government (Virginia is ranked 1st among the states in Department of Defense expenditures) and a deteriorating business climate (the Tax Foundation recently ranked Virginia 49th among the states in its attractiveness to capital-intensive new manufacturing industries).
- As the backbone of the modern technology economy, data centers play an important role in reversing these trends by facilitating the growth and diversification of Virginia's private sector economy.

11) Sales and use tax exemptions data center capital equipment purchases alleviate the undue tax burden placed on capital intensive industries and maintain Virginia's competitiveness:

- In 2010, in response to the loss of a \$1 billion Apple data center to North Carolina, Virginia significantly expanded the state's existing 2008 data center sales and use tax exemption on computer equipment. This exemption is similar to one Virginia has extended to the manufacturing sector for many years.
- In both cases, the sales and use tax exemption applies only to the purchase of capital equipment and does not affect the many other state and local taxes that these industries pay, such as the state corporate income tax or local property taxes. Also in both cases, the sales and use tax exemption serves to avoid imposing an undue tax burden on these industries relative to other industries because of their capital-intensity.
- When Virginia enacted its first data center sales and use tax exemption in 2008, only five other states offered such incentives. Today, 30 states have incentives that are targeted at attracting data centers, and 12 of those incentives have been enacted or revised in the last three years.
- In 2015, Virginia overtook New York as the world's largest market for data centers. If Virginia is to maintain its lead and avoid the fate of Washington State which has seen billions of dollars in data center investment migrate to other states because of its off-again/on-again approach to data center incentives it will need to maintain its competitive position in the data center market.



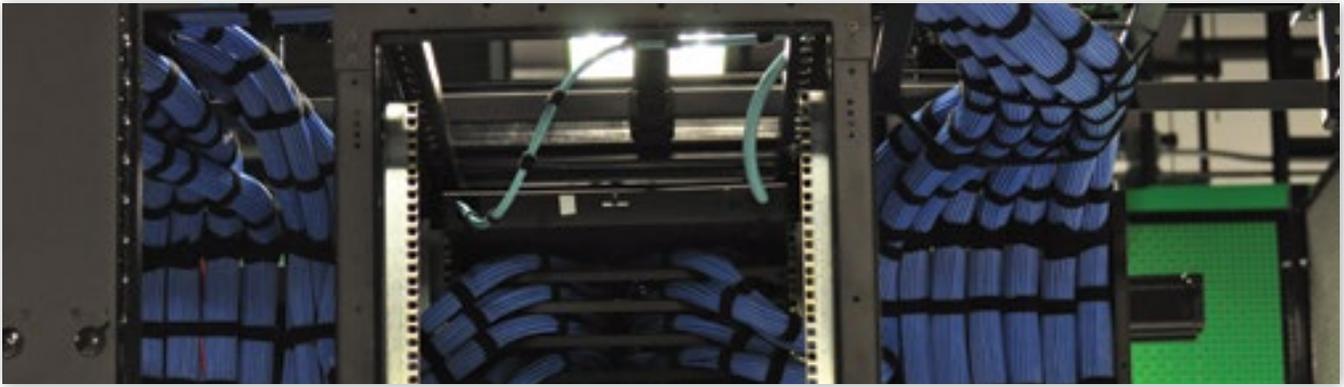
INTRODUCTION

Just as the industrial revolution of the late 18th century made the manufacturing sector the driving force for economic development at the time, the technological revolution of the late 20th century has made the technology sector the driving force for economic development in the modern economy. An important difference between the two, however, is that where the industrial revolution was largely confined to the manufacturing sector, the technological revolution is ubiquitous and has driven and connected innovations in almost every sector of the economy, including advanced manufacturing. Data centers and fiber networks are the core infrastructure that facilitates those connections and makes them possible. As a result, it is not an exaggeration to say that they have become the backbone of the modern economy.

In this report we quantify the economic and fiscal contributions that the Data Processing, Hosting, and Related Services industry, the formal industry classification that encompasses data centers, makes to Virginia. What that analysis shows is that this is a high-performance industry where employment and wages have grown at four-times the statewide average and one that directly and indirectly contributes approximately \$10.2 billion in economic activity to Virginia's economy annually. In addition, the Data Processing, Hosting, and Related Services industry is a significant driver of investment, contributing \$2.6 billion in capital investment to Virginia in 2016 alone, and helping to attract and develop the human capital that is the most critical component of a thriving technology industry ecosystem. In recent years, this industry has also emerged as one of the driving forces for energy efficiency and the development of renewable energy resources.

Although the Data Processing, Hosting, and Related Services industry is largely concentrated in Northern Virginia, it is also fostering economic development in other parts of the state, as demonstrated most recently by Facebook's announced plan to build a \$1 billion data center in Henrico County in Central Virginia. Moreover, as demonstrated by recently announced plans for a \$1.5 to \$2.0 billion data center park in Virginia Beach, that regional expansion of economic activity will likely be accelerated by the newly constructed MAREA and soon to be completed BRUSA, cable landings. These are the first subsea fiber-optic cable connections in the Mid-Atlantic, and the MAREA cable will be the highest capacity subsea cable linking the U.S to Europe.

¹ The Data Processing, Hosting, and Related Services industry (NAICS code 518210) is an official industry title within the U.S. Bureau of Labor Statistics' North American Industry Classification System (NAICS) taxonomy. Although it includes industries that would normally be considered data centers (e.g., Application Hosting, Automated Data Processing Services, Computer Data Storage Services, Data Processing Computer Services, etc.), it also includes a small number of industries that would not properly be considered data centers (e.g., Data Entry Services). However, Data Processing, Hosting, and Related Services is the most narrowly defined NAICS industry code available for assessing employment and wages in the data center industry, and therefore the NAICS industry code that we employ for empirical analyses in this report.



In addition, our analysis shows that the Data Processing, Hosting, and Related Services industry strengthens local economies. Much like the manufacturing sector, this industry is very capital-intensive. As a result, it makes a large fiscal contribution to localities through business personal property and real property taxes, while making minimal demands on local services. Using data from Loudoun County and Prince William County, we show that this combination provides these localities with a greater than 8-to-1 benefit to cost ratio, enables them to draw \$13.4 million a year less from the state general fund for school budgets, and reduces local property tax rates from what otherwise would be required to fund county operations.

Finally, our analysis shows that the Data Processing, Hosting, and Related Services industry also strengthens the state economy. Where not so long ago Virginia generally out-performed the national economy, we now generally under-perform the national economy. Much of that decline can be traced to Virginia's over-dependence on an increasingly cash-strapped federal government (Virginia is ranked 1st among the states in Department of Defense expenditures) and a deteriorating business climate (the Tax Foundation recently ranked Virginia 49th among the states in our attractiveness to capital-intensive new manufacturing industries). As the backbone of the modern technology economy, the Data Processing, Hosting, and Related Services industry plays an important role in reversing these unfortunate trends by facilitating the growth and diversification of Virginia's private sector economy.

The remainder of the report is divided into four sections. The Data Center Industry Profile section provides a profile of the data center sector in Virginia and details recent trends in that sector. The Economic and Fiscal Impact section quantifies the economic contribution that the data center industry provides to Virginia at a statewide and regional level. The Broader Contribution of Data Centers to Virginia's Economy section identifies and quantifies some of the more salient contributions that the data center sector makes to Virginia's economy. The Role of Incentives section discusses the role that state tax incentives are playing in the deployment of data centers in Virginia and across the United States. Finally, the Conclusion section provides a brief conclusion and summary of our findings.

DATA CENTER INDUSTRY PROFILE

In this section, we provide a general profile of the Data Processing, Hosting, and Related Services industry in Virginia. The data used to create that profile were provided by the Virginia Economic Development Partnership (VEDP) and cover private sector employment in the Data Processing, Hosting, and Related Services industry as defined by the U.S. Bureau of Labor Statistics. The regional aggregations of those data used in this section are based on the six sub-state regions employed by VEDP and are geographically depicted in the Virginia state map shown in Figure 1.



Figure 1: Virginia Economic Development Partnership Sub-state Regions

In 2016, private sector employment in the Data Processing, Hosting, and Related Services industry accounted for 13,415 jobs statewide in Virginia. Figure 2 depicts the regional distribution of that employment. As these data indicate, the largest proportion of employment in this industry (73 percent) was located in Northern Virginia. However, it is important to realize that industry employment was broadly distributed across other regions of the Commonwealth as well. Hampton Roads accounted for 11 percent of Data Processing, Hosting, and Related Services private sector employment in Virginia in 2016, Central Virginia 10 percent, Southern Virginia accounted for three percent, Southwest Virginia one percent, and the Shenandoah Valley two percent.

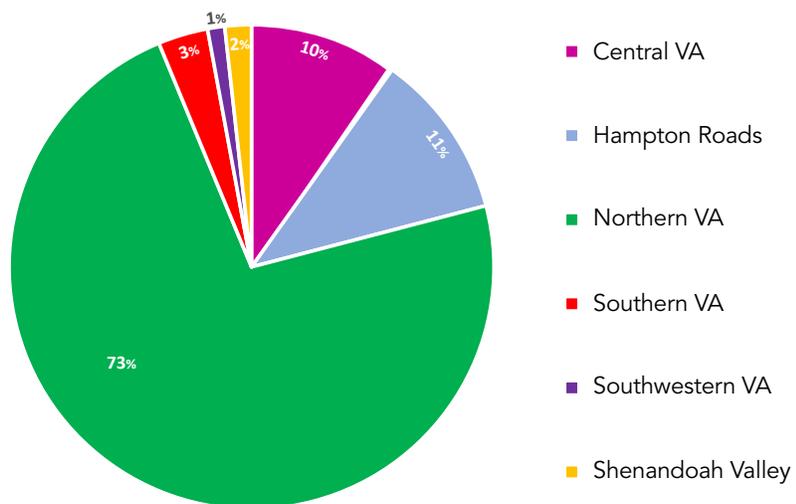


Figure 2: Regional Distribution of Data Processing, Hosting, and Related Services in Virginia in 2016.²

²Data Source: Virginia Economic Development Partnership.

Figures 3 and 4 provide additional detail on private sector employment trends in the Data Processing, Hosting, and Related Services industry from 2000 through 2016. As the data depicted in Figure 3 indicate, industry employment in Northern Virginia generally declined between 2004 and 2012, but has since escalated rapidly, coming in at 9,368 jobs in 2016.

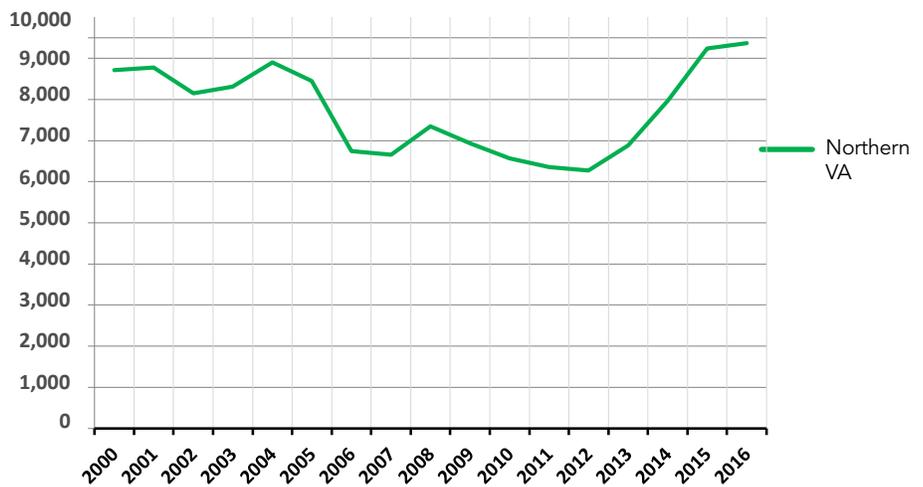


Figure 3: Data Processing, Hosting, and Related Services Private Sector Employment – 2000 to 2016.³

Figure 4 provides similar data for the other sub-state regions within Virginia. As these data show, private sector employment in the Data Processing, Hosting, and Related Services industry in Central Virginia peaked at 2,068 jobs in 2007 and has since declined, falling to 1,268 jobs in 2016. In Hampton Roads, employment grew rapidly until 2006 when it peaked at 2,042 jobs, but has since generally declined, falling to 1,424 jobs in 2016. In Southern Virginia, employment generally hovered around 500 jobs for most of the period and came in at 428 jobs in 2016. In Southwestern Virginia, data are not available for several years due to the small number of jobs involved and data confidentiality issues. However, employment came in at 147 jobs in 2016. In the Shenandoah Valley, employment peaked at 465 jobs in 2002 and has generally fallen since, coming in at 227 jobs in 2016.

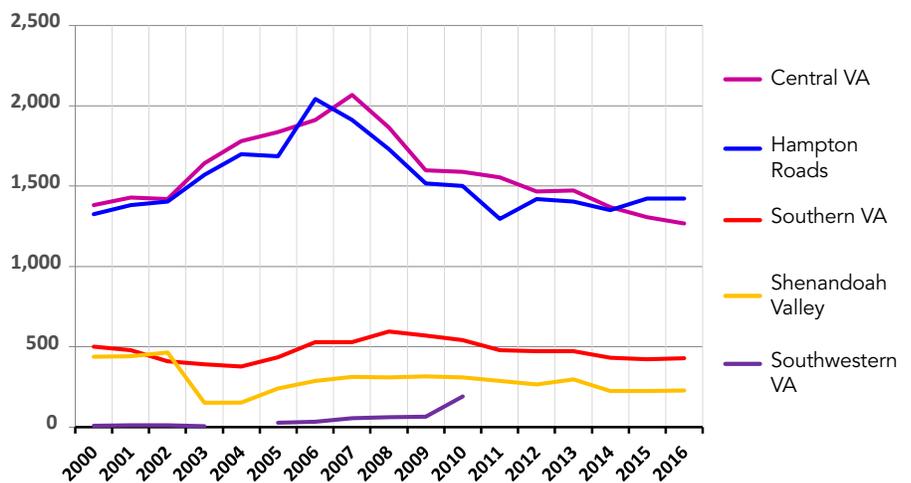


Figure 4: Data Processing, Hosting, and Related Services Private Sector Employment – 2000 to 2016.⁴

One of the key characteristics of the Data Processing, Hosting, and Related Services industry is that it is extremely capital-intensive. That means it has a high capital to labor ratio and typically employs a relatively small group of highly skilled, and highly paid, individuals. For that reason, employment trends are not necessarily the best measure of this industry's economic footprint within Virginia. To address that issue, Figures 5 through 8 take a look at trends in two other important metrics – private sector average annual wages and number of locations.

Figures 5 and 6 provide a look at one of the most prominent characteristics of the Data Processing, Hosting, and Related Services industry: it pays very high wages and those wages have grown rapidly over time (as will be demonstrated in the next section) at a rate that far outstrips the average growth rate for wages across all industry sectors. As shown in Figure 5, between 2000 and 2016 the average annual private sector wage in this industry in Northern Virginia grew from \$63,357 to \$138,345, a 118 percent, or more than two-fold, increase.

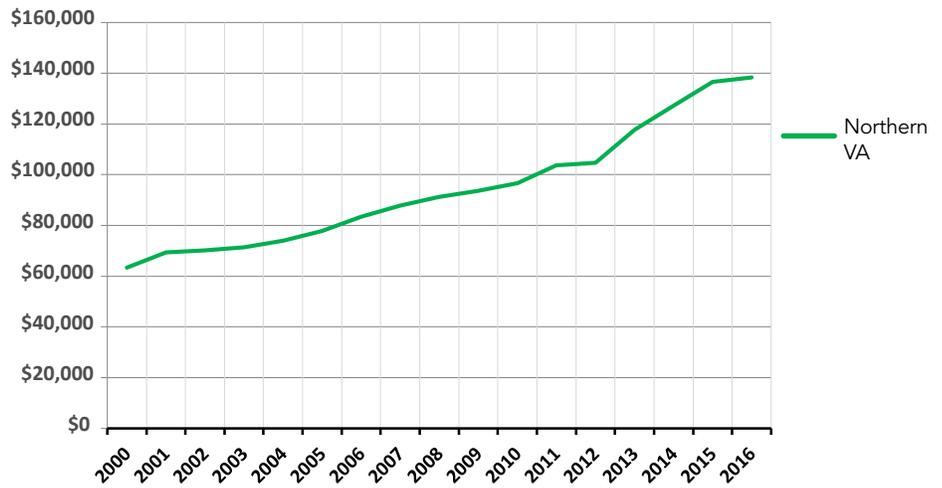


Figure 5: Data Processing, Hosting, and Related Services Private Sector Average Annual Wages – 2000 to 2016.⁵

Figure 6 provides comparable data for the other sub-state regions within Virginia. As these data indicate, wage growth in these regions followed a similar path. Between 2000 and 2016, average annual private sector wages in the Data Processing, Hosting, and Related Services industry increased by 141 percent in Central Virginia, 46 percent in Hampton Roads, 110 percent in Southern Virginia, 266 percent in Southwestern Virginia, and 87 percent in the Shenandoah Valley.

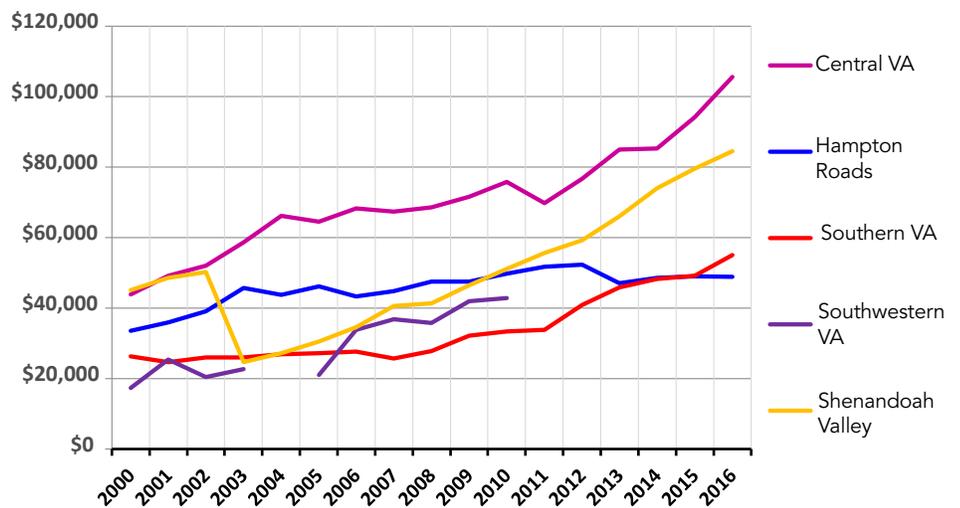


Figure 6: Data Processing, Hosting, and Related Services Private Sector Average Annual Wages – 2000 to 2016.⁶

^{5,6} Data Source: Virginia Economic Development Partnership.

Figure 7 depicts the trend in a number of private sector Data Processing, Hosting, and Related Services industry locations in Northern Virginia between 2000 and 2016. As these data indicate, that number showed consistent growth over the period, coming in at 410 in 2016.

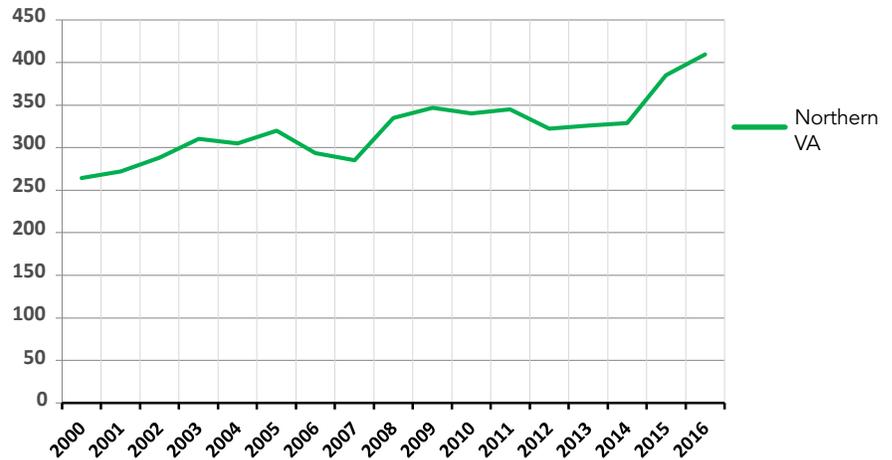


Figure 7: Data Processing, Hosting, and Related Services Private Sector Locations – 2000 to 2016.⁷

Figure 8 provides a similar look at the other sub-state regions within Virginia. As this graph shows, early in this period the growth in the number of locations escalated rapidly in Central Virginia and, to a lesser extent, in Hampton Roads before peaking in 2008-2009. However, since then the number of locations has declined, falling to 95 locations in Central Virginia and 51 in Hampton Roads in 2016. Growth in Southern Virginia, Southwestern Virginia, and the Shenandoah Valley followed a similar trajectory. These regions were respectively home to 21, 6, and 30 locations in 2016.

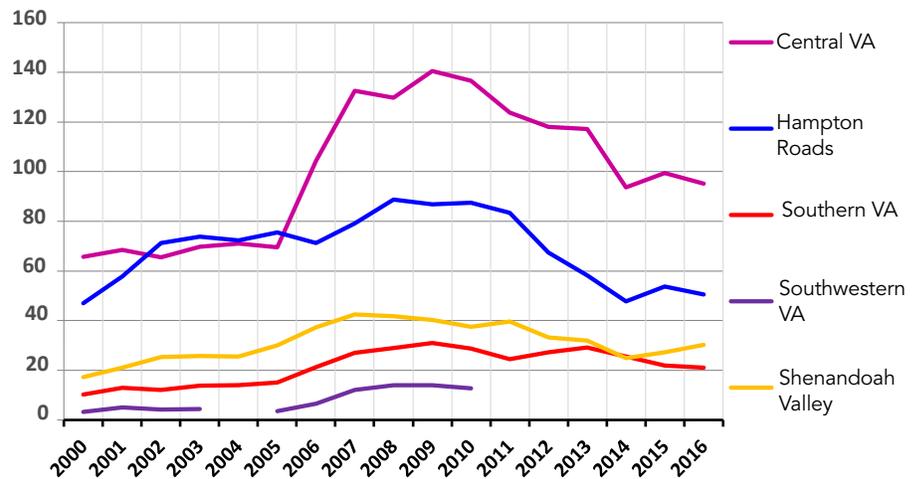


Figure 8: Data Processing, Hosting, and Related Services Private Sector Locations – 2000 to 2016.⁸



ECONOMIC AND FISCAL IMPACT

In this section, we quantify the economic and fiscal contribution that the Data Processing, Hosting, and Related Services industry makes to the Commonwealth of Virginia as a whole, and to the six sub-state regions employed by Virginia Economic Development Partnership (VEDP) and identified earlier in this report individually.

Method

To empirically evaluate the statewide and regional economic and fiscal impact attributable to the Data Processing, Hosting, and Related Services industry, we employ a commonly used regional economic impact model called IMPLAN.⁹ The IMPLAN model uses regional and national production and trade flow data to construct region- and industry-specific economic multipliers and uses these multipliers to quantify the economic impact. For purposes of this analysis, we have further customized these internal IMPLAN assumptions based on confidential data provided by a subset of Virginia data center firms to ensure that the specific model specifications we use reflect actual conditions within Virginia's Data Processing, Hosting, and Related Services industry as closely as possible. This confidential data is not published in nor otherwise used in this report.

Economic multipliers measure the ripple effects that an expenditure has as it makes its way through the economy. For example, when data centers purchase goods and services and when data center employees use their salaries and wages to make household purchases it generates income for someone else, and so on, and so on. Through this process, one dollar in expenditures generates multiple dollars of income. The mathematical relationship between the initial expenditure and the total income generated is the economic multiplier. The economic result of these ripple effects is called indirect impact when it refers to business-to-business transactions and induced impact when it refers to employee-to-business transactions.

In the analysis that follows, we also provide estimates for four categories of impact. The first is employment - the number of jobs that are created. The second is labor income - the salaries and wages associated with those jobs. The third is economic output - the total amount of economic activity that is created in the economy. The fourth is fiscal impact - the total tax dollars that are generated by that economic activity.

⁹ IMPLAN v.3 is produced by Minnesota IMPLAN Group, Inc.

Results

VIRGINIA

In conducting our analysis of the annual economic and fiscal impact that the Data Processing, Hosting, and Related Services industry had on the state of Virginia as a whole in 2016, we employ the following assumptions:

- Statewide employment in this sector was 13,415 in 2016.¹⁰
- Employer expenditures for employee health and dental insurance were \$124.5 million in 2016.¹¹
- Construction expenditures for new data centers were \$413.0 million in 2016.¹²

By feeding these assumptions into the IMPLAN model, we obtain the estimates of annual economic and fiscal impact shown in Table 1. As these data indicate, in 2016 the Data Processing, Hosting, and Related Services industry directly provided approximately: 1) 13,415 jobs, 2) \$1.6 billion in associated wages and salaries and 3) \$4.7 billion in statewide economic output to Virginia’s economy. In addition, the Data Processing, Hosting, and Related Services industry was also responsible for generating the following approximate second round indirect and induced economic activity within Virginia: 1) 29,860 additional full-time-equivalent jobs, 2) \$1.6 billion in additional associated labor income and 3) \$5.4 billion in additional economic output.

In combination, this means that the Data Processing, Hosting, and Related Services industry’s total 2016 economic impact on Virginia was approximately: 1) 43,275 jobs, 2) \$3.2 billion in labor income and 3) \$10.2 billion in economic output. Finally, this economic activity was also responsible for generating a total of approximately \$1.1 billion in tax revenue in 2016, of which \$349.3 million was state and local tax revenue.

First Round Direct Economic Activity			
	Employment	Labor Income	Output
Total First Round Activity	13,415	\$1,575,757,060	\$4,748,025,847
Second Round Indirect and Induced Economic Activity			
	Employment	Labor Income	Output
Operations	23,674	\$1,235,450,333	\$4,529,184,350
Health Services	1,569	\$122,626,059	\$234,979,905
Construction	4,617	\$254,311,395	\$669,854,077
Total Second Round Activity*	29,860	\$1,612,387,787	\$5,434,018,332
Total, Direct, Indirect and Induced Economic Activity			
	Employment	Labor Income	Output
TOTAL Economic Activity*	43,275	\$3,188,144,847	\$10,182,044,179
Total Fiscal Impact			
	State and Local	Federal	Total
TOTAL Fiscal Impact	\$349,257,738	\$759,479,129	\$1,108,736,867

*May not sum due to rounding.

Table 1: Estimated Economic and Fiscal Impact of the Data Processing, Hosting, and Related Services Industry on Virginia in 2016.

¹⁰ Data Source: Virginia Economic Development Partnership.

¹¹ Estimated based on proprietary data provided by a subset of Virginia data centers.

¹² Data Source: Derived from Virginia Economic Development Partnership announcements. Assumes 20 percent of announced capital investment is comprised of construction expenditures and 80 percent is comprised of equipment purchases. Our analysis is based on construction expenditures only.



Table 2 details the top 10 industries Virginia that received the largest economic benefit from this economic activity in 2016 (inclusive of the Data Processing, Hosting, and Related Services industry).

<i>Industry</i>	<i>FTE Employment</i>	<i>Labor Income</i>	<i>Output</i>
Data processing, hosting, and related services	13,505	\$1,586,292,440	\$4,779,770,752
Real estate	3,665	\$76,377,147	\$822,540,616
Construction of new power and communication structures	2,908	\$165,082,964	\$412,980,015
Investigation and security services	1,959	\$103,185,679	\$139,359,490
Full-service restaurants	1,102	\$24,706,257	\$49,795,859
Business and professional associations	1,069	\$104,445,511	\$253,053,815
Employment services	901	\$39,913,471	\$70,636,037
Offices of physicians	838	\$86,072,892	\$126,949,633
Limited-service restaurants	827	\$15,347,377	\$65,850,221
Hospitals	588	\$41,712,831	\$89,370,112

Table 2: Top 10 Industries Affected by the Data Processing, Hosting, and Related Services Industry in Virginia in 2016.



NORTHERN VIRGINIA

In conducting our analysis of the annual economic and fiscal impact that the Data Processing, Hosting, and Related Services industry had on Northern Virginia in 2016, we employ the following assumptions:

- Regional employment in this sector was 9,368 in 2016.¹³
- Employer expenditures for employee health and dental insurance were \$102 million in 2016.¹⁴
- Construction expenditures for new data centers were \$111.6 million in 2016.¹⁵

By feeding these assumptions into the IMPLAN model, we obtain the estimates of annual economic and fiscal impact shown in Table 3. As these data indicate, in 2016 the Data Processing, Hosting, and Related Services industry directly provided approximately: 1) 9,368 jobs, 2) \$1.3 billion in associated wages and salaries and 3) \$3.5 billion in economic output to Northern Virginia's economy. In addition, the Data Processing, Hosting, and Related Services industry was also responsible for generating the following approximate second round indirect and induced economic activity within Northern Virginia: 1) 15,645 additional full-time-equivalent jobs, 2) \$974.8 million in additional associated labor income and 3) \$3.0 billion in additional economic output.

In combination, this means that the Data Processing, Hosting, and Related Services industry's total 2016 economic impact on Northern Virginia was approximately: 1) 25,013 jobs, 2) \$2.3 billion in labor income and 3) \$6.6 billion in economic output. Finally, this economic activity was also responsible for generating a total of approximately \$726.6 million in tax revenue in 2016, of which \$205.1 million was state and local tax revenue combination, this means that the Data Processing, Hosting, and Related Services industry's total 2016 economic impact on Virginia was approximately: 1) 43,275 jobs, 2) \$3.2 billion in labor income and 3) \$10.2 billion in economic output. Finally, this economic activity was also responsible for generating a total of approximately \$1.1 billion in tax revenue in 2016, of which \$349.3 million was state and local tax revenue.

¹³ Data Source: Virginia Economic Development Partnership.

¹⁴ Estimated based on proprietary data provided by a subset of Virginia data centers.

¹⁵ Data Source: Derived from Virginia Economic Development Partnership announcements. Assumes 20 percent of announced capital investment is comprised of construction expenditures and 80 percent is comprised of equipment purchases. Our analysis is based on construction expenditures only.

Table 4 details the top 10 industries within Northern Virginia that received the largest economic benefit from this economic activity in 2016 (inclusive of the Data Processing, Hosting, and Related Services industry).

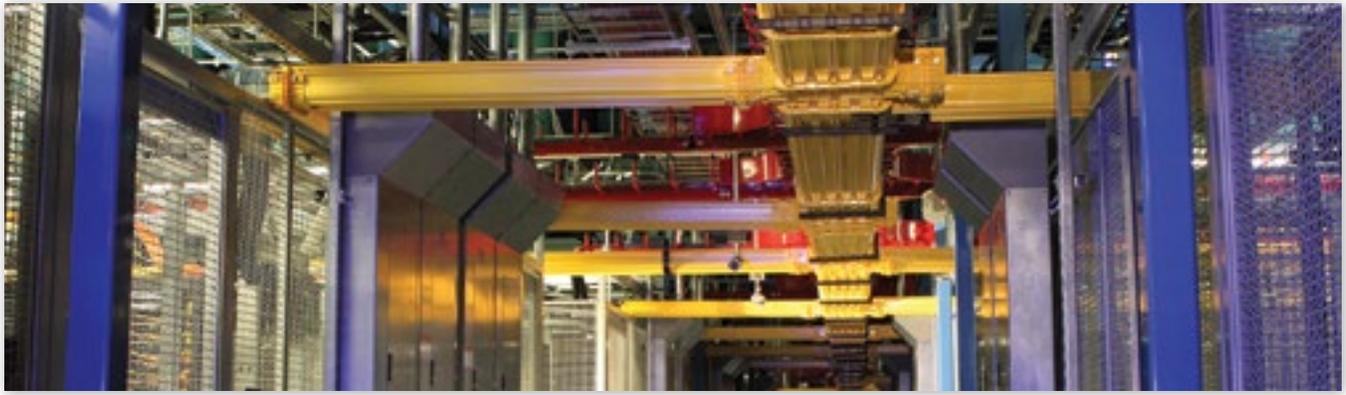
First Round Direct Economic Activity			
	<i>Employment</i>	<i>Labor Income</i>	<i>Output</i>
Total First Round Activity	9,368	\$1,290,876,141	\$3,541,481,465
Second Round Indirect and Induced Economic Activity			
	<i>Employment</i>	<i>Labor Income</i>	<i>Output</i>
Operations	13,427	\$807,012,955	\$2,687,537,297
Health Services	1,128	\$99,230,248	\$178,767,680
Construction	1,090	\$68,540,070	\$168,069,613
Total Second Round Activity*	15,645	\$974,783,273	\$3,034,374,590
Total, Direct, Indirect and Induced Economic Activity			
	<i>Employment</i>	<i>Labor Income</i>	<i>Output</i>
TOTAL Economic Activity*	25,013	\$2,265,659,414	\$6,575,856,055
Total Fiscal Impact			
	<i>State and Local</i>	<i>Federal</i>	<i>Total</i>
TOTAL Fiscal Impact	\$205,138,169	\$521,421,021	\$726,559,190

*May not sum due to rounding.

Table 3: Estimated Economic and Fiscal Impact of the Data Processing, Hosting, and Related Services Industry on Northern Virginia in 2016.

<i>Industry</i>	<i>FTE Employment</i>	<i>Labor Income</i>	<i>Output</i>
Data processing, hosting, and related services	9,425	\$1,298,775,069	\$3,563,151,944
Real estate	2,208	\$57,055,455	\$574,652,669
Investigation and security services	1,115	\$75,485,427	\$97,553,508
Offices of physicians	884	\$95,634,796	\$138,699,763
Construction of new power and communication structures	737	\$46,699,798	\$111,556,035
Full-service restaurants	656	\$17,495,116	\$32,343,062
Business and professional associations	629	\$68,329,775	\$163,367,918
Limited-service restaurants	447	\$9,939,019	\$39,000,167
Employment services	293	\$20,415,673	\$33,984,051
Services to buildings	287	\$8,577,119	\$13,097,017

Table 4: Top 10 Industries Affected by the Data Processing, Hosting, and Related Services Industry in Northern Virginia in 2016.



CENTRAL VIRGINIA

In conducting our analysis of the annual economic and fiscal impact that the Data Processing, Hosting, and Related Services industry had on Central Virginia in 2016, we employ the following assumptions:

- Regional employment in this sector was 1,268 in 2016.¹⁶
- Employer expenditures for employee health and dental insurance were \$7.4 million in 2016.¹⁷

By feeding these assumptions into the IMPLAN model, we obtain the estimates of annual economic and fiscal impact shown in Table 5. As these data indicate, in 2016 the Data Processing, Hosting, and Related Services industry directly provided approximately: 1) 1,268 jobs, 2) \$93.1 million in associated wages and salaries and 3) \$382.5 million in economic output to Central Virginia's economy. In addition, the Data Processing, Hosting, and Related Services industry was also responsible for generating the following approximate second round indirect and induced economic activity within Central Virginia: 1) 2,409 additional full-time-equivalent jobs, 2) \$118.9 million in additional associated labor income, and 3) \$460.7 million in additional economic output.

In combination, this means that the Data Processing, Hosting, and Related Services industry's total 2016 economic impact on Central Virginia was approximately: 1) 3,677 jobs, 2) \$212.0 million in labor income and 3) \$843.2 million in economic output. Finally, this economic activity was also responsible for generating a total of approximately \$86.0 million in tax revenue in 2016, of which \$30.0 million was state and local tax revenue.

Table 6 details the top 10 industries within Central Virginia that received the largest economic benefit from this economic activity in 2016 (inclusive of the Data Processing, Hosting, and Related Services industry).

First Round Direct Economic Activity			
	<i>Employment</i>	<i>Labor Income</i>	<i>Output</i>
Total First Round Activity	1,268	\$93,071,264	\$382,544,767
Second Round Indirect and Induced Economic Activity			
	<i>Employment</i>	<i>Labor Income</i>	<i>Output</i>
Operations	2,312	\$111,418,353	\$446,112,858
Health Services	97	\$7,491,975	\$14,566,935
Total Second Round Activity*	2,409	\$118,910,328	\$460,679,793
Total, Direct, Indirect and Induced Economic Activity			
	<i>Employment</i>	<i>Labor Income</i>	<i>Output</i>
TOTAL Economic Activity*	3,677	\$211,981,592	\$843,224,560
Total Fiscal Impact			
	<i>State and Local</i>	<i>Federal</i>	<i>Total</i>
TOTAL Fiscal Impact	\$29,987,788	\$56,021,832	\$86,009,620

*May not sum due to rounding.

Table 5: Estimated Economic and Fiscal Impact of the Data Processing, Hosting, and Related Services Industry on Central Virginia in 2016.

<i>Industry</i>	<i>FTE Employment</i>	<i>Labor Income</i>	<i>Output</i>
Data processing, hosting, and related services	1,275	\$93,564,214	\$384,570,905
Real estate	349	\$5,543,645	\$69,975,005
Investigation and security services	234	\$8,094,756	\$12,034,167
Business and professional associations	147	\$11,036,610	\$27,657,666
Employment services	108	\$4,523,676	\$8,083,352
Full-service restaurants	90	\$1,877,852	\$3,942,080
Limited-service restaurants	60	\$1,067,353	\$4,685,522
Electric power transmission and distribution	53	\$7,193,968	\$83,724,263
Hospitals	51	\$3,467,659	\$7,544,822
Offices of physicians	48	\$5,188,099	\$7,521,188

Table 6: Top 10 Industries Affected by the Data Processing, Hosting, and Related Services Industry in Central Virginia in 2016.



HAMPTON ROADS

In conducting our analysis of the annual economic and fiscal impact that the Data Processing, Hosting, and Related Services industry had on Hampton Roads in 2016, we employ the following assumptions:

- Regional employment in this sector was 1,424 in 2016.¹⁸
- Employer expenditures for employee health and dental insurance were \$8.6 million in 2016.¹⁹

By feeding these assumptions into the IMPLAN model, we obtain the estimates of annual economic and fiscal impact shown in Table 7. As these data indicate, in 2016 the Data Processing, Hosting, and Related Services industry directly provided approximately: 1) 1,424 jobs, 2) \$108.5 million in associated wages and salaries and 3) \$434.3 million in economic output to Hampton Road's economy. In addition, the Data Processing, Hosting, and Related Services industry was also responsible for generating the following approximate second round indirect and induced economic activity within Hampton Roads: 1) 2,123 additional full-time-equivalent jobs, 2) \$93.6 million in additional associated labor income, and 3) \$362.9 million in additional economic output.

In combination, this means that the Data Processing, Hosting, and Related Services industry's total 2016 economic impact on Central Virginia was approximately: 1) 3,547 jobs, 2) \$202.2 million in labor income and 3) \$797.2 million in economic output. Finally, this economic activity was also responsible for generating a total of approximately \$73.7 million in tax revenue in 2016, of which \$25.6 million was state and local tax revenue.

Table 8 details the top 10 industries within Hampton Roads that received the largest economic benefit from this economic activity in 2016 (inclusive of the Data Processing, Hosting, and Related Services industry).

First Round Direct Economic Activity			
	<i>Employment</i>	<i>Labor Income</i>	<i>Output</i>
Total First Round Activity	1,424	\$108,535,894	\$434,272,799
Second Round Indirect and Induced Economic Activity			
	<i>Employment</i>	<i>Labor Income</i>	<i>Output</i>
Operations	2,014	\$85,656,760	\$347,278,960
Health Services	109	\$7,991,284	\$15,608,051
Total Second Round Activity*	2,123	\$93,648,044	\$362,887,011
Total, Direct, Indirect and Induced Economic Activity			
	<i>Employment</i>	<i>Labor Income</i>	<i>Output</i>
TOTAL Economic Activity*	3,547	\$202,183,938	\$797,159,810
Total Fiscal Impact			
	<i>State and Local</i>	<i>Federal</i>	<i>Total</i>
TOTAL Fiscal Impact	\$25,553,007	\$48,135,867	\$73,688,874

*May not sum due to rounding.

Table 7: Estimated Economic and Fiscal Impact of the Data Processing, Hosting, and Related Services Industry on Hampton Roads in 2016.

<i>Industry</i>	<i>FTE Employment</i>	<i>Labor Income</i>	<i>Output</i>
Data Processing, Hosting, and Related Services	1,430	\$108,961,961	\$435,977,575
Real Estate	378	\$8,777,394	\$85,457,838
Investigation and Security Services	210	\$6,171,075	\$9,619,614
Employment Services	119	\$4,747,500	\$8,578,603
Full-service Restaurants	80	\$1,671,196	\$3,507,755
Business and Professional Associations	80	\$3,272,834	\$9,540,441
Limited-service Restaurants	65	\$1,104,477	\$4,958,293
Offices of Physicians	59	\$5,859,524	\$8,752,933
Services to Buildings	45	\$1,095,869	\$1,800,762
Hospitals	43	\$3,046,071	\$6,511,476

Table 8: Top 10 Industries Affected by the Data Processing, Hosting, and Related Services Industry in Hampton Roads in 2016.



SOUTHERN VIRGINIA

In conducting our analysis of the annual economic and fiscal impact that the Data Processing, Hosting, and Related Services industry had on Southern Virginia in 2016, we employ the following assumptions:

- Regional employment in this sector was 428 in 2016.²⁰
- Employer expenditures for employee health and dental insurance were \$1.6 million in 2016.²¹
- Construction expenditures for new data centers were \$50.3 million in 2016.²²

By feeding these assumptions into the IMPLAN model, we obtain the estimates of annual economic and fiscal impact shown in Table 9. As these data indicate, in 2016 the Data Processing, Hosting, and Related Services industry directly provided approximately: 1) 428 jobs, 2) \$20.0 million in associated wages and salaries and 3) \$115.8 million in economic output to Southern Virginia's economy. In addition, the Data Processing, Hosting, and Related Services industry was also responsible for generating the following approximate second round indirect and induced economic activity within Southern Virginia: 1) 1,173 additional full-time-equivalent jobs, 2) \$44.4 million in additional associated labor income, and 3) \$153.6 million in additional economic output.

In combination, this means that the Data Processing, Hosting, and Related Services industry's total 2016 economic impact on Southern Virginia was approximately: 1) 1,601 jobs, 2) \$64.5 million in labor income and 3) \$269.4 million in economic output. Finally, this economic activity was also responsible for generating a total of approximately \$24.3 million in tax revenue in 2016, of which \$8.7 million was state and local tax revenue.

Table 10 details the top 10 industries within Southern Virginia that received the largest economic benefit from this economic activity in 2016 (inclusive of the Data Processing, Hosting, and Related Services industry).

²⁰ Data Source: Virginia Economic Development Partnership.

²¹ Estimated based on proprietary data provided by a subset of Virginia data centers.

²² Data Source: Derived from Virginia Economic Development Partnership announcements. Assumes 20 percent of announced capital investment is comprised of construction expenditures and 80 percent is comprised of equipment purchases. Our analysis is based on construction expenditures only.

First Round Direct Economic Activity			
	<i>Employment</i>	<i>Labor Income</i>	<i>Output</i>
Total First Round Activity	428	\$20,039,692	\$115,811,704
Second Round Indirect and Induced Economic Activity			
	<i>Employment</i>	<i>Labor Income</i>	<i>Output</i>
Operations	526	\$18,961,480	\$77,428,783
Health Services	20	\$1,313,457	\$2,495,291
Construction	628	\$24,163,511	\$73,648,541
Total Second Round Activity*	1,173	\$44,438,448	\$153,572,615
Total, Direct, Indirect and Induced Economic Activity			
	<i>Employment</i>	<i>Labor Income</i>	<i>Output</i>
TOTAL Economic Activity*	1,601	\$64,478,140	\$269,384,319
Total Fiscal Impact			
	<i>State and Local</i>	<i>Federal</i>	<i>Total</i>
TOTAL Fiscal Impact	\$8,706,083	\$15,581,938	\$24,288,021

*May not sum due to rounding.

Table 9: Estimated Economic and Fiscal Impact of the Data Processing, Hosting, and Related Services Industry on Southern Virginia in 2016.

<i>Industry</i>	<i>FTE Employment</i>	<i>Labor Income</i>	<i>Output</i>
Construction of New Power and Communication Structures	436	\$16,721,416	\$50,320,002
Data Processing, Hosting, and Related Services	432	\$20,209,986	\$116,795,850
Employment Services	78	\$1,814,233	\$3,666,921
Business and Professional Associations	53	\$1,677,383	\$5,312,462
Investigation and Security Services	46	\$1,318,278	\$2,064,005
Full-service Restaurants	32	\$544,876	\$1,287,083
Real Estate	24	\$183,940	\$2,921,119
Limited-service Restaurants	23	\$342,807	\$1,648,214
Wholesale Trade	22	\$1,284,346	\$4,353,524
Hospitals	16	\$957,076	\$2,199,505

Table 10: Top 10 Industries Affected by the Data Processing, Hosting, and Related Services Industry in Southern Virginia in 2016.



SOUTHWEST VIRGINIA

In conducting our analysis of the annual economic and fiscal impact that the Data Processing, Hosting, and Related Services industry had on Southwest Virginia in 2016, we employ the following assumptions:

- Regional employment in this sector was 147 in 2016.²³
- Employer expenditures for employee health and dental insurance were \$370,866 in 2016.²⁴
- Construction expenditures for new data centers were \$8.4 million in 2016.²⁵

By feeding these assumptions into the IMPLAN model, we obtain the estimates of annual economic and fiscal impact shown in Table 11. As these data indicate, in 2016 the Data Processing, Hosting, and Related Services industry directly provided approximately: 1) 147 jobs, 2) \$4.7 million in associated wages and salaries and 3) \$37.2 million in economic output to Southwest Virginia's economy. In addition, the Data Processing, Hosting, and Related Services industry was also responsible for generating the following approximate second round indirect and induced economic activity within Southwest Virginia: 1) 207 additional full-time-equivalent jobs, 2) \$10.1 million in additional associated labor income and 3) \$31.4 million in additional economic output.

In combination, this means that the Data Processing, Hosting, and Related Services industry's total 2016 economic impact on Southwest Virginia was approximately: 1) 354 jobs, 2) \$14.8 million in labor income and 3) \$68.6 million in economic output. Finally, this economic activity was also responsible for generating a total of approximately \$5.6 million in tax revenue in 2016, of which \$2.0 million was state and local tax revenue.

Table 12 details the top 10 industries within Southwest Virginia that received the largest economic benefit from this economic activity in 2016 (inclusive of the Data Processing, Hosting, and Related Services industry).

²³ Data Source: Virginia Economic Development Partnership.

²⁴ Estimated based on proprietary data provided by a subset of Virginia data centers.

²⁵ Data Source: Derived from Virginia Economic Development Partnership announcements. Assumes 20 percent of announced capital investment is comprised of construction expenditures and 80 percent is comprised of equipment purchases. Our analysis is based on construction expenditures only.

First Round Direct Economic Activity			
	<i>Employment</i>	<i>Labor Income</i>	<i>Output</i>
Total First Round Activity	147	\$4,694,502	\$37,162,180
Second Round Indirect and Induced Economic Activity			
	<i>Employment</i>	<i>Labor Income</i>	<i>Output</i>
Operations	132	\$4,844,159	\$19,373,848
Health Services	4	\$283,125	\$550,820
Construction	71	\$4,969,111	\$11,522,009
Total Second Round Activity*	207	\$10,096,395	\$31,446,677
Total, Direct, Indirect and Induced Economic Activity			
	<i>Employment</i>	<i>Labor Income</i>	<i>Output</i>
TOTAL Economic Activity*	354	\$14,790,897	\$68,608,857
Total Fiscal Impact			
	<i>State and Local</i>	<i>Federal</i>	<i>Total</i>
TOTAL Fiscal Impact	\$1,976,672	\$3,574,854	\$5,551,526

*May not sum due to rounding.

Table 11: Estimated Economic and Fiscal Impact of the Data Processing, Hosting, and Related Services Industry on Southwest Virginia in 2016.

<i>Industry</i>	<i>FTE Employment</i>	<i>Labor Income</i>	<i>Output</i>
Data Processing, Hosting, and Related Services	148	\$4,709,036	\$37,277,236
Construction of New Power and Communication Structures	45	\$4,065,171	\$8,400,000
Investigation and Security Services	19	\$451,481	\$749,035
Business and Professional Associations	13	\$526,109	\$1,400,939
Employment Services	10	\$270,839	\$518,980
Full-service Restaurants	8	\$142,833	\$325,139
Limited-service Restaurants	6	\$95,895	\$447,994
Real Estate	4	\$19,670	\$438,030
Business Support Services	3	\$70,875	\$131,465
Electric Power Transmission and Distribution	3	\$351,500	\$4,399,968

Table 12: Top 10 Industries Affected by the Data Processing, Hosting, and Related Services Industry in Southwest Virginia in 2016.



SHENANDOAH VALLEY

In conducting our analysis of the annual economic and fiscal impact that the Data Processing, Hosting, and Related Services industry had on Shenandoah Valley in 2016, we employ the following assumptions:

- Regional employment in this sector was 227 in 2016.²⁶
- Employer expenditures for employee health and dental insurance were \$1.0 million in 2016.²⁷

By feeding these assumptions into the IMPLAN model, we obtain the estimates of annual economic and fiscal impact shown in Table 13. As these data indicate, in 2016 the Data Processing, Hosting, and Related Services industry directly provided approximately: 1) 227 jobs, 2) \$13.3 million in associated wages and salaries and 3) \$64.5 million in economic output to the Shenandoah Valley's economy. In addition, the Data Processing, Hosting, and Related Services industry was also responsible for generating the following approximate second round indirect and induced economic activity within the Shenandoah Valley: 1) 336 additional full-time-equivalent jobs, 2) \$13.9 million in additional associated labor income and 3) \$50.9 million in additional economic output.

In combination, this means that the Data Processing, Hosting, and Related Services industry's total 2016 economic impact on the Shenandoah Valley was approximately: 1) 563 jobs, 2) \$27.2 million in labor income and 3) \$115.3 million in economic output. Finally, this economic activity was also responsible for generating a total of approximately \$10.2 million in tax revenue in 2016, of which \$3.6 million was state and local tax revenue.

Table 14 details the top 10 industries within the Shenandoah Virginia that received the largest economic benefit from this economic activity in 2016 (inclusive of the Data Processing, Hosting, and Related Services industry).

First Round Direct Economic Activity			
	<i>Employment</i>	<i>Labor Income</i>	<i>Output</i>
Total First Round Activity	227	\$13,281,826	\$64,479,728
Second Round Indirect and Induced Economic Activity			
	<i>Employment</i>	<i>Labor Income</i>	<i>Output</i>
Operations	322	\$12,987,146	\$49,004,277
Health Services	14	\$948,931	\$1,851,500
Total Second Round Activity*	336	\$13,936,077	\$50,855,777
Total, Direct, Indirect and Induced Economic Activity			
	<i>Employment</i>	<i>Labor Income</i>	<i>Output</i>
TOTAL Economic Activity*	563	\$27,217,903	\$115,335,505
Total Fiscal Impact			
	<i>State and Local</i>	<i>Federal</i>	<i>Total</i>
TOTAL Fiscal Impact	\$3,642,557	\$6,535,538	\$10,178,095

*May not sum due to rounding.

Table 13: Estimated Economic and Fiscal Impact of the Data Processing, Hosting, and Related Services Industry on Shenandoah Valley in 2016.

<i>Industry</i>	<i>FTE Employment</i>	<i>Labor Income</i>	<i>Output</i>
Data Processing, Hosting, and Related Services	229	\$13,407,891	\$65,091,739
Investigation and Security Services	33	\$980,407	\$1,527,010
Employment Services	28	\$843,946	\$1,604,158
Full-service Restaurants	20	\$381,992	\$841,695
Business and Professional Associations	18	\$660,925	\$1,997,937
Real Estate	14	\$153,006	\$2,282,170
Limited-service Restaurants	10	\$169,407	\$780,160
Hospitals	8	\$577,386	\$1,203,041
Offices of Physicians	7	\$713,103	\$1,068,638
Other Computer Related Services, Including Facilities Management	7	\$361,438	\$885,000

Table 14: Top 10 Industries Affected by the Data Processing, Hosting, and Related Services Industry in Shenandoah Valley in 2016.

BROADER CONTRIBUTION OF DATA CENTERS TO VIRGINIA'S ECONOMY

In this section, we identify and quantify some of the other characteristics of the Data Processing, Hosting, and Related Services industry that make an important contribution to Virginia's economy.

High Performance Sector

It is important to realize that the Data Processing, Hosting, and Related Services industry is a high-performance industry in terms of both employment and wage growth. Figure 9 presents the most recent one-year (2015 to 2016) and five-year (2011 to 2016) statewide growth rates for private sector employment in this industry and compares them to the growth rates for total private employment across all industry sectors. As these data show, in terms of one-year growth, statewide employment in the Data Processing, Hosting, and Related Services industry increased by 1.8 percent over the period relative to 1.7 percent across all industries. In terms of five-year growth, statewide employment in the Data Processing, Hosting, and Related Services industry increased by 28.0 percent over the period relative to 7.1 percent across all industries.

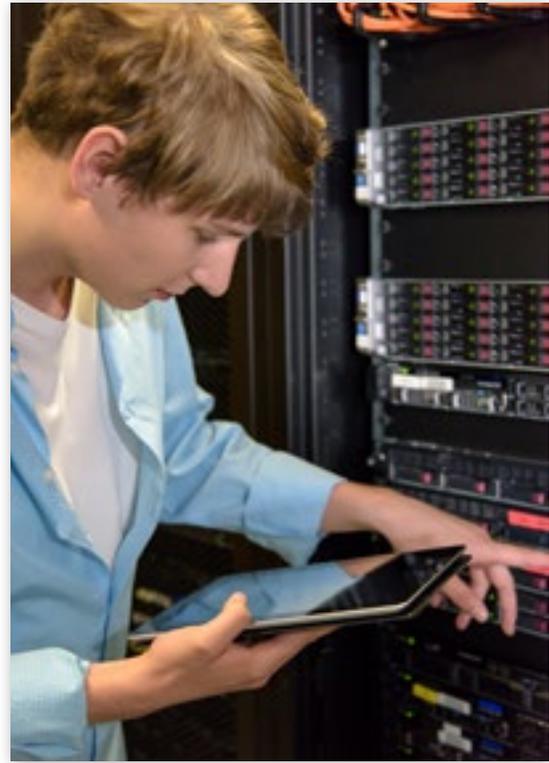
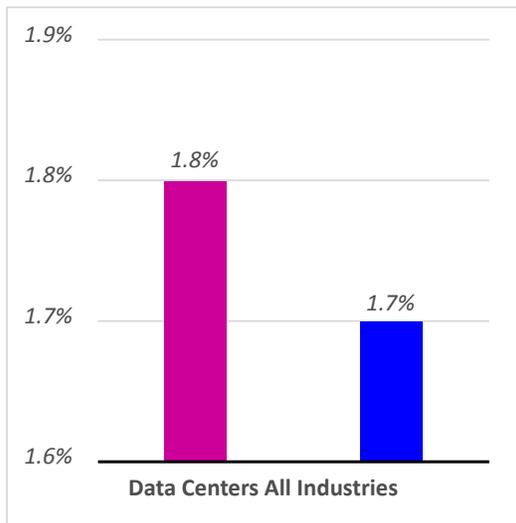
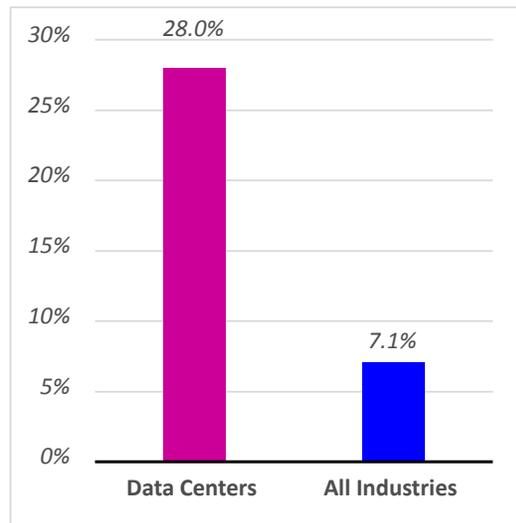


Figure 10 provides a similar comparison for one-year and five-year growth rates for wages. In terms of one-year growth, statewide wages in the Data Processing, Hosting, and Related Services industry increased by 2.7 percent over the period relative to 0.8 percent across all industries, while in terms of five-year growth, statewide wages in the Data Processing, Hosting, and Related Services industry increased by 38.4 percent over the period relative to 8.0 percent across all industries. It also bears notice that in 2016, the statewide average private sector weekly wage in the Data Processing, Hosting, and Related Services industry (\$2,336 per week) was 2.2 times greater than the average private sector weekly wage across all industries (\$1,044 per week) that year.

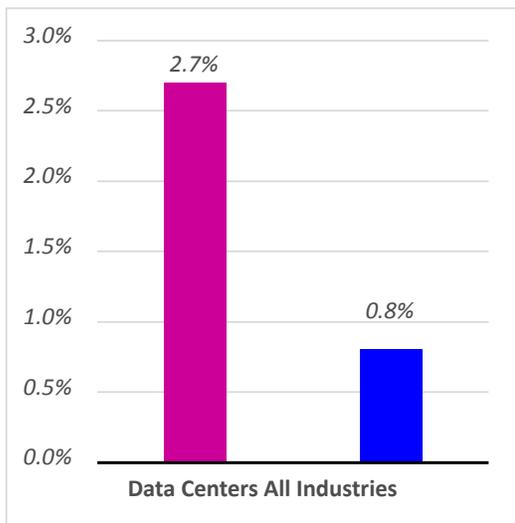


1 yr. Growth Rate

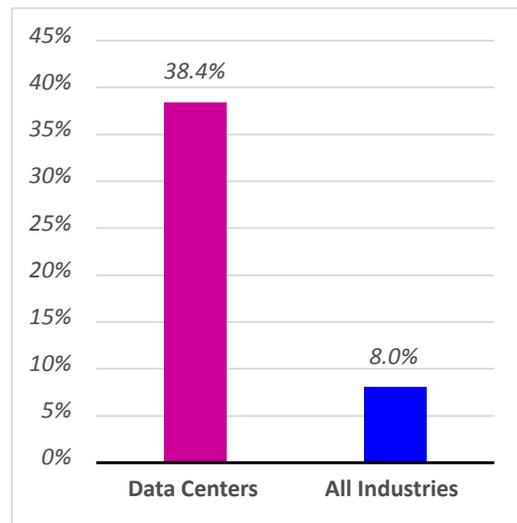


5 yr. Growth Rate

Figure 9: Employment Growth in Virginia’s Private Sector Data Processing, Hosting, and Related Services Industry relative to Total Private Sector Employment Growth.²⁸



1 yr. Growth Rate



5 yr. Growth Rate

Figure 10: Average Wage Growth in Virginia’s Private Sector Data Processing, Hosting, and Related Services Industry relative to Total Private Sector Wage Growth.

In short, Virginia’s Data Processing, Hosting, and Related Services industry is a fast-growing sector, that pays high wages, and those wages are rising at a rate that far outstrips the norm for Virginia’s economy. The latter is an important point from the state’s perspective, not only because it fosters broader economic prosperity, but because Virginia is much more dependent on individual income tax as a state revenue source than most other states. As a result, the \$3.2 billion that this industry is estimated to have directly and indirectly generated in wages in 2016 has a much larger impact on state revenue in Virginia than it would in most other states.

²⁸ Data Source: Virginia Economic Development Partnership and Virginia Employment Commission.



Broad Geographic Economic Development Potential

In no small part because of its status as a major internet hub, proximity to Washington D.C., and access to a highly skilled workforce, Northern Virginia is not only home to the largest concentration of private sector assets for Data Processing, Hosting, and Related Services in Virginia, but in the entire world. However, as demonstrated in the Data Center Industry Profile section, it is important to keep in mind that this industry is broadly represented in other regions of the Commonwealth as well.

Moreover, one of the trends that has manifested itself in recent years is that as Northern Virginia continues to become more congested, and that congestion continues to drive up the cost of land acquisition, there is a spillover effect that is leading to greater data center development in other localities within the state. In addition, the recent completion of the MAREA subsea cable landing in Virginia Beach, and the pending completion of the BRUSA subsea cable landing, will significantly enhance the potential for development of data centers and other data-dependent industries throughout Virginia. The MAREA cable is a joint venture by Microsoft and Facebook. It will be the first subsea cable connection in the Mid-Atlantic and the highest capacity subsea cable linking the U.S. to Europe. While, upon its completion, the BRUSA subsea cable will provide a link between Virginia Beach and South America.

These developments will continue to encourage investment in data centers and other data-dependent industries, not only outside of Northern Virginia, but also in rural communities outside of Virginia's "Golden Crescent." Examples of this trend include NxtVn's recently announced plan to construction a \$1.5 to \$2.0 billion data center park, and Globalinx Data Center's even more recently announced plan to construct up to 150,000 square feet of colocation data center space, in Virginia Beach in Hampton Roads; Facebook's recent announcement that it will build a \$1 billion data center facility in Henrico County in Central Virginia; Governor McAuliffe's public announcement of over \$1 billion in committed investments by Microsoft between 2014 and 2016 at its Mecklenburg County data center facility in Southern Virginia; Native Cloud's announcement of a \$42 million data facility in rural Scott County in Southwest Virginia in 2016; and DBT-Data's announcement of a \$38 million data facility in Harrisonburg in the Shenandoah Valley in 2014.²⁹



More generally, Figure 11 depicts the top 10 localities in Virginia in terms of cumulative Virginia Economic Development Partnership (VEDP) job announcements in the Data Processing, Hosting, and Related Services industry for the period from January 2000 through November 2017. These data depict direct employment associated with announced new businesses or existing business expansions within the Data Processing, Hosting, and Related Services industry.³⁰ Similarly, Figure 12 provides data for cumulative VEDP investment announcements for new businesses or existing business expansions within the Data Processing, Hosting, and Related Services industry.³¹

As these data clearly demonstrate, although Northern Virginia is well represented in these rankings, other regions of Virginia are as well. Moreover, several of these localities, such as Culpeper County in Central Virginia, Mecklenburg County in Southern Virginia, Russell County in Southwest Virginia and Warren County in the Shenandoah Valley, lie outside of Virginia's "Golden Crescent," which points to the role that data center and other data-dependent industry development is playing, and can play, in bridging the widening economic gap between Virginia's urban and rural communities.

Finally, it is important to keep in mind that the number of announced jobs depicted in Figure 11 is for direct employment within the Data Processing, Hosting, and Related Services industry only. It does not include any construction jobs that occurred as a result of these announced new businesses or existing business expansions. As already shown in the "Economic and Fiscal Impact" section, that construction impact can be quite large. In 2016 alone it accounted for an additional 4,617 jobs, \$254.3 million in additional labor income, and \$669.9 million in economic output statewide.

Moreover, in communities such as Fairfax County, Henrico County, Loudoun County, Mecklenburg County, and Prince William County where data center construction is an ongoing event, such impacts are more fairly characterized as continuous over time rather than episodic. As a result, some localities have developed relatively large construction sectors that specialize in data center construction.

³⁰ It is important to note that the job announcements depicted in Figure 11 are only for new industry openings or industry expansions as announced by the Virginia Economic Development Corporation. They do not represent total employment in the Data Processing, Hosting, and Related Services industry within these localities. In addition, they do not include announcements that were classified as confidential and for which specific details were not released to the public.

³¹ It is important to note that the investment announcements depicted in Figure 12 are only for new industry openings or industry expansions as announced by the Virginia Economic Development Corporation. They do not represent total investment in the Data Processing, Hosting, and Related Services industry within these localities. In addition, they do not include announcements that were classified as confidential and for which specific details were not released to the public.

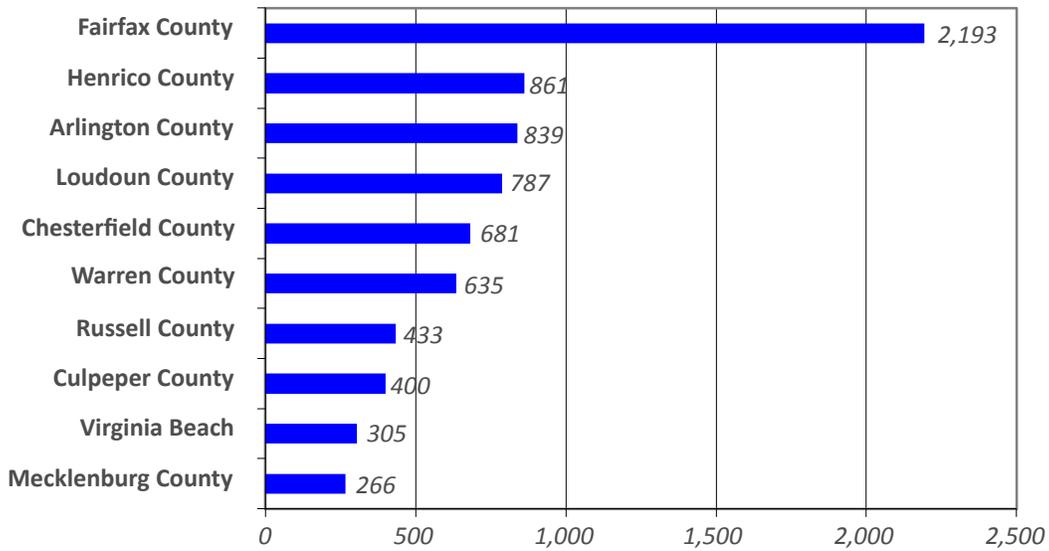


Figure 11: Top 10 Localities for Cumulative VEDP Job Announcements in the Data Processing, Hosting, and Related Services Industry – January 2000 through November 2017.³²

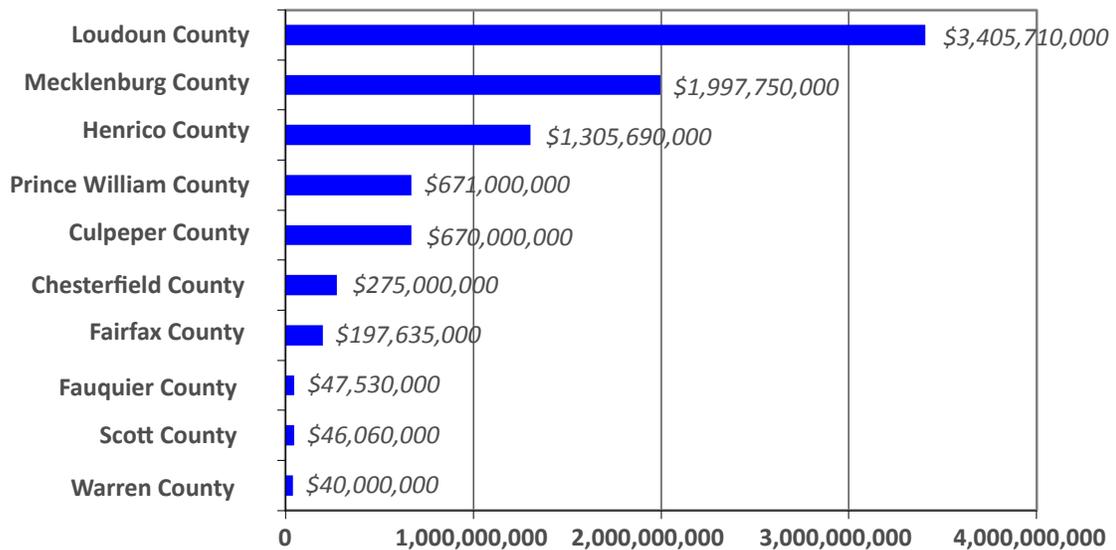


Figure 12: Top 10 Localities for Cumulative VEDP Investment Announcements in the Data Processing, Hosting, and Related Services Industry – January 2000 through November 2017.³³

Drives Large Capital Investment

As discussed earlier in this report, the Data Processing, Hosting, and Related Services industry is very capital-intensive. According to data from the U.S. Chamber of Commerce, the typical data center requires an initial investment of \$45 million in building construction and \$157 million in servers and other computer equipment.³⁴ Figure 13 depicts Virginia Economic Development Partnership (VEDP) investment announcements in Data Processing, Hosting, and Related Services for the period from January 2000 through November 2017. As these data demonstrate, since 2009 those investment announcements have averaged \$1.6 billion per year and reached a high of \$2.6 billion in 2016.

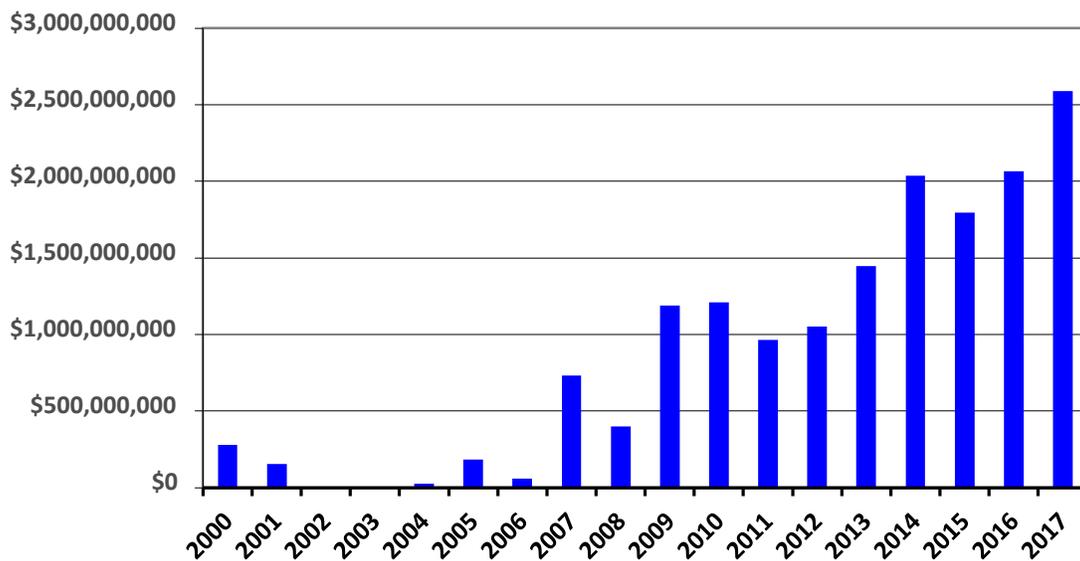


Figure 13: VEDP Investment Announcements in the Data Processing, Hosting, and Related Services Industry – January 2000 through November 2017.³⁵

Figure 14 provides an additional perspective on these Data Processing, Hosting, and Related Services investment data by presenting them as a percentage of total VEDP Investment announcements over the same period. As these data clearly demonstrate, particularly since 2009, that proportion is very high – ranging from 32 percent of total statewide investment announced in 2012 to 70 percent of total statewide investment announced in 2015. Moreover, just as the high wages paid by this sector have a large positive impact on the state’s largest source of tax revenue (individual income tax), as will be shown subsequently in this section, this disproportionately high level of capital investment has a large positive impact on localities’ largest source of tax revenue (property tax).

³⁴ Data Source: “Data centers: Jobs and Opportunities in Communities Nationwide,” U.S. Chamber of Commerce, June 2017.

³⁵ Data Source: Virginia Economic Development Corporation.

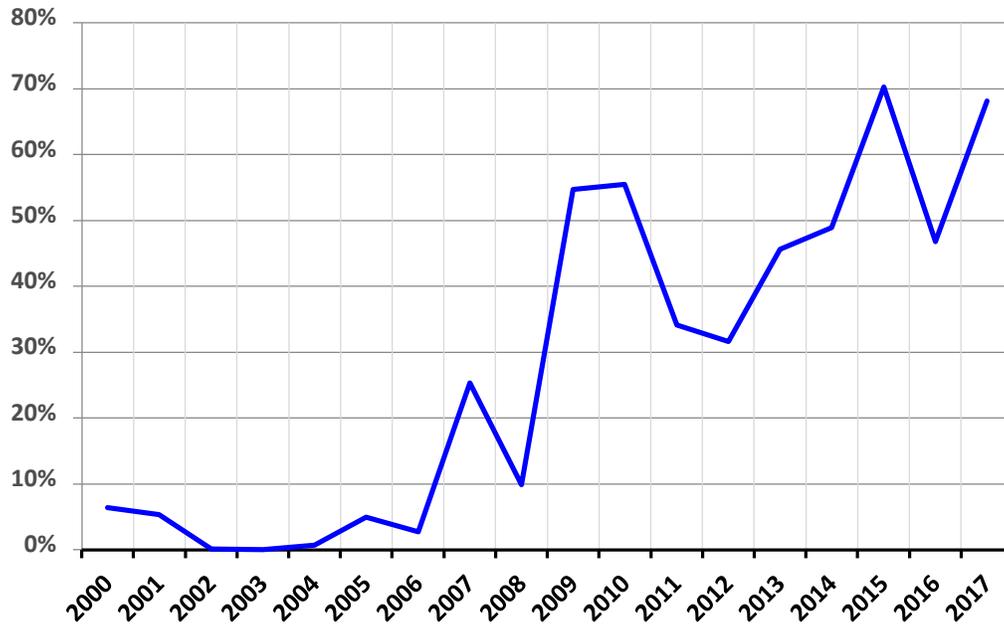
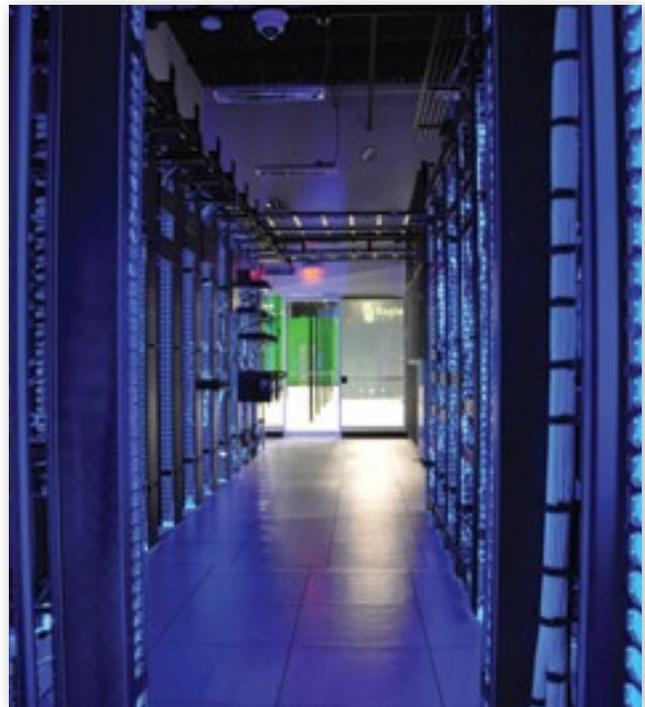


Figure 14: VEDP Investment Announcements in the Data Processing, Hosting, and Related Services Industry as a Proportion of Total Investment Announcements – January 2000 through November 2017.³⁶

Drives Human Capital Development

In the modern economy, one of the key resources that drives economic location decisions is access to a skilled workforce. This is particularly true of technology firms for which human capital is often their most critical resource need. As a result, technology industries with similar workforce requirements tend to cluster together to take advantage of a common workforce pool, in the same way that manufacturers have traditionally clustered together to take advantage of a common natural resource.



³⁶ Data Source: Virginia Economic Development Corporation.



Table 15 lists 10 key occupations in Virginia’s Data Processing, Hosting, and Related Services industry that collectively account for almost half of all employment in that industry. These data are taken from an industry staffing matrix produced by the Virginia Employment Commission and reflect estimated statewide industry-level staffing patterns in 2016.

<i>Occupation</i>	<i>Typical Degree Level</i>	<i>% of Industry Employment</i>
Computer and Information Systems Managers	BA	2.8%
Computer Operators	Associate’s	1.8%
Computer Programmers	BA	0.9%
Computer Systems Analysts	Associate’s	10.8%
Computer User Support Specialists	BA	8.4%
Information Security Analysts	BA	2.7%
Management Analysts	BA	4.1%
Network and Computer Systems Administrators	BA	7.0%
Software Developers, Applications	BA	2.9%
Software Developers, Systems Software	BA	3.1%

Table 15: Top 10 Key Occupations in Virginia’s Data Processing, Hosting, and Related Services Industry.³⁷

Based on that same staffing matrix, Table 16 lists the top 10 industries in Virginia, in addition to Data Processing, Hosting, and Related Services, that employ a large proportion of individuals in these 10 key occupations. Table 16 also lists the statewide average private sector weekly wage for each of these industries in 2016, and then compares that wage to the average across all private sector industries that year. As these data show, the industries that most heavily draw from the same pool of skilled workers as Data Processing, Hosting, and Related Services are, like that industry, very high paying industries. More specifically, they pay wages that range from 136 percent to 236 percent above the prevailing statewide wage.

³⁷ Data Source: Virginia Employment Commission.

<i>Industry</i>	<i>Avg. Private Sector Weekly Wage in 2016</i>	<i>As a % of the Avg. Private Sector Weekly Wage Across all Industries in 2016</i>
Architectural, Engineering, and Related Services	\$1,812	172%
Computer Systems Design and Related Services	\$2,219	210%
Credit Intermediation and Related Activities	\$1,625	154%
Data Processing, Hosting, and Related Service	\$2,266	215%
Insurance Carriers and Related Activities	\$1,439	136%
Management of Companies and Enterprises	\$2,206	209%
Management, Scientific, and Technical Consulting	\$2,046	194%
Scientific Research and Development Services	\$2,119	201%
Software Publishers	\$2,485	236%
Telecommunications	\$2,260	214%

Table 16: Top 10 Industries in Virginia Employing the Occupations listed in Table 15.³⁸

The question remains, however, whether these industries actually do cluster together to take advantage of a common workforce pool. Table 17 provides the answer to that question. Focusing on Northern Virginia, the area of Virginia with the largest concentration of private sector employment in Data Processing, Hosting, and Related Services, Table 17 lists the regional employment location quotient for each of the 10 industries listed in Table 16.³⁹ A location quotient measures the size of an industry’s employment footprint in an area relative to what one would otherwise expect based on the statewide norm. If the location quotient is greater than 1.0, that indicates that the industry’s employment footprint is larger than would be expected, and if it is less than 1.0 that indicates it is smaller than would be expected.

³⁸ Data Source: Virginia Employment Commission.

³⁹ For purposes of this table, Northern Virginia is defined as the combined Workforce Development Areas of Alexandria/Arlington and Northern Virginia, Greater Richmond is defined as the Capital Region Workforce Development Area, North Hampton Roads is defined as the Greater Peninsula Workforce Development Area, and South Hampton Roads is defined as the Hampton Roads Workforce Development Area.



<i>Industry</i>	<i>Northern Virginia</i>
Architectural, Engineering, and Related Services	1.5
Computer Systems Design and Related Services	2.1
Credit Intermediation and Related Activities	1.1
Data Processing, Hosting, and Related Service	2.1
Insurance Carriers and Related Activities	0.5
Management of Companies and Enterprises	1.0
Management, Scientific, and Technical Consulting	2.3
Scientific Research and Development Services	1.8
Software Publishers	2.1
Telecommunications	1.8

Table 17: Employment Location Quotients for Top 10 Industries listed in Table 16.⁴⁰

As the data presented in Table 17 indicate, eight of the 10 industries listed in Table 16 have an employment footprint in Northern Virginia that is larger than one would expect based on the statewide norm. In short, these data are consistent with the hypothesis that the Data Processing, Hosting, and Related Services industry is a high paying industry that makes a region more attractive to other high paying industries that must draw from the same highly skilled workforce pool.

⁴⁰ Data Source: Virginia Employment Commission.

Drives Energy Innovation

In a column published earlier this year, the online publication Data Center Frontier listed eight trends that they predicted would shape the data center industry in 2018.⁴¹ Number seven was “lead the transition to renewable energy.” Data centers use a lot of electricity. According to a recent analysis by the U.S. Chamber of Commerce, a typical data center spends about \$7.4 million a year on energy, and energy costs comprise between 40 and 80 percent of a data center’s annual operating budget.⁴² As a result, data centers are constantly working to reduce their energy footprint. Moreover, leading data center companies such as Amazon Web Services (AWS), Apple, Facebook, Google, and Microsoft have established goals to move toward sourcing 100 percent of their power needs from renewable energy and are actively working to achieve those goals. As a result, data centers have also become a driving force behind the development of utility scale renewable energy projects.

For example, as recently as 2015 wind and solar energy did not materially contribute to electricity production in Virginia, even though these renewable energy sources accounted for six percent of electricity generation nationally.⁴³ But that picture has since changed substantially. Dominion Energy, Virginia’s largest electricity producer, currently has more than 744-megawatts of solar generation capacity in Virginia that is either operational or under development.⁴⁴ Moreover, 580-megawatts or 78 percent of that capacity is directly attributable to partnerships with leading data center companies. To put that number in perspective, 580-megawatts of solar energy is enough to power 145,000 homes, or one-and-a-half times the total number of homes in the City of Richmond.⁴⁵

More specifically, a partnership between Dominion Energy and AWS has resulted in six projects totaling 260-megawatts in Virginia that involve long-term power purchase agreements to provide solar energy to support AWS’s renewable energy goals. One of those projects is Amazon Solar Farm U.S. East, an 80-megawatt solar facility located on Virginia’s Eastern Shore in Accomack County. Similarly, in 2016 Governor McAuliffe announced that the Commonwealth of Virginia, Microsoft and Dominion would partner to bring 20-megawatts of solar energy onto the grid in Virginia with the Remington solar project in Fauquier County.⁴⁶

Even more recently, Facebook has committed to supporting renewable energy projects to provide power to its proposed new \$1 billion data center in Henrico County and it is anticipated that commitment will lead to the development of 300-megawatts of new solar generating capacity. Finally, looking forward, Dominion Energy’s 2017 integrated resource plan calls for the development of up to 5,280-megawatts of solar generation by 2042, and to accommodate that development the company has also announced a comprehensive grid modernization effort that will involve the use of digital technologies to make the grid more efficient, reliable, secure, and better able to accommodate renewable energy.

⁴¹ <https://datacenterfrontier.com/the-8-trends-that-will-shape-the-data-center-industry-in-2018/>

⁴² Data Source: “Data Centers: Jobs and Opportunities in Communities Nationwide,” U.S. Chamber of Commerce, June 2017.

⁴³ Data Source: U.S. Energy Information Administration.

⁴⁴ Data Source: Dominion Energy.

⁴⁵ Data Source: U.S. Census Bureau.

⁴⁶ <https://governor.virginia.gov/newsroom/newsarticle?articleId=14609>

Strengthens Local Economies

Because the Data Processing, Hosting, and Related Services industry is very capital-intensive, it has a disproportionately positive impact on localities' largest source of tax revenue (property tax). But what might not be immediately obvious from that relationship is that this also places downward pressure on overall tax rates, thereby improving the locality's business climate and economic attractiveness.

BENEFIT/COST RATIO

In this portion of the section, we evaluate the benefit/cost ratio that the Data Processing, Hosting, and Related Services industry provides to localities. To accomplish that task, we focus on Loudoun County and Prince William County, home of the most significant concentrations of Data Processing, Hosting, and Related Services activity in Northern Virginia. Another reason for using these counties as an example is that we are able to take advantage of fiscal impact data provided by county personnel to better quantify the local fiscal benefit associated with this sector. Importantly, those data include fiscal impact assessments for both enterprise data centers that are owned and occupied by a single entity, and co-location data centers that lease space to one or more tenants. According to these data, the estimated fiscal impact of data center facilities in 2016 was approximately \$143.0 million in Loudoun County, and \$21.5 million in Prince William County.⁴⁸

On the other side of the ledger, to quantify the fiscal cost that the Data Processing, Hosting, and Related Services industry imposed on Loudoun County and Prince William County in 2016, we rely on data from the Virginia Department of Education on local elementary and secondary education expenditures per student, and data from the Virginia Auditor of Public Accounts on local non-education expenditures per county resident. Through this approach, we focus on the largest costs that any business imposes on a local government, which is the cost associated with providing primary and secondary education, and other county services, to the employees of that business.⁴⁹

Table 18 details the calculations used to produce our estimates of the primary fiscal cost that the Data Processing, Hosting, and Related Services industry imposed on Loudoun County and Prince William County in 2016. As shown in Table 18, we estimate those costs to have been approximately \$17.6 million in Loudoun County and \$2.5 million in Prince William County.

⁴⁷ These data are comprised of the real property and business personal property taxes paid by data centers to each county in 2016. The authors would like to express their profound gratitude to Buddy Rizer, Executive Director for Economic Development for Loudoun County, Robert S. Wertz, Jr., Commissioner of the Revenue for Loudoun County; Erin McLellan, Executive Director of the Department of Management and Budget Director for Loudoun County; Jeffrey Kaczmarek, Executive Director of the Department of Economic Development for Prince William County; Tim LeClerc, Deputy Finance Director for Prince William County, and their staffs for their assistance in developing and providing data without which this portion of our analysis would not have been possible.

⁴⁸ It is important to note that data for Prince William County do not include business personal property tax payments for leased equipment.

⁴⁹ In this analysis, we make the simplifying assumption that all employees within each county's Data Processing, Hosting, and Related Services industry are county residents. To the extent that some proportion of industry employees actually reside outside of the county, this assumption will slightly over-estimate the costs imposed by the industry, and therefore slightly under-estimate the benefit/cost ratio associated with the industry.

	<i>Loudoun County</i>	<i>Prince William County</i>
County private sector employment in Data Processing, Hosting, and Related Services in 2016⁵⁰	2,044	252
Students per employee ⁵¹	0.56	0.87
Per student county education expenditures ⁵²	\$9,437	\$4,911
Total Education Costs⁵³	\$10,719,134	\$1,079,920
County residents per employee ⁵⁴	2.75	4.46
Per resident non-education county expenditures ⁵⁵	\$1,225	\$1,292
Total Non-Education Costs⁵⁶	\$6,883,508	\$1,452,168
TOTAL COSTS⁵⁷	\$17,602,642	\$2,532,087

Table 18: Estimate of Total Fiscal Costs Imposed by the Data Processing, Hosting, and Related Services Industry in 2016.

As shown in Table 19, when we combine those estimates of fiscal cost with the respective \$143.0 million and \$17.6 million estimates of fiscal benefit, we are able to determine that the benefit/cost ratio associated with the Data Processing, Hosting, and Related Services industry was 8.1 in Loudoun County and 8.5 in Prince William County in 2016. This means that for every \$1.00 in county expenditures that the Data Processing, Hosting, and Related Services industry was responsible for generating in 2016, it provided approximately \$8.10 in tax revenue to Loudoun County, and approximately \$8.50 in tax revenue to Prince William County.

<i>Locality</i>	<i>Estimated Fiscal Benefit</i>	<i>Estimated Fiscal Cost</i>	<i>Benefit/Cost Ratio</i>
Loudoun County	\$142,970,214	\$17,602,642	8.1
Prince William County	\$21,519,155	\$2,532,087	8.5

Table 19: Estimated Benefit/Cost Ratio Associated with the Data Processing, Hosting, and Related Services Industry in 2016.

⁵⁰ Data Source: Virginia Employment Commission.

⁵¹ Data Source: Virginia Department of Education and Virginia Employment Commission. Derived by dividing total county elementary and secondary school enrollment in 2016 by total county employment in 2016.

⁵² Data Source: Virginia Department of Education.

⁵³ Derived as county private sector employment in Data Processing, Hosting, and Related Services in 2016, times students per employee, times per student education expenditures.

⁵⁴ Data Source: Virginia Auditor of Public Accounts and Virginia Employment Commission. Derived by dividing total county population in 2016 by total county employment in 2016.

⁵⁵ Data Source: Virginia Auditor of Public Accounts.

⁵⁶ Derived as county private sector employment in Data Processing, Hosting, and Related Services in 2016, times county residents per employee, times per resident non-education expenditures.

⁵⁷ Derived as the sum of total education costs and total non-education costs.

OPPORTUNITY COST

One of the most useful concepts in economics is the concept of opportunity cost – what is the cost of not doing something. Or in this case, what would have been the cost to these localities if their Data Processing, Hosting, and Related Services industries had not existed in 2016. The obvious answer is that they would not have received the estimated \$164.5 million in county tax revenue that this sector provided in 2016, and that in order to maintain county expenditures at the same level, that revenue would have had to come from other sources. The two most likely sources would have been: 1) additional education funding from the state triggered by the negative impact that this loss in tax base would have had on the composite index formula Virginia uses to allocate education funding to localities and 2) an increase in each county’s real property tax rate.

On average, the state of Virginia funds 55 percent of primary and secondary education expenditures, and localities are required to locally fund the remaining 45 percent.⁵⁸ But, that local funding percentage is adjusted up or down based on each locality’s “ability to pay” as measured by Virginia’s composite index formula that takes into account the locality’s property tax base, adjusted gross income, and taxable retail sales. Of these three factors, property tax base receives the highest weight (50 percent) and, therefore, has the largest influence on the final calculation.⁵⁹

The most recent composite index for Loudoun County was 0.5497 and for Prince William County 0.3848.⁶⁰ If we recalculate those indexes to take into account the loss of tax base implied by the \$164.5 million loss in tax revenue that would have occurred if the Data Processing, Hosting, and Related Services industry had not existed in these localities, those indexes fall to 0.5298 and 0.3790 respectively. As shown in Table 20, according to our estimates, this means that the state would have had to reallocate \$9.8 million in state education funding away from other Virginia localities to provide \$9.8 million in additional formula-driven funding to Loudoun County and \$3.6 million in additional funding to Prince William County. To put this number in perspective, \$13.4 million is larger than the state-funded portion of 37 county school budgets in Virginia in 2016.

<i>Locality</i>	<i>Revenue Loss</i>	<i>State Education Funding Off-Set</i>	<i>Additional Required Funding from Real Property Tax</i>
Loudoun County	\$142,970,214	\$9,810,117	\$133,160,097
Prince William County	\$21,519,155	\$3,548,842	\$17,970,313

Table 20: Estimated Additional Revenue Required to Compensate for loss of the Data Processing, Hosting, and Related Services Industry in 2016 by Source.

⁵⁸ Data Source: In actuality, however, baseline local funding percentages are typically higher than 45 percent because of local initiatives.

⁵⁹ Data Source: Virginia Department of Education. The actual formula weights each locality’s property tax base by 0.5, adjusted gross income by 0.4, and taxable retail sales by 0.1. Each metric is then divided by school population and total population and those per capita figures are divided by the average across all localities to determine ability to pay. The per capita figures are then themselves weighted with each per capita school population metric receiving a weight of 0.66 and each per capita population metric receiving a weight of 0.33.



The remaining \$151.1 million in lost tax revenue would likely have been made up through increased property taxes (by far the largest source of revenue for most localities). Figure 15 depicts our estimate of the increase in Loudoun County's and Prince William County's real property tax rates that would have been required to generate this \$151.1 million in lost tax revenue. As shown, Loudoun County's real property tax rate would have likely had to increase from \$1.125 per \$100 of assessed value to \$1.326 (a 17 percent increase) and Prince William County's would likely had to increase from \$1.122 per \$100 of assessed value to \$1.145 (a two percent increase).

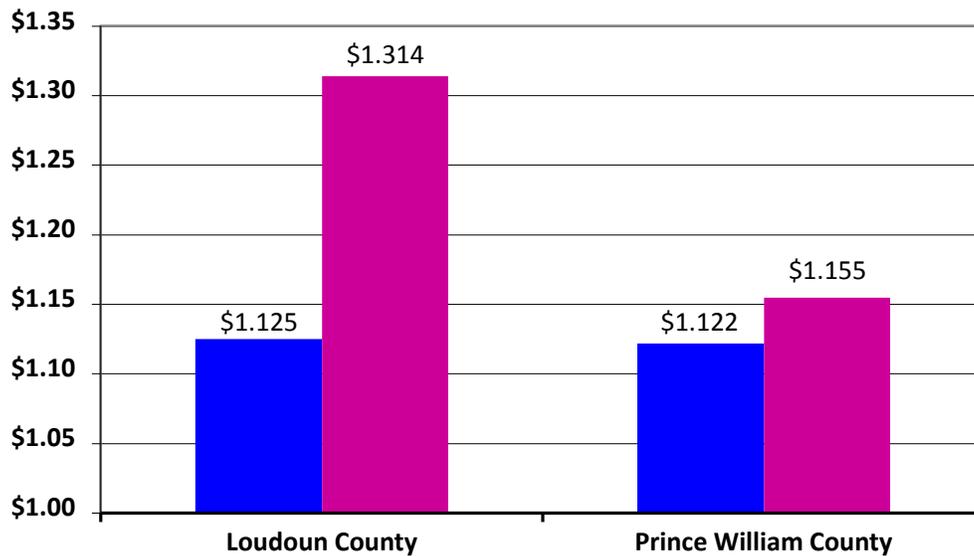


Figure 15: Estimated County Real Property Tax Rates with and without the Data Processing, Hosting, and Related Services Industry.

Strengthens and Diversifies the State Economy

In addition to directly and indirectly supporting approximately 43,275 jobs and \$3.2 billion in associated labor income in Virginia, adding \$10.2 billion to the state's economic output, generating \$349.3 million in state and local tax revenue, and helping to bridge the growing economic disparity between urban and rural communities in the Commonwealth, the Data Processing, Hosting, and Related Services industry also plays an important role in one of the state's most pressing economic challenges – increasing the diversity of our economic base and growing private sector employment.



VIRGINIA'S RECENT ECONOMIC UNDER PERFORMANCE

Traditionally, Virginia enters a recession later than the country as a whole, is less adversely affected than the country as a whole, and comes out of the recession sooner than the country as a whole. In that regard, the Great Recession of 2007 impacted the state about as one would expect. Where things went wrong, however, was during the “recovery.”

Figure 16 compares the year-over-year change in total nonfarm employment in Virginia to that of the U.S. as a whole from January 2008 through October 2017. Any point above the zero line in this graph indicates positive year-over-year employment growth, while any point below the zero line indicates a decline in year-over-year employment. This graph clearly shows the impact of the Great Recession of 2007 as employment growth moved into negative territory in early 2008, bottomed out in late 2009, and did not move back into positive territory until late 2010. Although, as these data indicate, throughout that period Virginia continued to do better than the nation as a whole.

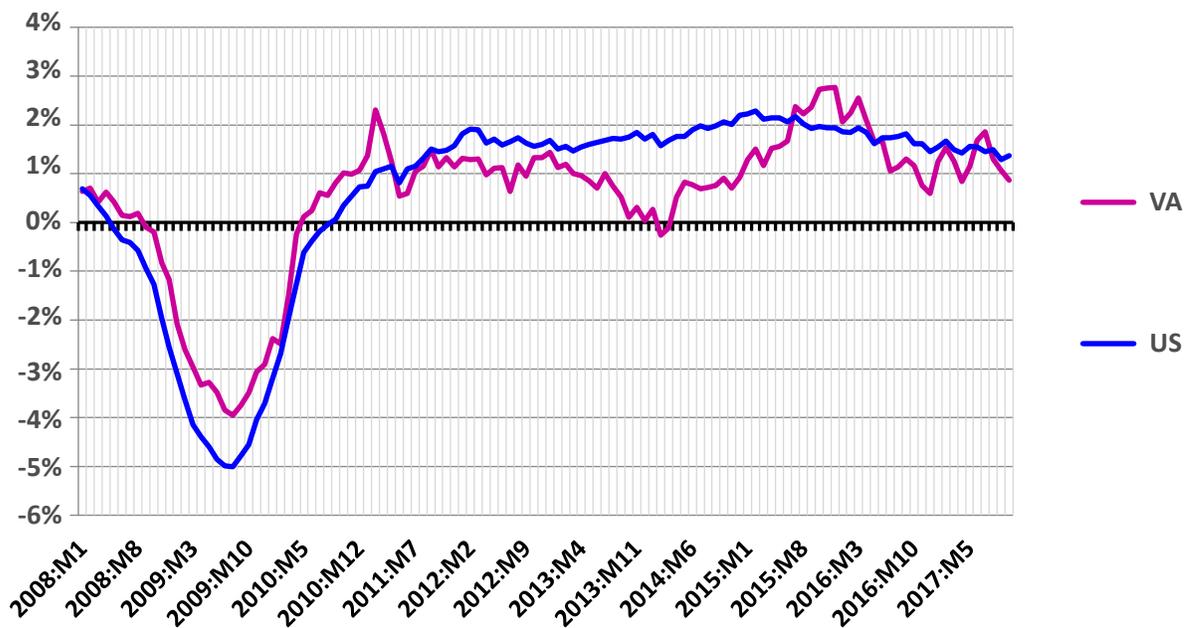


Figure 16: Year-over-Year Change in Total Nonfarm Employment – January 2008 to October 2017.⁶¹

⁶¹ Data Source: Bureau of Labor Statistics.

However, starting in mid-2011 that situation changed and Virginia started under-performing the nation as a whole. In 2013, that divergence in trend became even more acute and, except for a brief period from mid-2015 to mid-2016, Virginia has since continued to generally under-perform the national norm. As of October 2017, the year-over-year change in Total Nonfarm employment stood at 0.9 percent in Virginia, as compared to 1.4 percent nationwide. Moreover, to add insult to injury, as shown in Figure 17, Virginia has also fallen behind its immediate neighbors and is now substantially under-performing North Carolina and frequently also under-performing Maryland. In contrast to Virginia's 0.9 percent year-over-year increase in Total Nonfarm employment in October 2017, the comparable figures for North Carolina and Maryland were 1.7 percent and 2.0 percent respectively.

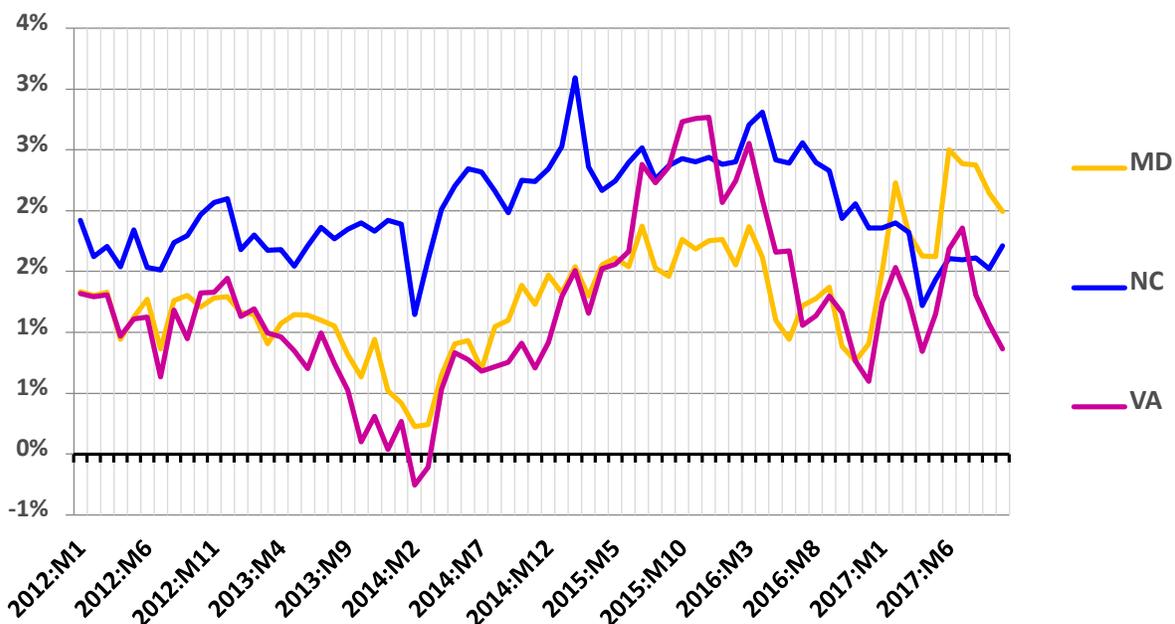


Figure 17: Year-over-Year Change in Total Nonfarm Employment – January 2012 to October 2017.⁶²

As shown in Figure 18, much of this disparity can be traced to differences in the performance of each state's Professional, Scientific, and Technical Services industry. Professional, Scientific, and Technical Services is a key industry in all three states, but it is particularly important in Virginia, where it comprises 10.1 percent of total employment (as compared to 5.3 percent in North Carolina and 9.1 percent in Maryland). In 2016, this industry employed 409,308 people statewide (61 percent of whom were employed in Northern Virginia) and paid an average weekly wage of \$1,936, almost twice the statewide average weekly wage of \$1,044. It should also be noted that many of the industries cited earlier in Table 16 as drawing from the same highly skilled labor pool as the Data Processing, Hosting, and Related Services industry, are Professional, Scientific, and Technical Services industries.

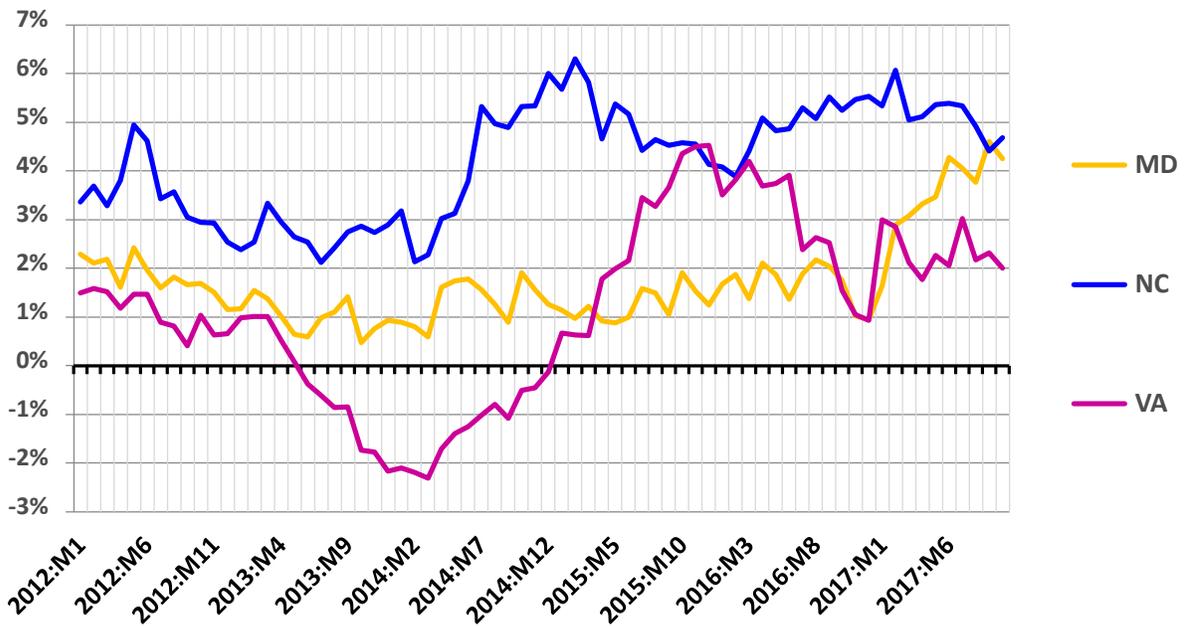


Figure 18: Year-over-Year Change in Professional, Scientific, and Technical Services Employment – January 2012 to October 2017.⁶³

The question these data ultimately raise is why has Virginia’s economic performance deteriorated in recent years? Although a comprehensive answer to that question is beyond the scope of this report, there are at least two apparent answers: 1) Virginia’s economy is overly dependent on the federal government and 2) we have seen a deterioration in our business climate.

VIRGINIA’S OVER-DEPENDENCE ON THE FEDERAL GOVERNMENT

The significant downturn that Virginia experienced in Professional, Scientific, and Technical Services employment shown in Figure 18 starting in 2013 has generally been attributed to the effect of the 2013 federal sequester. The 2013 federal sequester had a disproportionately large negative impact on Department of Defense contracting expenditures, which in turn had a disproportionately large negative impact on Northern Virginia’s Professional, Scientific, and Technical Services industry. And because Professional, Scientific, and Technical Services accounts for 21 percent of Northern Virginia’s total employment, and Northern Virginia accounts for 32 percent of Virginia’s overall total employment, that had a large negative impact on Virginia’s economy.

⁶³ Data Source: Bureau of Labor Statistics.

Moreover, there are reasons to believe that, in the long-term at least, one should not expect these conditions to change substantially. Virginia traditionally leads all other states as the largest recipient of federal government defense expenditures. According to data compiled by the National Conference of State Legislatures, in 2016 Virginia benefited from \$53 billion in federal defense expenditures and those expenditures accounted for 11.8 percent of the state's GDP.⁶⁴

Figure 19 depicts recent trends in real (inflation adjusted) federal government defense and non-defense consumption and investment expenditures benchmarked against their 2009 level. As these data show, real federal government consumption and investment expenditures on defense fell below 2009 levels in the fourth quarter of 2011 and have generally continued to deteriorate since, coming in at 85 percent of 2009 levels in the third quarter of 2017.

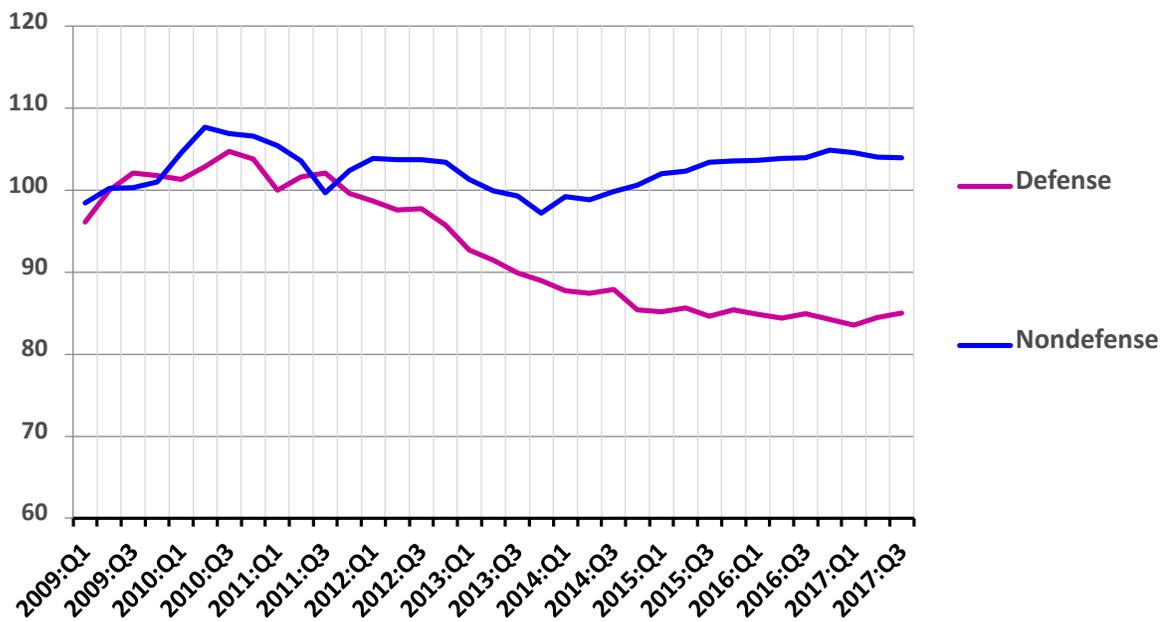


Figure 19: Federal Government Defense and Nondefense Expenditures Quantity Index (2009 Expenditure Levels = 100).⁶⁵

When one combines these data with the fact that the Congressional Budget Office currently projects that the annual interest payment on our \$20.5 trillion national debt will go from accounting for \$1 out of every \$13 collected in federal tax revenue in 2017, to \$1 out of every \$7 in 2027, and then \$1 out of every \$5 in 2037, it becomes evident that the defense spending trend depicted in Figure 19 is unlikely to change substantially in the long-term.⁶⁶ This clearly shows that one of the most pressing economic challenges currently facing Virginia is how to grow its private sector to diversify its economy away from an over-dependence on federal government expenditures. As a private sector, high-technology, high-wage, high-growth industry, the Data Processing, Hosting, and Related Services industry can serve as an instrument in affecting that change.

⁶⁴ National Council of State Governments, "Military's Impact on State Economies," February 2017.

⁶⁵ Data Source: Bureau of Labor Statistics.

⁶⁶ Data Source: Congressional Budget Office, "Long-Term Budget projections," March 2017.



VIRGINIA'S DETERIORATING BUSINESS CLIMATE

In the not too distant past, Virginia typically scored at or near the top of most business climate rankings. In recent years, however, the state has lost significant ground relative to other states. Between 2010 and 2017, Virginia slipped from 2nd to 5th in Forbes' "Best States for Business" ranking, 2nd to 7th in CNBC's "America's Top States for Business" ranking, 2nd to 7th in the U.S. Chamber of Commerce's "Enterprising States" ranking, 4th to 15th in Chief Executives' "Best and Worst States for Business" ranking, and 4th to 9th in Site Selection Magazine's "Business Climate" ranking. In most cases, these declines were largely driven by the Commonwealth's recent lackluster employment growth. But tax rates, and particularly taxes on capital investment, have also played a role.

In the Tax Foundation's "2018 State Business Tax Climate Index," Virginia's overall state business tax climate was ranked 31st among the states, down from 23rd as recently as 2012.⁶⁷ The primary reason for the Commonwealth's low ranking was that it was ranked in the bottom half of the states with regard to individual income tax, unemployment insurance tax, and property tax rates.

In 2015, the Tax Foundation also published the "Location Matters" report that performed a more comprehensive assessment of state tax climate from the perspective of seven specific types of industries.⁶⁸ Among those seven were capital-intensive manufacturing and labor-intensive manufacturing. According to the Tax Foundation's analysis, Virginia ranked:

- 20th among the states for mature capital-intensive manufacturers, and 49th among the states for new capital-intensive manufacturers (only Maryland was ranked worse than Virginia); and
- 2nd among the states for mature labor-intensive manufacturers, and 36th among the states for new labor-intensive manufacturers.

⁶⁷ https://files.taxfoundation.org/20171016171625/SBTCL_2018.pdf

⁶⁸ https://files.taxfoundation.org/20170112211359/TF_LocationMatters_2015.pdf



In explaining why Virginia was ranked so much more poorly for new firms as opposed to mature firms, and capital-intensive industries as opposed to labor-intensive industries, the Tax Foundation made clear that Virginia's, "high property taxes on equipment drive tax burdens on some firms, with a particularly dramatic effect on new operations." Later, focusing more succinctly on new operations, the Tax Foundation went on to say that new firms experience "heavy property tax burdens due to the state's tax on equipment, which is more than double the national average."⁶⁹

These findings have obvious negative implications for Virginia's ability to further diversify its economy by expanding private sector employment in new, capital-intensive, high-wage industries. First, they point to the important role that taxes on capital investment play in business attraction and retention. Second, they make clear that Virginia is already at a significant competitive disadvantage relative to other states in regard to taxes on capital investment.

But more specifically, they also are of particular relevance to the capital-intensive Data Processing, Hosting, and Related Services industry. As we have demonstrated, because the Data Processing, Hosting, and Related Services industry provides such a high benefit/cost ratio to localities, it enables them to maintain lower overall property tax rates than would otherwise be the case. As made clear by the Tax Foundation's "Location Matters" report, this aids in ameliorating one of Virginia's larger business climate liabilities.

In addition, it is important to keep in mind that the Data Processing, Hosting, and Related Services industry is not only extremely capital-intensive, but also must replace its capital equipment on an unusually short three-year cycle. As a result, any further exacerbation of Virginia's already significant competitive disadvantage in regard to taxes on capital equipment could have a disproportionately negative impact on the state's ability not only to attract Data Processing, Hosting, and Related Services industries, but also to retain them, given their unusually short equipment refreshment rates.



ROLE OF INCENTIVES

Data center location choices generally depend on several main factors: the availability and price of fiber; the availability and price of real estate; the availability of water; the lack of exposure to environmental risks (earthquake, hurricane, etc.); the availability of skilled labor; and taxes. In the short run, it is difficult for a locality to change most of those factors. However, taxes are the easiest to affect as a matter of policy, and the enactment and updating of state tax incentives often has a significant impact on data center location decisions.

The Virginia Data Center Incentive

In 2009, Apple decided to build a \$1 billion data center in Maiden, NC instead of Virginia.⁷⁰ Both states had vied for the facility.⁷¹ But after Apple indicated that it was leaning toward a Virginia location⁷², the North Carolina legislature enacted tax incentives to secure the Apple facility.⁷³ In response to that loss, the Virginia General Assembly voted in early 2010 to significantly expand the state's existing 2008 data center sales and use tax exemption on computer equipment to remove requirements pertaining to local unemployment rates and increase the scope of qualified equipment to include servers, routers, generators, chillers and other enabling hardware. Subsequent to the enactment of that legislation, Governor McDonnell announced in August of 2010 that Microsoft would build its Boydton data center campus, the east coast hub for Microsoft's online services, in Mecklenburg County.⁷⁴

Then, in 2012 the incentive was amended again to allow co-location data center facilities to aggregate the capital investment and new job requirements of the data center owner and its tenants. These updates were enacted to keep Virginia competitive in the data center location market. They were scheduled to expire in 2020. Most recently, in 2016 Virginia extended the data center incentive program to 2035 in order to send a clear signal to data center firms that Virginia intended to remain competitive with other states for data centers.

⁷⁰ <http://www.datacenterknowledge.com/archives/2009/07/06/apple-confirms-maiden-site-for-idatacenter/>

⁷¹ <http://www.datacenterknowledge.com/archives/2010/02/05/virginia-nc-battling-for-microsoft-data-center/>

⁷² <http://www.datacenterknowledge.com/archives/2009/07/07/how-apple-played-the-incentive-game/>

⁷³ <http://www.datacenterknowledge.com/archives/2010/02/05/virginia-nc-battling-for-microsoft-data-center/>

⁷⁴ http://www.thenewsrecord.com/index.php?/news/article/mecklenburg_lands_microsoft_data_center/

Table 21 provides additional details on the data center incentives offered by each state.⁷⁵

State	Year Enacted or Revised	Latest Version of Incentive
Florida ⁷⁶	2017	Sales and use tax exemption on property, equipment and IT electric load for new facilities with total power capacity of 15MW, and a cumulative capital investment of at least \$150 million. Also, every tenant must have 1MW dedicated power capacity.
Utah ⁷⁷	2016	Sales tax exemption for data center equipment with one year of economic life.
Pennsylvania ⁷⁸	2016	Sales and use tax refunds for capital investments of \$25 million or \$50 million depending on county population and \$1 million in annual employee compensation.
Tennessee ⁷⁹	2016	Tax credit for construction materials for \$100 million investment and 15 jobs paying 150 percent of average state wage plus an electricity tax rate set at 1.5 percent.
Virginia ⁸⁰	2016	Sales and use tax exemption for \$150 million investment and 50 jobs paying 150 percent of average local wage (or 25 jobs in rural or high unemployment areas).

Table 21: State Incentives Specifically for Data Centers.

⁷⁶ https://www.myfloridahouse.gov/Sections/Documents/loaddoc.aspx?FileName=_h7109er.docx&DocumentType=Bill&BillNumber=7109&Session=2017

⁷⁷ <https://le.utah.gov/interim/2017/pdf/00002800.pdf>

⁷⁸ http://www.revenue.pa.gov/GeneralTaxInformation/IncentivesCreditsPrograms/Documents/computer_data_center_equipment_program_guidelines.pdf

⁷⁹ <https://trackbill.com/bill/tn-sb2537-taxes-exemption-and-credits-as-enacted-reduces-the-capital-investment-requirement-for-eligibility-for-qualified-data-center-sales-and-use-tax-exemptions-from-250-million-to-100-million-exempts-cooling-equipment-and-backup-power-equipment-sold-or-used-by-qualified-data-centers-from-the-sales-and-use-tax-requires-qualified-data-center-that-applies-for-job-tax-credits-to-certify-that-it-has-not-within-the-previous-12-months-been-found-to-be-in-violation-of-certain-laws-amends-tca-ti/1240411/>

⁸⁰ <http://www.yesvirginia.org/Content/pdf/guides/Virginia%20Guide%20to%20Business%20Incentives%202016-2017.pdf>

<i>State</i>	<i>Year Enacted or Revised</i>	<i>Latest Version of Incentive</i>
North Carolina ⁸¹	2015	Sales tax exemption for electricity for use at a qualifying data center, and for data center support equipment to be located and used at a data center with more than a \$75 million investment.
Michigan ⁸²	2015	Sales tax exemption on equipment from 2016 potentially through 2035. However, to extend the exemption past January 1, 2022, the data center industry in Michigan as a whole must add 400 new jobs by 2022 and a total of 1,000 new jobs by 2026.
Missouri ⁸³	2015	Sales tax exemption for \$25 million in investment in 3 years plus 10 new jobs paying 150 percent of the average state wage.
Nevada ⁸⁴	2015	Partial sales and property tax reductions for 10 years on \$25 million investment plus 10 jobs paying average state wage plus healthcare in 5 years, or for 20 years on \$100 million investment plus 50 jobs paying average state wage plus healthcare.
North Dakota ⁸⁵	2015	Sales tax exemption on equipment through 2020 for the first 4 data centers of 16,000 sq. ft. approved by the state.
Oregon ⁸⁶	2015	Central tax assessment exemption.
Washington ⁸⁷	2015	Sales and use tax exemption for 100,000 sq. ft. building in rural counties.
Arizona ⁸⁸	2013	Sales and use tax exemption for up to 20 years for \$50 million investment within 5 years in the 2 largest counties or for \$25 million investment within 5 years in the other counties.

Table 21: State Incentives Specifically for Data Centers.

⁸¹ <https://www.ncleg.net/Sessions/2015/Bills/House/PDF/H117v8.pdf>

⁸² <http://michiganradio.org/post/gov-snyder-signs-major-tax-breaks-data-centers>

⁸³ <http://www.missouripartnership.com/Portals/0/PDF/Data%20Center%20Sales%20Tax.pdf>

⁸⁴ http://www.diversifynevada.com/documents/Summary_Data_Center_Tax_Abatement_FY2016.pdf

⁸⁵ <http://www.legis.nd.gov/cencode/t57c39-2.pdf>

⁸⁶ <http://www.bendbulletin.com/localstate/3008035-151/data-center-bill-took-a-perilous-path-before#>

⁸⁷ https://dor.wa.gov/sites/default/files/legacy/Docs/Pubs/Incentives/TaxIncentivesOverview_web.pdf

⁸⁸ <http://www.azcommerce.com/incentives/computer-data-center-program>

<i>State</i>	<i>Year Enacted or Revised</i>	<i>Latest Version of Incentive</i>
Ohio ⁸⁹	2013	Sales tax exemption on \$100 million investment in 3 years plus \$1.5 million per year in payroll.
Texas ⁹⁰	2013	Sales and use tax exemption for \$200 million investment and 20 jobs paying 120 percent of the average local wage.
Alabama ⁹¹	2012	Sales and use tax exemption for 10 years for up to \$200 million investment within 10 years, for 20 years for \$200 million to \$400 million investment within 10 years, or for 30 years for over \$400 million investment within 20 years plus 20 new jobs in each category.
Indiana ⁹²	2012	Property tax exemptions for \$10 million investment in high technology districts paying employees 125 percent of average county wage.
Louisiana ⁹³	2012	Single sales factor permitted for up to 40 years for approved data centers with more than 50 percent of sales outside of the state.
Minnesota ⁹⁴	2012	Sales tax exemption for 20 years for \$30 million investment in 4 years on 25,000 sq. ft.
Nebraska ⁹⁵	2012	A complex tiered scheme of incentives beginning with a partial sales tax refund and investment and compensation credits or \$3 million in investment plus 30 new jobs paying 60 percent of the average state wage.
South Carolina ⁹⁶	2012	Sales and electricity tax exemption for \$50 million investment within 5 years and 25 jobs paying 150 percent of the average wage.

Table 21: State Incentives Specifically for Data Centers.

⁸⁹ http://archives.legislature.state.oh.us/BillText130/130_SB_243_EN_N.pdf

⁹⁰ <https://comptroller.texas.gov/taxes/data-centers/>

⁹¹ https://revenue.alabama.gov/wp-content/uploads/2017/05/TaxIncentives_Summary.pdf

⁹² <http://www.in.gov/legislative/bills/2012/SE/SE0302.1.html>

⁹³ [http://revenue.louisiana.gov/Publications/lsis\(2012\).pdf](http://revenue.louisiana.gov/Publications/lsis(2012).pdf)

⁹⁴ <http://mn.gov/deed/business/financing-business/tax-credits/data-center-credit/>

⁹⁵ http://www.revenue.nebraska.gov/incentiv/Summary_new.pdf

⁹⁶ https://dor.sc.gov/resources-site/lawandpolicy/Documents/SC_TIED_Complete.pdf

<i>State</i>	<i>Year Enacted or Revised</i>	<i>Latest Version of Incentive</i>
Wyoming ⁹⁷	2011	Sales and use tax exemption on infrastructure and computer equipment for \$5 million investment with \$2 million in 1-year sales and use tax exemption on cooling and power equipment for \$50 million investment.
New Mexico ⁹⁸	2011	Receipts from web hosting service may be deducted from total receipts.
Mississippi ⁹⁹	2010	Sales tax exemption for \$50 million investment plus 50 new jobs paying 150 percent of the average state wage.
Kentucky ¹⁰⁰	2009	Refund of taxes paid on purchase and operation of \$100 million of equipment.
West Virginia ¹⁰¹	2009	Sales and use tax exemption and 95 percent reduction in property tax without any limits.
Iowa ¹⁰²	2007	Partial refund of sales taxes paid on power for \$1 million to \$10 million investment in 3 years; partial refund of sales taxes paid on equipment and power for \$10 million to \$200 million investment in 6 years; or sales and property tax exemption on equipment and power for \$200 million investment in 6 years.
Georgia ¹⁰³	2005	Sales and use tax exemption in any year with a \$15 million investment.
New York ¹⁰⁴	2000	Sales and compensating use tax exemption on equipment in high-security facilities providing uninterrupted access and continuous traffic management for web pages.
Oklahoma ¹⁰⁵	1993	Sales tax refund on computer equipment used by establishments with 80 percent annual gross revenue from outside of the state.

Table 21: State Incentives Specifically for Data Centers.

⁹⁷ http://wyomingbusiness.org/documentlibrary/wbc/wbc_datacenters_profile_092915.pdf

⁹⁸ <https://law.justia.com/codes/new-mexico/2011/chapter7/article9/section7-9-56.2/>

⁹⁹ <https://www.mississippi.org/assets/incentives/sales-and-use-tax-exemption-data-centers.pdf>

¹⁰⁰ <http://www.lrc.ky.gov/record/14RS/HB308.htm>

¹⁰¹ <http://www.wvcommerce.org/business/industries/datacenters/default.aspx>

¹⁰² <http://iowascreativecorridor.com/files/Data%20Center%20Iowa%20Legislation%20Summary.pdf>

¹⁰³ <http://rules.sos.ga.gov/GAC/560-12-2-.107>

¹⁰⁴ https://www.tax.ny.gov/pdf/memos/sales/m00_7s.pdf

¹⁰⁵ http://okcommerce.gov/wp-content/uploads/2015/06/Oklahoma_Business_Incentives_and_Tax_Guide.pdf

In the 25-year history of tax incentives impacting data centers, only one state, Washington, has ever rescinded incentives (most recently in 2014). Since that time, 12 states have added or updated their incentives to make them easier to gain.

In 2016 and 2017, Pennsylvania and Florida enacted data center tax incentives for the first time. The Florida tax incentive is especially noteworthy as it was enacted while Jacksonville is working to attract data centers to the undersea cable landing that was recently constructed there.

In 2015 and 2016, Virginia, Tennessee, North Carolina and Utah revised their data center tax incentives. The Virginia incentive was extended without changing the qualifications or expanding the incentives. The revisions in North Carolina, Tennessee and Utah all made it easier for data centers to qualify for the incentives to more aggressively compete for data center developments.

Data Centers Follow Incentives

INCENTIVES INFLUENCE LOCATION DECISIONS

Tax incentives have become a critical component of the competition between states for data centers. Moreover, as Microsoft's Boydton campus illustrates, incentives can be particularly helpful in luring data centers to less-developed rural communities. In Wyoming, the least populated state in the union, Randy Bruns, director of Cheyenne LEADS, has stated that,



*"Without [Wyoming's sales and use tax exemption on data center purchases of computer equipment], the state is immediately at a four percent to six percent tax disadvantage relative with Colorado or Nebraska or Utah. ... We have to make a good business case for a company to be here," Burns added. "They won't come here just because they like us here in Wyoming."*¹⁰⁶

South Carolina lawmakers have also attempted to position their state to more aggressively compete in the data center market. After losing a \$450 million Facebook data center to North Carolina, South Carolina revised their data center incentive in May 2015 to lower the required amount of investment and to exempt data centers from taxes on electricity as well as sales taxes on equipment. State Representative Phyllis Henderson (R-Greenville) stated,

*"The main piece of this legislation is because of North Carolina. We were just losing projects right and left to them."*¹⁰⁷

¹⁰⁶ http://trib.com/news/local/putting-cheyenne-on-the-data-center-map/article_856c306f-9050-58a6-ad35-5cafb3b32e17.html

¹⁰⁷ <http://www.thestate.com/news/politics-government/article14403305.html>



In addition, the competition between Virginia and North Carolina did not end with North Carolina beating out Virginia for the Apple facility in 2009,¹⁰⁸ and Virginia beating out North Carolina for the Microsoft facility in 2010. In September 2015, North Carolina lowered its investment criteria for its data center incentive and provided a tax exemption for data center purchases of electricity to better compete with Virginia, and to better target multi-tenant co-location facilities that typically provide a larger number of total jobs.¹⁰⁹

Also, the state of Michigan enacted data center incentives on December 16, 2015. Those incentives enabled Michigan to beat out New York in a competition for a new \$5 billion Switch data center in Grand Rapids. The Switch facility is expected to provide 1,000 jobs and will be the largest data center in the eastern half of the U.S.¹¹⁰

WASHINGTON: THE ONLY STATE TO EVER REMOVE DATA CENTER INCENTIVES

Washington state's experience with data center incentives is also illustrative, but in a different way. Washington's data center incentives were legislatively enacted in April 2010, sparking a construction boom and up to \$2 billion in new private investment in the state.¹¹¹ But, in June 2011, the incentives were allowed to lapse, which significantly slowed data center growth in Washington and drove a \$1 billion investment boom in nearby Oregon as Adobe, Apple,¹¹² Fortune Data Centers,¹¹³ and NetApp¹¹⁴ all announced that they would be building data centers there rather than in Washington. In May 2012, Washington again re-enacted their¹¹⁵ data center incentives, only to fail to reauthorize them during the 2014 legislative session.¹¹⁶ Washington then re-enacted its data center incentives yet again in July 2015.¹¹⁷

¹⁰⁸ <http://www.datacenterknowledge.com/archives/2009/06/03/its-official-apple-to-north-carolina>

¹⁰⁹ <http://www.datacenterknowledge.com/archives/2015/10/01/north-carolina-makes-data-center-tax-breaks-easier-to-get>

¹¹⁰ <http://www.freep.com/story/money/business/michigan/2015/11/16/data-center-switch-steelcase-grand-rapids-pyramid/75896236/>

¹¹¹ <https://washingtonstatewire.com/data-center-fumble-costs-jobs-in-washington-state-and-maybe-big-money/>

¹¹² <http://www.datacenterknowledge.com/archives/2012/02/21/apple-confirms-plans-for-oregon-data-center>

¹¹³ <http://www.datacenterknowledge.com/archives/2011/10/21/fortune-expands-to-portland-oregon>

¹¹⁴ <http://www.datacenterknowledge.com/archives/2011/10/17/digital-realty-to-build-netapp-facility-in-oregon>

¹¹⁵ <https://washingtonstatewire.com/data-center-fumble-costs-jobs-in-washington-state-and-maybe-big-money/>

¹¹⁶ <http://blogs.seattletimes.com/opinionnw/2014/04/28/new-microsoft-data-center-in-iowa-offers-a-billion-dollar-lesson/>

¹¹⁷ <https://wiredre.com/data-center-tax-incentives-extended-in-washington-state/>



GAINS AND LOSSES

There are some obvious lessons to be learned from the experiences of Wyoming, Nebraska, Colorado, Utah, South Carolina, Virginia, North Carolina, Michigan, New York, New Mexico, Washington, Oregon and Iowa.

First, no state has a natural lock on attracting data centers. Only a few years ago, New York was the world's largest market for data centers. In 2015, Virginia took over that spot because the state and localities within it worked aggressively to attract data centers. The state of Washington would seem to be the obvious, natural choice for Microsoft's data centers because the company is headquartered in Washington. Yet, when Washington's data center tax incentives were allowed to lapse in 2011, data center growth was negatively impacted, as Microsoft and other firms, based on published reports, appear to have expanded data center presence in other states.

Second, it is a mistake to think that giving tax incentives to data centers that locate in a state represents a "loss" for the state. The reality is that you cannot lose something you would not otherwise have. As discussed earlier in the "Virginia's Deteriorating Business Climate" section in the Tax Foundation's 2015 "Location Matters" report, Virginia was ranked next to last among the states for its attractiveness to new capital-intensive manufacturers.

Like manufacturers, data centers are very capital-intensive. The reason why most states, including Virginia, provide sales tax exemptions on capital equipment purchases to manufacturers, and increasingly to data centers, is to avoid imposing an undue tax burden on them relative to other industries because of their capital-intensity.

Unlike manufacturers, data centers typically replace their capital equipment on an unusually short three-year cycle. That makes it much easier for them to avoid a deteriorating business climate by relocating to a more business friendly state. Which implies that any further exacerbation of Virginia's already significant competitive disadvantage in regard to taxes on capital equipment could have a disproportionately negative impact on the state's ability not only to attract data centers, but also to retain them.



CONCLUSION

Just as the industrial revolution of the late 18th century made the manufacturing sector the driving force for economic development at the time, the technological revolution of the late 20th century has made the technology sector the driving force for economic development in the modern economy. Data centers and fiber networks are the core infrastructure that supports that technology sector, and as a result, it is not an exaggeration to say that they constitute the backbone of the modern economy.

In this report we have quantified the economic and fiscal contributions that the Data Processing, Hosting, and Related Services industry, the formal industry classification that encompasses data centers, makes to Virginia. That analysis has shown, first and foremost, that the Data Processing, Hosting, and Related Services industry makes a large contribution to Virginia's economy. In 2016, this industry was responsible for directly and indirectly supporting approximately 43,275 jobs, \$3.2 billion in labor income, and \$10.2 billion in economic output in Virginia.

Moreover, although much of this impact is concentrated in Northern Virginia, it is increasingly spreading to other regions of the state. In addition, that regional expansion of economic activity will likely be accelerated by the newly constructed MAREA cable landing in Virginia Beach, the first subsea fiber-optic cable connection in the Mid-Atlantic, and the highest capacity subsea cable linking the U.S to Europe. As well as the soon to be completed BRUSA cable landing in Virginia Beach, which will be the first subsea fiber-optic cable connection between the Mid-Atlantic and South America. Both of which were credited in NxtVn's recently announced plans for a \$1.5 to \$2.0 billion data center park, and Globalinx Data Center's even more recently announced plan to construct up to 150,000 square feet of colocation data center space, in Virginia Beach in Hampton Roads; and Facebook's recent announcement that it will construct a \$1 billion data center in Henrico County in Central Virginia.

Our analysis has also shown that Data Processing, Hosting, and Related Services is a high-performance industry that pays wages that are more than twice the average private sector wage in Virginia, and that has experienced employment and wage growth over the last five years that is four-times the average across all private sector industries in Virginia. In addition, the Data Processing, Hosting, and Related Services industry is also a significant driver of investment, contributing \$2.6 billion in capital investment to Virginia in 2016, and an average of \$1.6 billion a year since 2009. In 2016 alone, this capital investment was responsible for supporting approximately 4,617 jobs, \$254.3 million in labor income, and \$670.0 million in economic output in Virginia's construction industry.

The Data Processing, Hosting, and Related Services industry also aids in attracting and developing the human capital that is the most critical component of a thriving technology industry ecosystem. Moreover, our analysis has shown that there is substantial spillover between the talent needs of the Data Processing, Hosting, and Related Services industry and a broad range of other fast growing, high wage industries such as Architecture and Engineering; Computer System Design; Management of Companies and Enterprises; Management, Scientific, and Technical Consulting; Scientific Research and Development; and Telecommunications – all of which draw from the same talent pipeline.

It also bears notice that in recent years, motivated in part by their substantial energy needs, the Data Processing, Hosting, and Related Services industry has emerged as one of the driving forces in energy efficiency and the development of renewable energy resources. As recently as 2015, renewable energy did not materially contribute to electricity generation in Virginia. However, as of today, Dominion Energy, Virginia's largest electricity producer, has more than 744-megawatts of solar generation capacity in Virginia that is either operational or under development and 580-megawatts of that capacity is directly attributable to partnerships with leading data center companies. To put that number in perspective, 580-megawatts of solar energy is enough to power 145,000 homes, or one-and-a-half times the total number of homes in the City of Richmond.

Importantly, our analysis has also shown that the Data Processing, Hosting, and Related Services industry strengthens local economies. Because the Data Processing, Hosting, and Related Services industry is very capital-intensive, it has a disproportionately positive impact on localities' largest source of tax revenue (property tax), while making minimal demands on local services. Using data from Loudoun County and Prince William County, we have shown that this combination provides these localities with a greater than 8-to-1 benefit to cost ratio, enables them to draw \$13.4 million a year less from the state general fund for school budgets, and reduces local property tax rates from what otherwise would be required to fund county operations.



Even more importantly, our analysis has shown that the Data Processing, Hosting, and Related Services industry promotes the evolution of Virginia's statewide economy. Where not so long ago Virginia generally out-performed the national economy, we now generally under-perform the national economy. Much of that decline can be traced to Virginia's over-dependence on an increasingly cash-strapped federal government (Virginia is ranked 1st among the states in Department of Defense expenditures) and a deteriorating business climate (the Tax Foundation recently ranked Virginia 49th among the states in our attractiveness to capital-intensive new manufacturing industries). As the backbone of the modern technology economy, the Data Processing, Hosting, and Related Services industry plays an important role in reversing these unfortunate trends by facilitating the growth and diversification of Virginia's private sector economy.

Finally, our analysis has shown that investment decisions in the Data Processing, Hosting, and Related Services Industry are increasingly sensitive to state tax regimes. In 2010, in response to the loss of a \$1 billion Apple data center to North Carolina, Virginia significantly expanded the state's existing 2008 data center sales and use tax exemption on computer equipment. This tax exemption is much like the sales and use tax exemption Virginia has extended to the similarly capital-intensive manufacturing sector for many years. In both cases, the sales and use tax exemption applies only to the purchase of capital equipment and does not affect the many other state and local taxes that these industries pay, such as the state corporate income tax or local property taxes. Also in both cases, the sales and use tax exemption serves to avoid imposing an undue tax burden on these industries relative to other industries because of their capital-intensity.

When Virginia enacted its first data center sales and use tax exemption in 2008, only five other states offered such incentives. Today, 30 states have incentives that are targeted at attracting data centers, and 12 of those incentives have been enacted or revised in the last three years. In 2015, Virginia overtook New York as the world's largest market for data centers because the state and its localities worked aggressively to attract this industry. If Virginia is to maintain its lead, and avoid the fate of Washington State which has seen billions of dollars in data center investment migrate to other states because of its off-again/on-again approach to data center incentives, it will need to maintain its competitive position in the data center market.



ADDENDUM: DATA SOURCES

In this report we have quantified the economic and fiscal contributions that the Data Processing, Hosting, and Related Services industry, the formal industry classification that encompasses data centers, makes to Virginia at a statewide level and regionally. To accomplish that task we have made use of third party, verified, statewide data sources. Principal among those are Quarterly Census of Employment and Wages data from the Virginia Employment Commission (VEC), and economic development announcement data from the Virginia Economic Development Partnership (VEDP). As is the case with all data, however, these data have their limitations.

Quarterly Census of Employment and Wages

The Quarterly Census of Employment and Wages (QCEW) is conducted by the VEC and other state employment agencies on behalf of the U.S. Bureau of Labor Statistics. Because it is a census, rather than a survey, the QCEW is by far the most comprehensive source for data on employment and wages by industry in the country.

QCEW data are restricted to private sector workers covered by state unemployment insurance laws, state and local government workers, and non-military federal government workers (with the exception of certain national security agencies). To ensure confidentiality, the public release of QCEW data is suppressed when such release might enable other parties to “reverse engineer” employment and wages in a specific business. Typically this occurs in smaller geographies where there are a limited number of businesses in an industry, or when employment within a geography and industry is dominated by a single large business. Importantly, data suppression can cause employment data for a specific industry to be under-reported in these circumstances.

QCEW data are organized according to North American Industry Classification System (NAICS) codes. The Data Processing, Hosting, and Related Services industry (NAICS code 518210) is the most narrowly defined industry classification within the NAICS taxonomy that encompasses data centers. As a result, in this report we use data from the Data Processing, Hosting, and Related Services industry to approximate employment and wages within the data center industry.

However, it is important to note that although the Data Processing, Hosting, and Related Services industry classification includes industries that would properly be considered data centers (e.g., Application Hosting, Automated Data Processing Services, Computer Data Storage Services, Data Processing Computer Services, etc.), it also includes a small number of industries that would not properly be considered data centers (e.g., Data Entry Services). This unavoidably introduces some noise into our analysis and may cause our estimate of data center employment to be biased upward in some instances.

Moreover, the degree of that upward bias will depend on the distribution of businesses in any given locality. For example, in a locality where there were a large number of Data Entry Services businesses relative to Computer Data Storage Services businesses, employment in the Data Processing, Hosting, and Related Services industry classification would be more likely to over-represent actual data center employment than in a locality where the reverse were true. As a case in point, it is likely that this anomaly at least partly explains why Loudoun County is ranked 1st in Figure 12 for cumulative VEDP investment announcements in Data Processing, Hosting, and Related Services and Fairfax County is ranked 7th, while in Figure 11 Fairfax County is ranked 1st for cumulative VEDP employment announcements in Data Processing, Hosting, and Related Services and Loudoun County is ranked 4th.

Economic Development Announcements

VEDP publicly provides data on economic development announcements for new facilities and expansions of existing facilities in Virginia. These data include the number of jobs and total capital investment announced, as well as the location of the new or expanding facility, and the NAICS code associated with the industry involved. The VEDP announcement database is the only publically available source for statewide data on economic development announcements in Virginia. For that reason, in this report we use data from the VEDP announcement database to approximate the geographic dispersion and size of new and expanding data center announcements across Virginia.

However, it is important to note that, unlike the QCEW data where businesses and localities are statutorily required to report data to VEC, there is no statutory obligation to report economic development announcements to VEDP. As a result, the VEDP database only contains information on announcements that VEDP is, or has been made, aware of. In addition, the VEDP announcement data do not provide location specifics for announcements that have been categorized as confidential and it is often the case that confidential announcements comprise a large proportion of total announcements. For example, the VEDP announcement database lists \$2.1 billion in announced new or expanding capital investments in the Data Processing, Hosting, and Related Services industry in Virginia in 2016, the reference year used in this report. Of that total, however, \$1.2 billion or 57 percent were classified as confidential and it is not possible to identify the locality in which those investments occurred.

In practice, this means that locality specific data on announcements of anticipated new employment or investment in the Data Processing, Hosting, and Related Services industry used in this report (see Figures 11 and 12) will generally be under-reported. As a result, those data should properly be viewed as a relative measure of anticipated new employment or investment across localities, rather than a specific measure of anticipated new employment or investment within localities.

To provide a more concrete example of why this is the case, according to data provided directly by county staff, in 2016 there were \$820.3 million in announced new capital investments in data centers in Loudoun County. However, VEDP announcement data for 2016 only show \$160.5 million in new capital investments in the Data Processing, Hosting, and Related Services industry in Loudoun County. The difference between these two figures is almost certainly explained within the \$1.2 billion in announced new capital investments in the Data Processing, Hosting, and Related Services industry that were classified as confidential in the VEDP announcements database that year and for which location specifics were not provided.

Finally, it is important to realize that announcements of new or expanding data centers are just that, announcements of new or expanding data centers. These data do not encompass existing employment or investments within this industry at the statewide level or within specific localities.



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