



North Dakota
Technology Champion
Barry Batcheller, Appareo
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STATE OF THE
TECHNOLOGY INDUSTRY
2019 GUIDE



The State of North Dakota's Technology Industry

Jeremy Neuharth, President,
Technology Council of North Dakota

Technology continues to be an economic driver for North Dakota as it impacts virtually all industries, from agriculture to health care and finance to energy, as well as stimulating job growth and innovation. The deck is stacked in our favor as North Dakota has seen numerous tech-related accomplishments over the past few years and is well-positioned to capitalize on several opportunities.

The state is led by Governor Doug Burgum, a former tech entrepreneur and businessman. Entrepreneurs, such as 2018 North Dakota Technology Champion Barry Batcheller, founder of Appareo, are locating here due to public and private sector commitment to technology infrastructure, education and business-friendly policies.

There have been two new data centers completed in 2018, significantly expanding data storage capacity in the state. North Dakota is known nationwide for its advancements in unmanned aerial vehicles.

And, North Dakota is a national leader in broadband connectivity with more than \$938 million invested in broadband infrastructure and the announcement that the state will be the first in the nation to achieve one-gigabit connectivity for all its school districts.

With this success comes one looming challenge – lack of workforce. To address this issue long-term, the Technology Council of North Dakota (TechND) has partnered with the North Dakota Department of Public Instruction, along with several other public and private entities, on the North Dakota Computer and Cyber Sciences Initiative (CCS). This initiative will make us the first state in the nation to provide technology and security fundamentals for all students by adopting K-12 computer and cyber science standards. The CCS Initiative will provide a foundation for students to acquire the base technology and security knowledge vital to the future workforce, no matter what career path is pursued.

In a cooperative effort to share the status of North Dakota technology industry, the Technology Council of North Dakota, along with its important sponsors, is pleased to present the *2019 State of the Technology Industry Guide*. It is an assessment of the state's technology industry in the areas of infrastructure, workforce, trends, competitiveness, and economic impact.

All industries have an incredible opportunity to leverage technology like never before. TechND will do its part by continuing to actively encourage the use, growth and development of technology in North Dakota. This will be accomplished by advocating for favorable policy, addressing workforce needs and championing the technology community. We welcome your participation. Feel free to contact me at jneuharth@sycorr.com or 701-540-4976 or Executive Director Deana Wiese at office@technd.org or 701-355-4458.

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Introduction

The technology industry in North Dakota plays an important role in the state's economy. In addition to the contribution of tech businesses, technology is vital to virtually every business, government, education, or nonprofit entity across the state, nation and world.

This biannual report showcases the impact of the state's technology sector and identifies opportunities and challenges within the industry. The data was collected by TechND in partnership with Job Service North Dakota and supplemented by the results of surveys of the TechND membership. The information throughout the report refers to the North Dakota American Industry Classification System (NAICS) and the Occupational Information Network (O*NET).

For the purpose of this report, the North Dakota technology sector includes businesses classified within NAICS 51 – Information and NAICS 54 – Professional, Scientific and Technical Services. References made to the North Dakota technology subsectors include NAICS 511 – Publishing Industries (except Internet); NAICS 517 – Telecommunications; NAICS 518 – Data Processing, Hosting and Related Services; NAICS 519 – Other Information Services; and NAICS 541 – Professional, Scientific and Technical Service (Table 1).

TechND, along with its sponsors, is pleased to present the 2019 edition of the *State of the Technology Industry Guide*, which provides a snapshot of North Dakota's tech industry, including the economic impact to the state; the status of the tech workforce and infrastructure; the competitiveness of the industry at the regional and national level; and the key industry trends.

[Table 1]

TECH INDUSTRY BREAKDOWN

North Dakota Technology Sector (NAICS)

- 51 – Information
- 54 – Professional, Scientific and Technical Services

North Dakota Technology Subsectors (NAICS)

- 511 – Publishing Industries (except Internet)
- 517 – Telecommunications
- 518 – Data Processing, Hosting and Related Services
- 519 – Other Information Services
- 541 – Professional, Scientific and Technical Services

North Dakota Technology Occupations (SOC)

- 11-3021 – Computer and Information Systems Managers
- 15-1122 – Information Security Analysts
- 15-1131 – Computer Programmers
- 15-1132 – Software Developers, Applications
- 15-1133 – Software Developers, Systems Software
- 15-1134 – Web Developers
- 15-1141 – Database Administrators
- 15-1142 – Network and Computer Systems Administrators
- 15-1143 – Computer Network Architects
- 15-1151 – Computer User Support Specialists
- 15-1152 – Computer Network Support Specialists
- 15-1199 – Computer Occupations, All Other
- 25-1021 – Computer Science Teachers, Postsecondary

Source: Job Service North Dakota

Executive Summary

North Dakota's economy is strong, and the state's technology industry is no exception. With job growth in North Dakota's technology subsector increasing by more than 11% over the past decade, the industry remains a growing and vibrant part of the state's economy. Opportunities for existing and start-up tech businesses are abundant, and North Dakota boasts one of the lowest unemployment rates in the country.

The state's technology subsectors employ 21,744 people at more than 3,500 businesses. These businesses contribute nearly **\$3 billion to the state's gross domestic product**. There are 7,880 North Dakotans with technology occupations. These include jobs in the technology industry, but also in other industries, such as agriculture, energy, finance, and health care.

The average annual wage for technology positions in North Dakota is \$61,900, which is **23% higher than the state average**. North Dakota wages for tech professionals still lag behind surrounding states and the nation, but the state is closing this gap as wages have increased at a greater rate than the national averages.

With the growth of the industry, workforce continues to be a challenge. North Dakota has seen an increase of more than 27% in technology occupations over the past decade and is projecting a 20% increase for the next 10 years. Between 2016 and 2026, it is estimated more than **6,500 new and replacement technology positions** will be needed in North Dakota. Growth in the industry will create the need for more than 1,300 employees to fill new positions, and the remaining positions will be replacements. With the state's technology industry currently employing 7,880 North Dakotans, this projected growth means replacement and new positions will equal 82% of the state's current technology workforce.

In an effort to address this issue, industry, government and education stakeholders are collaborating to inform students about the technology career opportunities and potential education pathways to secure these positions. North Dakota currently offers internship opportunities, more than 60 post-secondary education programs and a loan forgiveness program. TechND is also partnering with the North Dakota Department of Public Instruction and other state agencies on the **Computer and Cyber Sciences Education Initiative** to provide technology and security fundamentals for all North Dakota students by adopting K-12 computer and cyber science standards.

The ever-changing environment of the technology industry creates ongoing opportunities and challenges. Tech leaders statewide identified **hybrid cloud services, mobility and security** as the trends that most impact North Dakota's technology industry. The state is well positioned to take advantage of the opportunities and address the challenges presented by these emerging trends due to the cooperation among North Dakota's industry, government and education entities.

Technology continues to play a vital role in North Dakota's economy, and the future of the industry is bright. As the industry continues to evolve, collaboration at the state and federal level will allow North Dakota's tech industry to remain a strong competitor in the global economy.

North Dakota Technology Champion

Barry Batcheller, Appareo

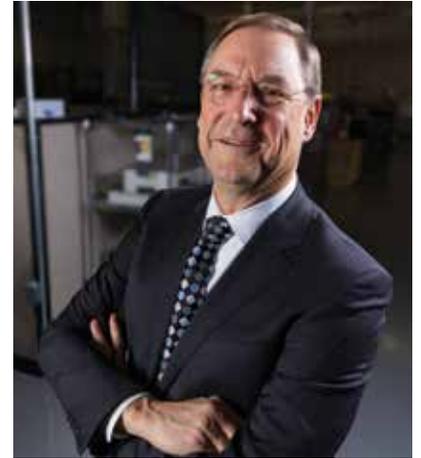
North Dakota's positive business climate has led to numerous entrepreneurial success stories. TechND honored Barry Batcheller, one of the state's premier entrepreneurs, with its 2018 North Dakota Technology Champion award.

Over the past 40 years, Barry has been involved in the startup of six successful companies, including Appareo, and also served as director of technology growth at Deere & Co. He holds more than 20 U.S. and foreign patents on control systems, instrumentation systems and embedded mobile electronic devices and has authored numerous technical papers on the use of electronics in agriculture. His impact on the state's technology industry has been significant and will continue well into the future. We visited with Barry to learn more about how it all started and what the future holds at Appareo.

Why did you decide to start Appareo in North Dakota?

I came to North Dakota from New York to study aerospace engineering and electrical engineering at North Dakota State University (NDSU). At the time, NDSU was one of the only universities in the nation that allowed a double major in those two areas. I met my wife, Julien, whose family farms near Ada, Minn. This is what ultimately made North Dakota our home. Back in 1999, I worked with NDSU President Joe Chapman to start the NDSU Research and Technology Park. I saw great potential in the area, specifically the opportunity for private and public partnerships, with good proximity to raw material (i.e., engineering students).

Appareo's value isn't measured in terms of acquisition value; rather, the business itself is the value. Other companies are started as a means to personal wealth. For me, the art of building the business was the ultimate



reward. Appareo was intended to be a legacy company. Creating high-paying jobs for our state, making an impact on the community – those are the things that my family and I take great pride in.

Tell us about Appareo's history and impact on the state.

Starting with two employees in a closet-sized office in the NDSU Research and Technology Park, Appareo quickly expanded through several different spaces, including the Park's Technology Incubator. The business's close connections with NDSU have always been an important part of its success,



providing the company with a steady stream of talented engineers. In fact, more than half of our engineers are graduates of NDSU. Appareo also works closely with the flight school at the University of North Dakota and employs a number of their graduates in engineering and business development.

Appareo has continued a trajectory of rapid growth, averaging a compounded annual growth rate of 45% since 2005. Once the company reached an employee count of 50 people in 2009, we built the Genesis building in the Park. To better accommodate the growing list of global customers, we opened Appareo offices in Tempe, Ariz., and Paris, France. Then in 2013, we expanded the Fargo manufacturing facility to accommodate a second SMT production line, quickly outgrew it and purchased the adjacent manufacturing facility in 2014. The new building, Horizon, more than doubled our existing headquarters and manufacturing space. Appareo surpassed the 200-employee mark in 2016, and we currently employ 220.

What does the future hold for Appareo?

While scientists are the ones who discover new technologies, engineers are the ones who put those technologies to work to improve lives and society. At Appareo, the engineers have learned how to learn. Even with me stepping back, they're equipped to grow. The role of CEO has been passed on to David, my son, and there's no indication that Appareo is slowing down. In all the things in my life, working with Dave on a daily basis has been by far the most enjoyable thing I have ever done. I believe what was started here is the very beginning of this journey. I think these folks are building one of America's great businesses.



North Dakota CONNECTED

North Dakotans rely on broadband access, speed and affordability for business and personal needs, and the demand is increasing at a record pace. North Dakota's telecommunications companies have stepped up to the challenge, making the state a leader in connectivity.

Broadband Investment and Gigabit Internet Access

There has been more than \$938 million invested in North Dakota broadband infrastructure over the past five years. These private- and public-sector investments brought gigabit Internet access to 75% of North Dakotans in more than 325 communities, both urban and rural. It has also provided access to state-of-the-art broadband for businesses, state agencies, higher education institutions, K-12 school districts and the medical community.

Dakota Carrier Network (DCN) and its 15 member-owner companies have installed more than 40,000 miles of fiber optic cable throughout the state since 1996, reaching every community in North Dakota and providing gigabit Internet to nearly 300 communities. In 2018, DCN and the North Dakota Information Technology Department (ITD) announced plans to deliver 1-gigabit connectivity for state and local governments, K-12 schools and higher ed institutions through ITD's network, STAGENET. North Dakota will be the first state to achieve 1-gigabit connectivity for all its school districts. "DCN and its member companies have been keeping North Dakota's public schools connected since 2000, and we know that reliable, fast broadband connectivity is key to keeping our kids competitive in our increasingly digital world," says Seth Arndorfer, DCN CEO. "We're proud to take this next step in increasing the speed of connectivity for students across the state, as well as in our local and state government offices."

\$938 million in broadband investments over the past five years

In addition, over the past several years, Midco has significantly expanded its footprint across the state. "Midco has extended gigabit service to 50 communities throughout North Dakota," says Steve Grosser, Midco CFO. "We offer gigabit services to more than 90% of the customers we serve throughout the state."

CenturyLink has invested more than \$80 million and 702 Communications more than \$15 million in their North Dakota networks since 2012. "We are committed to providing broadband services to residents and businesses in communities throughout North Dakota," says Julie Darrington, CenturyLink vice president of operations for North Dakota, South Dakota, Nebraska, and southwest Iowa. The company recognizes the importance of broadband in creating a foundation for a strong community, attracting new businesses and driving economic growth. "702 Communications' continued investment in infrastructure ensures that we'll continually make available world-class Internet services while ensuring healthy competition in our markets," says Brian Crommett, 702 Communications sales and service manager.

Since 2009, the U.S. Department of Agriculture (USDA) has invested more than \$330 million in North Dakota telecommunications and broadband projects. This has included grants and loans to local Internet service providers to assist in the build-out of infrastructure to provide better service to their customers. USDA recognizes the economic development, educational, health care, social, and public safety benefits of well-connected states.

Not only do North Dakota citizens have accessibility to gigabit Internet, which is 35 times faster than the average high-speed internet, it is affordable. The rapid expansion in availability has positively impacted the consumer's

pocketbook. Gigabit Internet is available for as little as \$99 per month in many areas across the state, both to homes and businesses.

There is no question access to fast, reliable and affordable broadband provides North Dakota with a competitive edge. Benefits of this connectivity include the ability for businesses to compete globally, schools to provide distance learning opportunities, remote health care consultations to occur and personal connections to be enhanced.

75 percent of North Dakotans have gigabit Internet access

Dakota Fiber Initiative – Driver for Change

What is the driver for the rapid roll-out of gigabit Internet services? The answer is the Dakota Fiber Initiative (DFI), which was championed by the Technology Council of North Dakota (TechND) beginning in 2013. The objective of the Dakota Fiber Initiative was to *“provide affordable, world-class internet speed and reliability to every individual in the state of North Dakota.”* DFI was rolled out during the 2013 State of Technology event, hosted by U.S. Senator Hoeven and the Fargo Moorhead West Fargo Chamber, when now-Governor Doug Burgum shared his vision for North Dakota to have the highest speed and greatest bandwidth internet infrastructure in the world by 2015 through partnerships with the public and private sector.

TechND championed the initiative given its infrastructure development goal of working for affordable access to state-of-the-art voice, video and data service for all North Dakotans. In addition, it was the statewide entity representing both the supply and demand side of the broadband issue. TechND, in cooperation with private- and public-sector stakeholders, launched the Dakota Fiber Initiative in October 2013 to ensure the state remains at the top of the nation in broadband availability, speed and affordability. At the onset, TechND was aware North Dakota had significant bandwidth coverage across the state. However, initial discussions pointed to the issues of inadequate speed, affordability of adequate speed and assurance that capacity can meet future demands. As a result of the initiative, the state’s telecommunications providers rose to the DFI challenge and have done an outstanding job in providing fast, reliable and affordable broadband to North Dakota’s citizens and businesses.

What Is Next

North Dakota’s data center infrastructure has expanded significantly as well. Both DCN and Midco have constructed Tier III data centers in Fargo. These projects had a combined investment of \$17 million and were both completed in 2018.

This is DCN’s second data center expansion project in two years and its fourth in the past 11 years. “Every DCN facility is built in a hardened bunker format with redundant cooling and electrical systems, which protect the buildings against F4 tornadoes with winds up to 200 mph and power outages, effectively ensuring the data centers will never be offline,” says DCN CEO Seth Arndorfer. “To qualify as a Tier III building, the Fargo data center also includes two independent power feeds and two generators.”

The Fargo Data Center is Midco’s third center, and its largest and most significant. The 16,000-square-foot facility (expandable to 28,000 square feet) provides enhanced reliability with its superior facility design, while reinforcing Midco’s dedication to customers’ needs. “The Fargo data center is a cost-effective way for businesses to secure critical data and their IT infrastructure,” says Midco CFO Steve Grosser.

Over the past five years, the state’s telecommunication providers have ensured North Dakota’s broadband infrastructure has expanded at a feverish pace to meet the demand of businesses and citizens. This has provided North Dakota with a competitive advantage in the way we live, work and play.

Economic Impact

The diversity of the state's technology industry contributes significantly to the overall growth and economic strength of North Dakota. More than 3,500 businesses within the tech subsectors employ 21,744 North Dakotans in various fields including technology, human relations, finance, and marketing.

The tech industry generates tax revenue for both local and state governments, and agriculture, health care, energy, manufacturing, and financial services are all impacted by technology, which plays a key role in enhancing the productivity and growth of these and many other industries.

The impact of technology on the state is outlined in three critical elements:

- Tech businesses are knowledge-based and create a significant number of high-paying jobs.
- The tech industry is categorized as a primary sector, meaning it brings outside dollars into the state.
- Tech industries on average generate higher-added value per worker than non-tech industries.

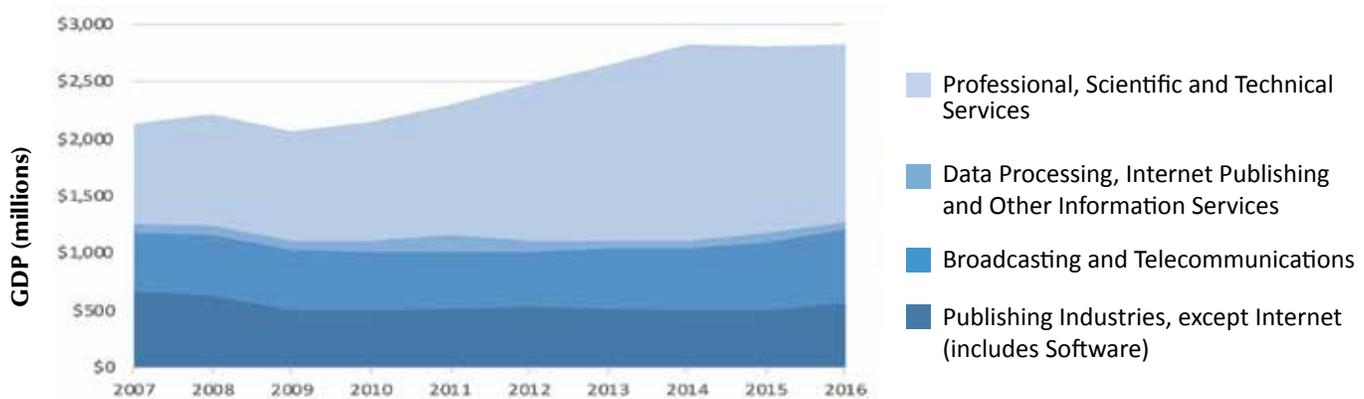
Gross Domestic Product Contributions

Gross domestic product (GDP) is defined as the total market value of all goods and services produced within a state and is on the measures of income and output for the state's economy. It is considered the sum of the value added at every state of production.

Over the past decade, the contribution of the technology subsectors to the state's GDP grew 89%. The tech subsectors are responsible for 6% of the state's 2016 total GDP of \$52.09 billion, with contributions of nearly \$3 billion.

[Figure 1]

GDP: TECH SUBSECTORS (2007-2016)



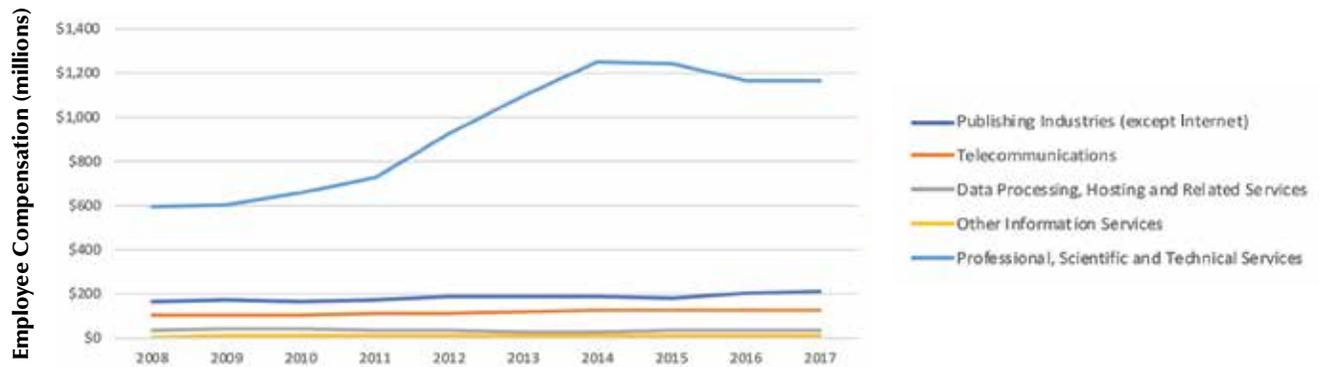
Source: U.S. Bureau of Economic Analysis, U.S. Department of Commerce

Pay Contributed to the Economy

In 2017, the 21,744 jobs in the technology subsectors contributed to the state's economy through nearly \$1.2 billion in total employee compensation. This has nearly doubled over the past decade (Figure 2).

EMPLOYEE COMPENSATION CONTRIBUTED TO THE ECONOMY (2008-2017)

[Figure 2]



Source: Job Service North Dakota, Quarterly Census of Employment and Wages

The average pay for those employed in the technology subsector has increased 42% over the past decade (Table 2). In 2017, the average annual wage for tech occupations was \$61,900, which is 23% higher than the average annual wage for all occupations (\$50,313).

[Table 2]

AVERAGE PAY (2008-2017)

NAICS	Subsectors	2008	2017	% Increase
511	Publishing Industries (except Internet)	\$54,321	\$80,877	49%
517	Telecommunications	\$55,460	\$70,725	28%
518	Data Processing, Hosting and Related Services	\$38,253	\$56,790	48%
519	Other Information Services	\$26,288	\$30,959	18%
541	Professional, Scientific and Technical Services	\$43,658	\$70,151	61%

Source: Job Service North Dakota, Quarterly Census of Employment and Wages

Economic Impact

Technology Subsector Job Growth

On average, employment in the state's and nation's tech subsectors has continued to experience growth. North Dakota's growth was on par with that of the nation with an 11% increase in employment in North Dakota's tech subsectors from 2008 to 2017 and a 10% increase in the nation's tech subsector employment (Table 3). North Dakota's growth was in the professional, scientific and technical service subsector while the remaining subsectors declined.

[Table 3]

TECH SUBSECTOR JOB GROWTH (2008-2017)

NAICS	Subsector	2008 ND	2017 ND	2008 US	2017 US	ND % change	US % change
511	Publishing Industries (except Internet)	2,938	2,598	876,983	722,719	-13%	-21%
517	Telecommunications	1,887	1,759	1,019,147	777,554	-7%	-31%
518	Data Processing, Hosting and Related Services	857	572	260,562	314,116	-50%	17%
519	Other Information Services	193	187	135,535	284,050	-3%	52%
541	Professional, Scientific and Technical Services	13,631	16,628	7,816,999	8,987,648	18%	13%
	Total	19,506	21,744	10,109,226	11,086,087	11%	10%

Source: Job Service North Dakota, Quarterly Census of Employment and Wages



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Status of the Workforce

North Dakota has one of the top economies in the nation thanks to numerous successful industries, including technology. The state offers many opportunities for business start-ups and expansions and consistently boasts one of the lowest unemployment rates in the country. Through the cooperative efforts of industry, government and education, potential in- and out-of-state employees are also kept well-informed of the great jobs that exist in North Dakota's tech industry.

North Dakota's five technology subsectors employ 21,744 individuals, and these subsectors include the state's tech businesses. There are 7,880 North Dakotans with technology occupations (Table 4). Some are employed by technology companies, but many are employed in other industries, including agriculture, energy, finance, and health care.

[Table 4]

NORTH DAKOTANS WITH TECH OCCUPATIONS (2017)

SOC	Occupation	Number of Employees
11-3021	Computer and Information Systems Managers	500
15-1121	Computer Systems Analysts	670
15-1122	Information Security Analysts	180
15-1131	Computer Programmers	670
15-1132	Software Developers, Applications	950
15-1133	Software Developers, Systems Software	590
15-1134	Web Developers	260
15-1141	Database Administrators	150
15-1142	Network and Computer Systems Administrators	620
15-1143	Computer Network Architects	180
15-1151	Computer User Support Specialists	1,550
15-1152	Computer Network Support Specialists	620
15-1199	Computer Occupations, All Other	810
25-1021	Computer Science Teachers, Postsecondary	130
	Total	7,880

Source: Occupation Employment Statistics, Job Service North Dakota

[Table 5]

CHANGE IN TECH OCCUPATIONS (2008-2017)

SOC	Occupation	2008 Employment	2017 Employment	Number Change	% Change
11-3021	Computer and Information Systems Managers	460	500	40	8%
15-1121	Computer Systems Analysts	860	670	-190	-28%
15-1131	Computer Programmers	580	670	90	13%
15-1132	Software Developers, Applications	630	950	320	34%
15-1133	Software Developers, Systems Software	190	590	400	68%
15-1142	Network and Computer Systems Administrators*	460	620	160	26%
15-1143	Computer Network Architects	240	180	-60	-33%
15-1151	Computer User Support Specialists	1,540	1,550	10	1%
15-1199	Computer Occupations, All Other	160	810	650	80%
25-1021	Computer Science Teachers, Postsecondary	120	130	10	8%

Source: Job Service North Dakota

Technology Occupations

The number of North Dakotans holding technology occupations totals more than 7,880, and the number of jobs grew by 15% between 2008 and 2017. The growth, both in number and percent, was shown in the occupations of computer occupations, all other; software developers, systems software; and software developers, applications. (Table 5).

Employee Concentration

The number of employees in North Dakota's technology subsectors totals 21,744, and the largest concentration of workers is found in the following counties: Cass (8,783), Burleigh (3,542), Grand Forks (1,779), Ward (932), and Williams (892).

Projected Technology Workforce Needs

Over the next 10 years, North Dakota is estimated to need more than 6,500 new and replacement technology positions. Growth in the industry will create the need for 1,340 employees to fill new positions. The remaining positions will be replacements.

The state's technology industry currently employs 7,880 North Dakotans, and this projected growth means replacement combined with new positions will equal 82% of the state's current technology workforce. Computer science teachers, post secondary is the technology occupation with the highest percentage of projected growth (30%). Information security analysts (3.5%) and software developers, applications (2.9%) are the technology occupations with the second and third highest percentage of projected growth.

Through 2026, the three technology occupations projected to have the largest number of openings include computer user support specialists with 1,397 openings; software developer, applications with 1,324 projected openings; and network and computer systems administrators with 573 openings (Table 6).

[Table 6]

PROJECTED TECH WORKFORCE NEEDS (2016-2026)

SOC	Occupation	% Growth	# of Openings	Annual Average Wage	Growth Openings	Replacement Openings
11-3021	Computer and Information Systems Managers	1.5%	511	\$119,770	89	422
15-1121	Computer Systems Analysts	1.2%	544	\$72,470	86	458
15-1122	Information Security Analysts	3.5%	259	\$76,070	88	171
15-1131	Computer Programmers	-0.1%	367	\$67,080	0	367
15-1132	Software Developers, Applications	2.9%	1,324	\$74,310	410	914
15-1133	Software Developers, Systems Software	1.4%	475	\$67,500	85	390
15-1134	Web Developers	1.8%	230	\$61,090	46	184
15-1141	Database Administrators	1.8%	153	\$75,710	34	119
15-1142	Network and Computer Systems Administrators	1.5%	573	\$67,750	113	460
15-1143	Computer Network Architects	2.1%	175	\$87,100	43	132
15-1151	Computer User Support Specialists	1.5%	1,397	\$54,660	239	1158
15-1152	Computer Network Support Specialists	1.5%	454	\$59,220	76	378
25-1021	Computer Science Teachers, Postsecondary	30.0%	87	\$90,460	3	84
	Total				1,312	5,237

Source: Job Service North Dakota

North Dakota a Leader in Technology Education

TechND partners on the North Dakota Computer and Cyber Science Education Initiative

The Technology Council of North Dakota (TechND) is a partner in the North Dakota Computer and Cyber Science Education Initiative (CCS Initiative), which is being led by the North Dakota Department of Public Instruction (DPI). TechND supports DPI's efforts to be first state in the nation to provide technology and security fundamentals for all North Dakota students by adopting K-12 computer and cyber science standards.

A group of stakeholders recognized the significant demand and need for students to learn how to effectively and safely leverage technology and developed the CCS Initiative. The stakeholders include DPI, TechND, Governor's Office, Department of Career and Technical Education (CTE), Education Standards and Practices Board (ESPB), University System (NDUS), and key legislative leaders.

Why is it Needed?

Technology drives job growth and innovation throughout our economy and society. Computing occupations are the number one source of all new wages in the United States and make up more than half of all projected new jobs in STEM fields. In addition to computing jobs, technology impacts virtually every occupation. Foundational technology and security knowledge is not just an opportunity for students, it is vital for any career field. However, to date, it has not been an educational focus. Fewer than half of U.S. schools offer any computer science courses and only 8% of STEM graduates study it.

According to Code.org:

58% of new STEM jobs are in computing

8% of STEM graduates are in computer science

93% of parents want their child's school to teach computer science, but only 40% of schools teach it

67% of parents and 56% of teachers believe students should be required to learn computer science

50% of Americans rank computer science as one of the two most important subjects after reading and math

North Dakota currently has 935 open computing jobs, which is 3.3 times the average demand rate. The average salary for a North Dakota computing occupation is \$70,000, which is 49% higher than the state's average salary. The existing open jobs alone represent a \$65.7 million opportunity in terms of annual salaries. Yet, North Dakota had only 117 computer science graduates in 2015, 96 AP Computer Science exams taken by high school students in 2017 and 10 schools that offered an AP Computer Science course in 2016-2017.

The CCS Initiative will provide a foundation within K-12 for students to acquire the base technology and security knowledge vital for the future workforce, no matter what career path is pursued. It is essential students are taught to leverage technology safely and effectively as it will impact any chosen occupation.

Measuring Up

North Dakota's technology employees receive wages that are competitive with several surrounding states, including South Dakota and Montana. However, North Dakota's average median hourly wage for tech-related occupations lags behind Minnesota and the national average (Table 7). The state's wages for technology occupations are increasing at a slightly higher rate than that of the nation (Table 8).

[Table 7]

MEDIAN HOURLY WAGES (2017)

SOC	Occupation	Median Hourly Wage (\$)				
		ND	SD	MT	MN	Nation
11-3021	Computer and Information Systems Managers	\$53.66	\$56.74	\$46.31	\$60.30	\$66.93
15-1121	Computer Systems Analysts	\$32.27	\$33.16	\$30.93	\$42.43	\$42.44
15-1122	Information Security Analysts	\$37.12	\$41.20	\$27.79	\$42.64	\$45.92
15-1131	Computer Programmers	\$29.38	\$24.07	\$29.06	\$37.41	\$39.54
15-1132	Software Developers, Applications	\$35.05	\$36.21	\$34.70	\$43.48	\$48.94
15-1133	Software Developers, Systems Software	\$29.64	\$39.51	\$35.86	\$50.43	\$51.73
15-1134	Web Developers	\$28.80	\$25.74	\$22.92	\$30.35	\$32.69
15-1141	Database Administrators	\$32.41	\$33.92	\$27.43	\$43.96	\$41.84
15-1142	Network and Computer Systems Administrators	\$30.67	\$28.67	\$28.20	\$38.21	\$38.99
15-1143	Computer Network Architects	\$43.15	\$40.53	\$30.21	\$49.09	\$50.31
15-1151	Computer User Support Specialists	\$23.73	\$17.67	\$19.80	\$24.37	\$24.14
15-1152	Computer Network Support Specialists	\$27.70	\$22.73	\$25.82	\$29.36	\$29.97
15-1199	Computer Occupations, All Other	\$33.64	\$36.86	\$32.80	\$35.68	\$42.56
	Total	\$33.63	\$34.74	\$31.37	\$41.82	\$42.77

Source: U.S. Bureau of Labor Statistics

[Table 8]

MEDIAN HOURLY WAGE CHANGES (2008-2017)

SOC	Occupation	U.S. % Change	ND % Change
11-3021	Computer and Information Systems Managers	19.4%	31.6%
15-1131	Computer Programmers	15.4%	25.0%
15-1132	Software Developers, Applications	16.1%	21.3%
15-1133	Software Developers, Systems Software	14.1%	-35.8%
15-1141	Database Administrators	19.9%	12.5%
15-1142	Network and Computer Systems Administrators	18.2%	25.6%
15-1143	Computer Network Architects	32.1%	41.0%
15-1151	Computer User Support Specialists	13.5%	39.4%
15-1199	Computer Occupations, All Other	15.1%	13.4%

Source: Occupational Employment Statistics, Job Service North Dakota

Measuring Up

Regional Competitive Growth

The regional competitive effect explains how much of the growth change is due to some unique competitive advantage the region possesses because the growth cannot be explained by national trends in that industry or the economy as a whole. Typically, according to Job Service North Dakota, the nation as a whole will outperform an individual state. However, over the past decade, North Dakota has outperformed the nation in the occupations of computer programmers, software developers (systems software) and network systems and data communications analysts. This indicates these occupations are thriving at an exceptional rate due to an advantage the state has in comparison to the rest of the nation (Table 9).

[Table 9]

REGIONAL COMPETITIVE GROWTH (2008-2017)

SOC	Occupation	National Growth	ND Growth	Regional Competitive Growth
11-3021	Computer and Information Systems Managers	88,870	40	-88,830
15-1121	Computer Systems Analysts	187,730	90	-187,640
15-1131	Computer Programmers	-246,470	40	246,510
15-1132	Software Developers, Applications	467,400	760	-466,640
15-1133	Software Developers, Systems Software	-95,300	-270	95,030
15-1142	Network and Computer Systems Administrators	47,190	160	-47,030
15-1143	Computer Network Architects	-72,580	-60	72,520
15-1199	Computer Occupations, All Other	124,050	650	-123,400
25-1021	Computer Science Teachers, Postsecondary	-290	10	300

Source: Job Service North Dakota

Location Quotient

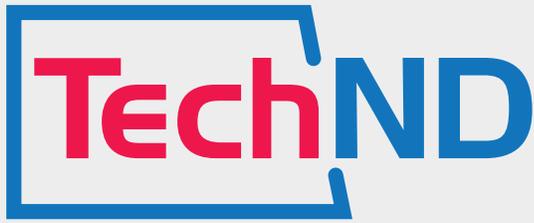
Location Quotient (LQ) compares an area's business composition to that of a larger area (Table 10). For the purpose of this document, the technology occupations at the state and national level are compared. If an LQ is greater than one (1), it indicates the state has proportionally more workers than the nation employed in that occupation. This indicates an opportunity for the state to attract additional technology professionals to meet workforce demand.

[Table 10]

TECH OCCUPATION LQ (2008-2017)

SOC	Occupation	LQ 2008	LQ 2017
11-3021	Computer and Information Systems Managers	0.71	0.47
15-1121	Computer Systems Analysts	0.50	0.39
15-1131	Computer Programmers	0.61	0.93
15-1132	Software Developers, Applications	0.16	0.38
15-1133	Software Developers, Systems Software	1.01	0.51
15-1142	Network and Computer Systems Administrators	0.61	0.57
15-1143	Computer Network Architects	0.45	0.39
15-1151	Computer User Support Specialists	1.16	0.86
15-1199	Computer Occupations, All Other	0.34	0.88
25-1021	Computer Science Teachers, Postsecondary	1.26	1.38

Source: Occupational Employment Statistics, Job Service North Dakota



North Dakota Technology Award Winners

2017

Premier IT Business
High Point Networks, West Fargo

Technology Innovator
Midco

North Dakota IT Champion
Garrett Moon and Justin Walsh,
Coschedule

2018

Premier Technology Business
True IT, West Fargo

Technology Innovator
Xcel Energy

**North Dakota
Technology Champion**
Barry Batcheller, Appareo

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- #1 Housing Growth per Capita**
(U.S. Census, 2017) 4th consecutive year
- #1 Growth Performer States Since 2000**
(U.S. Chamber, 2015)
- #1 Best States for Young Adults**
(Moneyrates.com, 2017)
- #1 Best States for Entrepreneurship**
(University of Nebraska, 2014)
- #1 Best States for Millennials**
(Moneyrates.com, 2017) 2nd consecutive year
- #2 Oil Producing State**
(ND Mineral Resource Division, 2017)
- #2 In State Competitiveness**
(Beacon Hill Institute, 2017)
- #4 Economic Competitiveness**
(American Legislative Council, 2017)
- #6 Pro-Business State**
(Pollina Corporate RE, 2015)
- #9 Best States for Business**
(Forbes Magazine, 2017)

BUSINESS FRIENDLY

- #1 Entrepreneurs in the Nation**
(University of Nebraska)
- #1 Entrepreneurship Environment**
(Kauffman Index)
- #1 Best Environment for Start-up Survival**
(Kauffman Index)

STRONG ECONOMY

- #1 Growth Performer State Since 2000**
(U.S. Chamber)
- #2 In State Competitiveness**
(Beacon Hill Institute)

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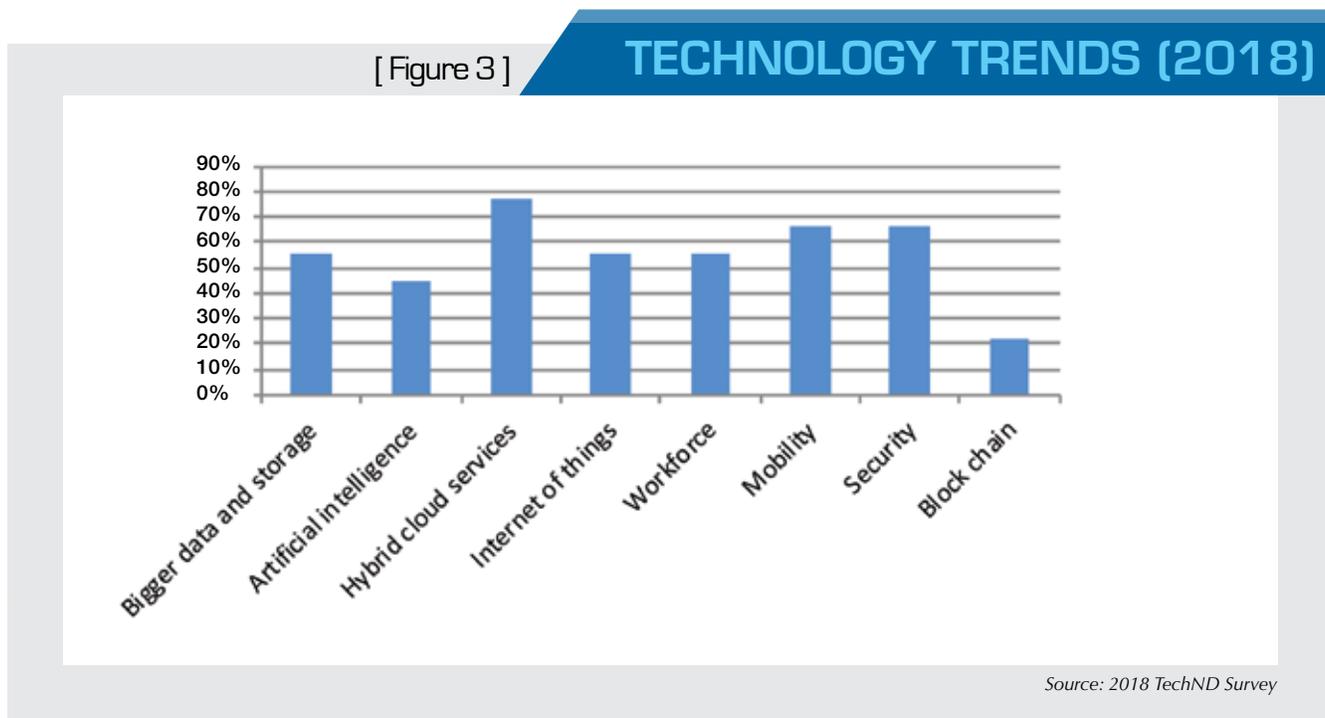
- #1 Quality of Life**
(U.S. News & World Reports)
- #1 State for Millennials**
(University of Nebraska)
- #1 Best States for Young Adults**
(Moneyrates.com)
- 4th Youngest State in the Nation**
(U.S. Census Bureau North Dakota)

Emerging Trends

The diversity of the technology industry means it impacts virtually every business – from the service industry and trucking companies to manufacturing specialists and health care professionals and from large companies to small sole proprietor businesses. New technologies and applications, as well as North Dakota’s strong economy, have the potential to create opportunities, along with challenges, for North Dakota’s technology industry.

Hybrid Cloud Services

In a survey conducted by TechND, North Dakota technology leaders within in the state identified hybrid cloud services as the top trend impacting their business or organization. Survey respondents also identified mobility and security as state and national trends impacting or having the most potential to impact their business (Figure 3).



Building the Workforce

Educational Opportunities

Computer and Cyber Sciences Education Initiative

TechND has partnered with the North Dakota Department of Public Instruction and other public-and private-sector partners on the North Dakota Computer and Cyber Sciences Education Initiative. The objective of the initiative is to be the first state in the nation to provide technology and security fundamentals for all North Dakota students by adopting K-12 computer and cyber science standards. TechND's role is to provide the industry voice, outreach on workforce needs and leadership on required policy changes.

Secondary Technology Education

The mission of North Dakota Career and Technical Education (CTE) is to work with others to provide all North Dakota citizens with the technical skills, knowledge and attitudes necessary for successful performance in a globally competitive workplace. Information technology (IT) education prepares students for future employment and/or continuing education opportunities in the growing field of IT, which includes jobs in networking services, hardware/software services, web/digital communications, computer programming and cybersecurity in face-to-face, hybrid or online class settings. High school and post-secondary students can earn industry recognized certifications during their school training. During the 2017-18 school year, IT courses were offered in 64 schools serving 1,827 students.

North Dakota is engaged in a focused effort to increase computer science and cybersecurity courses throughout North Dakota. As part of the North Dakota Computer and Cyber Sciences Education initiative, North Dakota Department of Public Instruction and teachers throughout the state are creating K-12 standards for both computer science and cybersecurity education.

In addition to standards and increased teacher trainings and new programs starting throughout the state, K-12 and CTE, along with higher education, industry, North Dakota Department of Commerce, North Dakota Information Technology Department, and North Dakota Educational Technology Council, have partnered to form the K-20W task force to determine a comprehensive plan around cybersecurity education and training. For more information, visit www.nd.gov/cte.

Post Secondary Technology Education

To help fill the demand for technology professionals in the state, more than 60 IT-related certificate and degree programs are offered at North Dakota's 11 public, three private and five tribal colleges and universities. In 2016-2017, more than 458 college students graduated with IT-related degrees from the North Dakota University System, which includes the 11 public colleges and universities. This is a 20% increase from a decade ago. For more information, visit www.ndus.edu.

STEM Occupations Student Loan Forgiveness Program

Recognizing the need for high-quality employees in the areas of science, technology, engineering and mathematics (STEM), the state established the STEM Occupations Student Loan Program. The intent of the program is to reduce student loan indebtedness for individuals who have graduated in a STEM-related field and have been employed in a STEM occupation in North Dakota for one year. Eligible recipients must have an income of \$60,000 or less to be considered. Funded individuals are eligible for up to \$6,000 lifetime maximum. Individuals must reapply annually for new or continued funding. Qualifications and additional information are available at www.ndus.edu.

Building the Workforce

Operation Intern

Operation Intern provides a valuable way for students to make connections with businesses and identify career options in North Dakota. The program's primary focus is employers in the state's targeted industries of energy, advanced manufacturing, value-added agriculture, tourism and technology-based businesses. Priority is given to new startups, companies who have never participated in the program, and new internship or apprenticeship positions. The maximum amount of funds an employer can receive is \$15,000 per funding round or \$30,000 per biennium. Employers are limited to a maximum of five interns each funding round with two funding rounds per biennium. Additional information is available at www.operationintern.com.

Workforce Training Programs

Job Service North Dakota • www.jobsnd.com

New Jobs Training offers incentives to primary sector businesses creating new employment opportunities through business expansion and relocation to the state by providing no-cost funding to help offset the cost of training new employees. The business must be in a primary sector industry and may obtain funds in the form of a loan, a repayable grant or a self-financing option. The loan or grant, plus interest, is repaid through state income tax withholding generated from the new jobs created and can be captured for up to 10 years or until the loan or self-financing option is repaid. Of the companies setting up new agreements under New Jobs Training in 2016 and 2017, 25% were IT-based. The use of the program by new and expanding IT companies remains steady.

Workforce Innovation and Opportunity Act (WIOA) provides funding for on-the-job training, youth employment and training, and adults and dislocated worker assistance. Funding is available for a maximum of three years of training. In program year 2017, the WIOA provided 14 individuals with training opportunities in IT-related careers.

North Dakota Department of Commerce • www.ndcommerce.com

Workforce Enhancement Grant Program provides funding for a demand driven response to workforce training needs through development of curriculum, purchase of equipment and technology, recruitment of participants, and training and certification for instructors. The funding may not be used to supplant funding for current operations. Eligible institutions include Bismarck State College, Lake Region State College, North Dakota State College of Science and Williston State College. More information about the program can be found at www.workforce.nd.gov/workforce/workforceenhancementgrants/.

North Dakota University System • www.ndus.edu

TrainND offers customized training on a wide variety of topics ranging from computer applications and health care to organizational soft skills and technical trades. In fiscal year 2017, a total of 843 businesses were served by the program with 10,917 employees participating in training activities. TrainND has a loyal business base, with 61% of businesses served in 2017 indicating a need for repeat or additional training. Satisfaction rates associated with training events and the responsiveness of TrainND to meet industry needs are consistently at 99% across the four service regions in the state.

Expanding & Attracting Business

North Dakota Department of Commerce

www.ndcommerce.com

Research ND helps entrepreneurs develop and commercialize products and processes through industry and university research partnerships. Entrepreneurs submit a joint proposal with a private sector partner and a researcher from one of the two research universities: North Dakota State University or University of North Dakota. The proposal includes expectations on business and job creation in North Dakota. As a competitive grant fund, projects are prioritized based on expected outcomes. Research ND provides matching funds to help companies pay for university research, and projects are initiated by the companies to meet their own research and development goals. More information about the program can be found at www.ResearchND.com.

Innovate ND awards dollars to North Dakota-based entrepreneurs and innovators working on a new concept and wanting access to Innovation Center resources (North Dakota State University, University of North Dakota or Idea Center), online entrepreneur education, extensive entrepreneurial tools and an entrepreneurial ecosystem. Innovate ND awards dollars through a voucher and grant system. Vouchers are issued in Phase I and II, and grants are issued in Phase III. Vouchers can be used to develop business plans or prototypes or to secure coaching, consulting or marketing assistance to prepare for business launch. Grants are used to execute the plan developed in the first two phases. More information about the program can be found at www.InnovateND.com.

North Dakota Office of State Tax Commissioner

www.nd.gov/tax

INCOME TAX INCENTIVES

Angel Investor Investment Income Tax Credit – (Note: This program replaced the angel fund investment credit program, effective July 1, 2017.) Qualified early- or mid-stage private, nonpublicly traded businesses in need of cash to fund operations and growth may be able to obtain that funding from a North Dakota angel fund. The angel investor investment income tax credit program was established to provide an incentive to individuals (“angel investors”) to set up angel funds to pool monies to make cash investments in qualified businesses. To participate, both the angel fund and qualified business must be certified by the North Dakota Department of Commerce, and the cash investment must be made in exchange for an ownership interest. An income tax credit equal to 35% or 25% is allowed, depending on whether the investment is made in an in-state (i.e., North Dakota) or out-of-state qualified business respectively.

Internship Employment Income Tax Credit – An income tax credit is available to a business that employs an individual under a qualified internship program. A qualified internship program is located in North Dakota, is limited to college or vocational technical education program students majoring in a field related to the work to be performed, provides academic credit for the internship, and requires employer supervision and evaluation. The credit is equal to 10% of the compensation paid to an intern. The credit is allowed for up to five interns employed at the same time, and the maximum credit allowed to a business is \$3,000 over all tax years.

New or Expanding Business Income Tax Exemption – A new or existing primary sector business in North Dakota may be eligible to exempt from income tax part or all the net income derived from its new or expanded operations. The exemption may be granted for up to five years. A “primary sector” business is one that the

Expanding Business

North Dakota Commerce Department certifies as producing new wealth in North Dakota through the use of knowledge or labor to add value to a product, process or service. “New wealth” means income from sales to customers outside North Dakota or from sales to customers in North Dakota if the product, process or service was not previously available or was difficult to obtain. A business must apply for the exemption through the North Dakota State Board of Equalization (c/o the North Dakota Office of State Tax Commissioner). (Note: A new or existing primary sector business in North Dakota may also be eligible for a property tax exemption of up to five years, which must be applied for at the city or county level, depending on where the property is located.)

Renaissance Zone Income Tax Exemptions and Credits – A variety of income tax exemptions and credits, all but one of which are allowed over a five-year period, are available to individuals and businesses for purchasing, leasing, expanding or making improvements to real property located in a North Dakota renaissance zone. To qualify, taxpayers must apply in advance to the local zone authority of the city in which the renaissance zone is located to obtain zone project status for any proposed real property transaction.

Research Expense Income Tax Credit – An income tax credit is available to taxpayers for conducting qualified research in North Dakota. The credit is equal to a percentage of the qualified research expenses incurred in North Dakota that exceed a base amount in North Dakota. “Qualified research expenses” and “base amount” have the same meaning as defined for purposes of the research credit available under federal income tax law. The credit percentage is 25% of the first \$100,000 of excess qualified research expenses, and 8% of the excess qualified research expenses over \$100,000, in a tax year.

Seed Capital Investment Income Tax Credit – A new or existing primary sector business in need of cash to fund its startup or continuing operations in North Dakota may be able to obtain funding through use of the seed capital investment income tax credit program. An income tax credit is provided as an incentive for taxpayers to make cash investments in primary sector businesses that the North Dakota Commerce Department certifies as qualifying businesses under the program. (See “New or Expanding Business Income Tax Exemption” above for primary sector definition.) The credit is equal to 45% of qualifying investments in the business, up to a lifetime maximum credit limit of \$225,000 for all qualifying investments.

Workforce Recruitment Income Tax Credit – An income tax credit is available to a business that has employed certain extraordinary recruitment methods (as defined by the statute) for at least six months to hire employees for hard-to-fill positions in North Dakota. The credit is equal to 5% of the compensation paid during the first 12 consecutive months to the employee(s) hired to fill those positions and is allowed in the first tax year following the tax year in which the employee completes the 12-consecutive month employment period.

SALES AND USE TAX INCENTIVES

Computer and Telecommunications Equipment Exemption – A sales and use tax exemption is available to certain primary sector businesses for purchases of computer and telecommunications equipment. To qualify, the equipment must be an integral part of a new business or create an economic expansion of an existing business. Purchases of replacement equipment do not qualify.

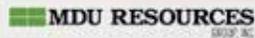
Data Center Technology Equipment and Software Exemption – A newly constructed or substantially refurbished data center in North Dakota may be eligible for a sales and use tax exemption on information technology equipment and computer software, including replacement equipment and software, that is purchased between January 1, 2015, and December 31, 2020. The data center must be at least 16,000 square feet. Only the first four data centers approved by the North Dakota Office of State Tax Commissioner are eligible for this exemption.



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North Dakota IT coursework provides students with the opportunity to explore IT Careers in Computer Networking, Hardware, Programming, Digital Communications and Cybersecurity. They can also earn CompTIA IT Fundamentals, Certipoint IC3 or Microsoft Technology Associate (MTA) Industry Certifications.



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