NORTH DAKOTA

2021 STATE OF technology

North Dakota Technology Champion Vern Dosch, National Information Solutions Cooperative

TechND

The State of North Dakota's Technology Industry

Justin Forde
President, Technology Council of North Dakota

We can all agree the role of technology in our personal and professional lives has never been greater. Remote work and education have become commonplace and those previously resistant to technology have quickly become adopters. North Dakota's technology businesses have been the driving force in creating solutions to the ever-changing challenges faced by our world today.

Thanks to our state's broadband providers, North Dakota continues to be a national leader in affordable, high-speed Internet access to homes, schools and health care. Biotech company Aldevron is assisting in vaccine development and retired tech industry leader Vern Dosch was tapped to lead the state's COVID-19 contact tracing efforts. UAV companies, such as SkySkopes, are working to bring efficiency and reliability to the state's traditional industries. The examples are numerous – find more throughout the publication.

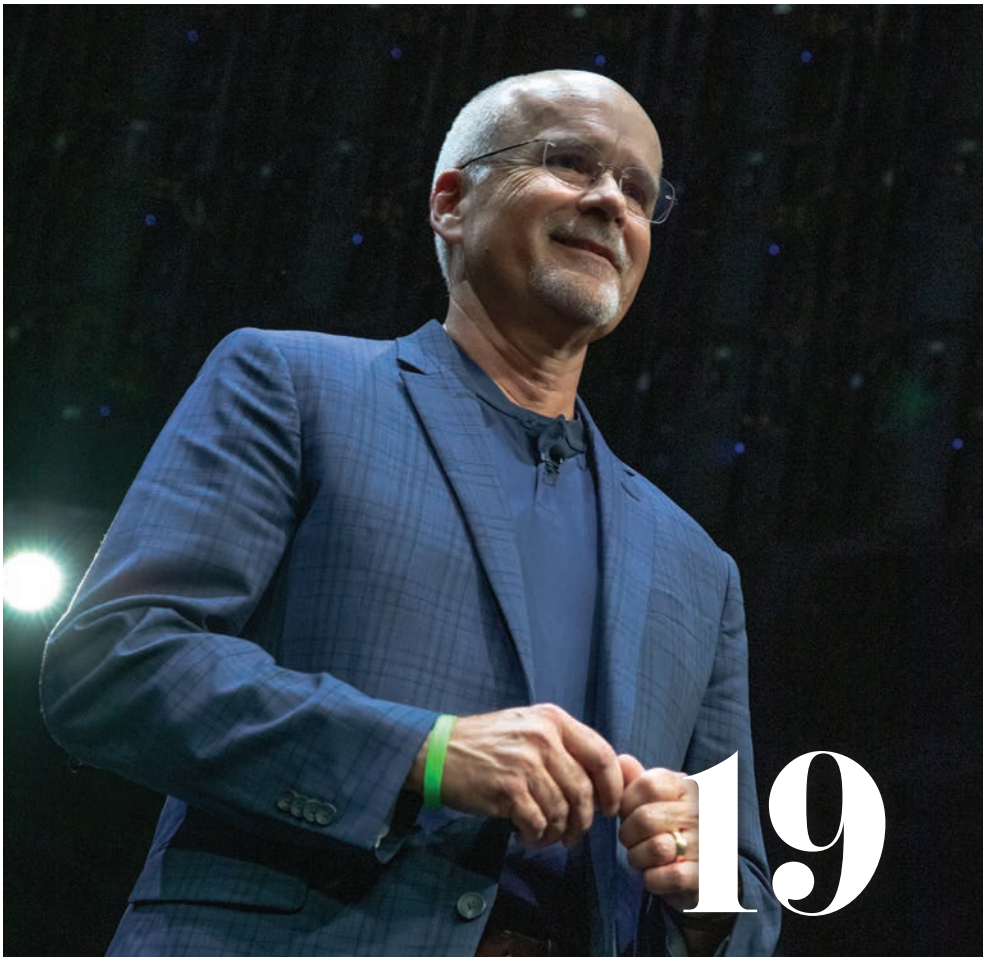
Previous efforts, many led by TechND, to make North Dakota a leader in connectivity, as well as advancements in technology infrastructure, education and business-friendly policies, have set the stage for technology sector growth. Over the past two decades, TechND (formerly Information Technology Council of North Dakota) has partnered with public and private entities on initiatives such as the Dakota Fiber Initiative, IT Career Awareness Program and North Dakota Computer and Cyber Sciences Education Initiative to ensure the state's technology industry was well-positioned. The value of these initiatives has never been clearer.

As North Dakota's local, state and federal leaders make decisions for the future, it is more important than ever to prioritize the growth and expansion of the state's technology sector as the third leg of the economic stool, next to energy and agriculture. There is no question, 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.

TechND is pleased to present the 2021 State of Technology publication, which highlights the state's technology industry in the areas of infrastructure, workforce, trends, competitiveness and economic impact. TechND will continue to actively encourage the use, growth and development of technology in North Dakota by advocating for favorable policy, addressing workforce needs and championing the technology community.

We welcome your participation. Feel free to contact me at *justin.forde@midco.com* or 701-527-4293 or Executive Director Deana Wiese at *office@technd.org* or 701-355-4458.

Justin Forde



Contents

4 Introduction

5 Executive Summary

7 ND Connected

9 Economic Impact

13 Status of Workforce

18 ND Tech Awards

19 2020 North Dakota Technology Champion

21 2020 Premier Technology Business

23 2020 Technology Innovator

25 2019 Award Winners

27 Measuring Up

33 North Dakota a Leader in Tech Education

37 Building the Workforce

42 Soaring to New Heights

45 Emerging Trends

49 Expanding & Attracting Business

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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. From computers on farm combines to the state-of-the-art contact-tracing apps in the age of COVID-19, there isn't a sector that isn't affected by technology.

This biannual report showcases the impact of the state's technology sector and identifies opportunities and challenges within the industry. We are excited to highlight the past as we also look ahead to technology's promising future in North Dakota.

The data in this publication 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."

TechND, along with its sponsors, is pleased to present the 2021 edition of the State of Technology, which provides a snapshot of North Dakota's tech industry. From the economic impact to the state to the status of the tech workforce and infrastructure to the competitiveness of the industry at regional and national levels, this comprehensive report highlights it all.

TECH INDUSTRY BREAKDOWN

[Table I]

Based on the North American Industry Classification System (NAICS), this list of principal business activities and their associated codes is designed to classify an enterprise by the type of activity in which it is engaged.

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)

These occupational employment and wage estimates are calculated with data collected from employers in all industry sectors in metropolitan and non-metropolitan areas in North Dakota. These codes reflect the major occupational groups of Management Occupations (11-000), Computer and Mathematical Occupations (15-000) and Educational Instruction and Library Occupations (25-000).

- 11-3021 – Computer and Information Systems Managers
- 15-1211 - Computer Systems Analysts
- 15-1212 – Information Security Analysts
- 15-1251 – Computer Programmers
- 15-1256 – Software Developers and Software Quality Assurance Analysts and Testers
- 15-1257 – Web Developers and Digital Interface Designers
- 15-1245 – Database Administrators and Architects
- 15-1244 – Network and Computer Systems Administrators
- 15-1241 – Computer Network Architects
- 15-1232 – Computer User Support Specialists
- 15-1231 – Computer Network Support Specialists
- 15-1299 – Computer Occupations, All Other
- 25-1021 – Computer Science Teachers, Postsecondary

Source: Job Service North Dakota

Executive Summary

As a whole, 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 17% over the past decade, this 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. Take a look at what this looks like:

EMPLOYMENT

The state's technology subsectors employ

21,877

people at more than

3,700 BUSINESSES

7,620 NORTH DAKOTANS have technology occupations. These include jobs in the technology industry, but also in other industries, such as agriculture, energy, finance, and health care

It is estimated more than

7,500

new and replacement technology positions will be needed in North Dakota over the next decade

This includes

900 EMPLOYEES

to fill new positions, with the remaining being replacements

GDP

Together, these **businesses contribute**

MORE THAN $3 BILLION

to the state's gross domestic product

This is 5.5%

of the state's total

GDP in 2019 of

$54 billion

Over the past decade, the contribution of technology subsectors to the state's GDP grew

41%

Total contributions to North Dakota's economy over the past decade by technology sector employees account for

$14.2 billion

in spending

GROWTH

Job growth in North Dakota's technology subsectors increased by more than

17%

over the past decade

North Dakota is projecting an

11% increase

in workforce needs over the next 10 years

With 7,620 technology positions currently in the state, this projected growth means replacement and new positions will equal

99% of the state's current technology workforce

WAGES

The average annual wage for technology positions in North Dakota is $66,113, which is

27% HIGHER

than the state average. While these overall wages lag behind surrounding states, North Dakota is closing the wage gap at a greater rate than national averages

The average annual wages for

technology positions increased 41%

over the past decade

With a median hourly wage of

$33.25,

North Dakota's technology employees receive wages **competitive** with several surrounding states, including Montana and South Dakota, but lag behind Minnesota and the national average

EDUCATION

In an effort to address the industry's swift growth, 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, a digital academy and more than 60 post-secondary education programs.** Additionally, TechND is 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.

Technology continues to play a vital role in North Dakota's economy, and the future of the industry is as bright as ever. 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 CONNECTED

Broadband access and connectivity are critically important to ensuring North Dakota remains competitive in a global economy. Key players in North Dakota's broadband industry, Dakota Carrier Network (DCN), Midco and 702 Communications, provide their insight into the importance of reliable Internet connection in business, education and government, regardless of location.

Broadband Investment and Gigabit Internet Access

To remain connected globally, North Dakotans rely on fast and affordable Internet to meet their business and personal communication needs. This need generated innovation in the state that led to North Dakota becoming an established national leader in connectivity.

"At DCN, our main priority is keeping our customers connected," said Seth Arndorfer, chief executive officer of DCN. "During COVID-19, that connection has been more important than ever before."

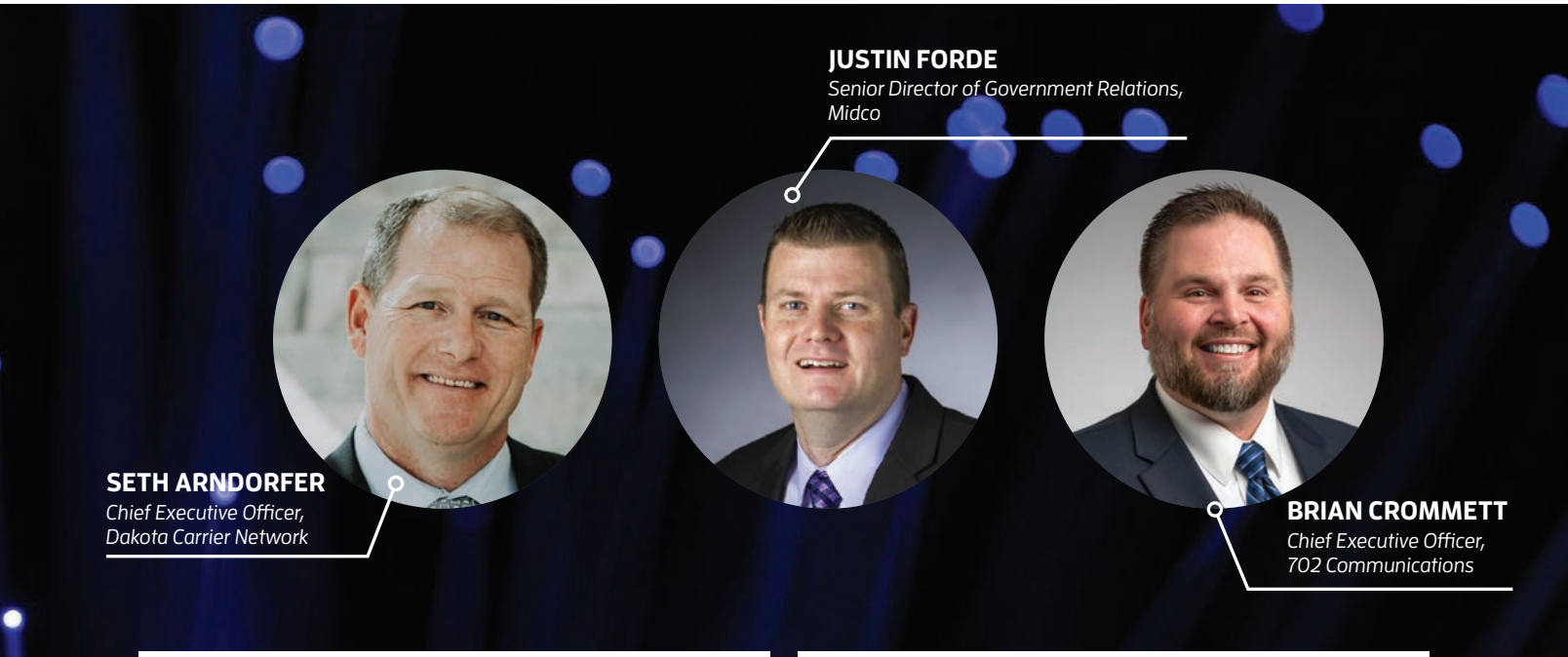
A billion-dollar investment over the past decade by DCN and their 14 member-owners has positioned North Dakota to be a leader in connectivity and gigabit Internet access delivered on the state's largest fiber optic network.

The fiber optic network provided by DCN and its member-owners also ensured that North Dakota was a leader in the nation getting students, including rural students, connected to high-speed broadband for distance learning. Within a few weeks of schools closing amid the pandemic, DCN and its owners had connected 99.8 percent of rural students to broadband Internet at home. It took a tremendous amount of innovation and collaboration across the state to make this happen. "That's how we're getting through COVID-19, by working together," said Arndorfer.

"Midco has been proud to be a technology leader in the Northern Plains since 1931," said Justin Forde, senior director of government relations at Midco. "Today, that means Midco has invested private capital in bringing gigabit Internet and state-of-the-art connectivity options to communities all across North Dakota."

Midco has also invested in fixed 5G wireless technology that reaches farms, homes and businesses up to 30 miles away from their fiber network.

"Aside from the fiber infrastructure investments that 702 makes on a yearly basis, we also opened up our data center in Fargo and brought the Internet's backbone one step closer to end-users when Hurricane Electric established a Point of Presence there," said Brian Crommett, chief executive officer of 702 Communications. "That benefits 702's customers, other local Internet providers as well as enterprise customers in Fargo-Moorhead."



Telecommunication

Telecommunication has assumed a heightened role in workplaces during the pandemic as many businesses opt to operate remotely. Keeping employees connected and productive with adequate infrastructure is critical to the continued success of North Dakota's economy. Broadband makes it possible for diverse industries to thrive and stay connected in rural North Dakota, even during a pandemic.

DCN, their member-owners and the Broadband Association of North Dakota (BAND) all stepped up in unprecedented ways to support their customers. They all signed the Federal Communication Commission's "Keep Americans Connected" pledge, agreeing to not terminate service to any residential or small business customers because of their inability to pay their bills and to waive any late fees that may be incurred because of economic circumstances related to the COVID-19 pandemic. These organizations continued to support and connect rural North Dakota communities by laying fiber past their service territories and doubling speeds at no cost.

This effort to increase infrastructure isn't reactive, but preemptive. As many factors of normal life are uncertain at the moment, the telecommunication companies connecting North Dakota are working continuously to ensure the rapid adoption of remote work and education is affordable and accessible.

"If COVID has taught us anything, it's that remote work can become a necessity," said Crommett. "In order to keep our people employed and our economy healthy, we need that connectivity to the end-users so we don't just shut down in the face of a pandemic, weather event or other natural disasters."

Connectivity is continually becoming more important. DCN, Midco and 702 Communications continue to expand to rural areas and explore new technologies to ensure everyone, regardless of where they live, can experience a seamless connection with the rest of the world.

"Health care, education, agriculture, energy, and so many businesses of our key sectors in North Dakota need that strong Internet connection to the world to do well in today's economy," said Forde.

ECONOMIC IMPACT

The diversity of the state's technology industry contributes significantly to the overall growth and economic strength of North Dakota. More than 3,700 businesses within the tech subsectors employ 21,877 North Dakotans in various fields including technology, human relations, finance, and marketing.

The technology industry generates tax revenue for both local and state governments. 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.

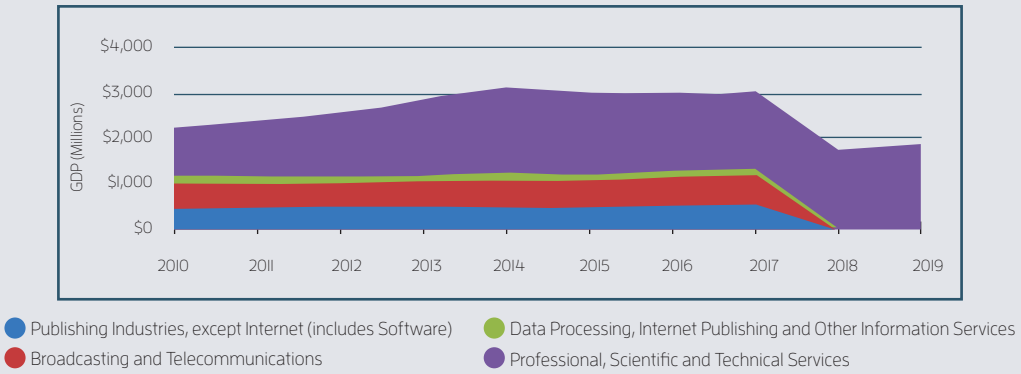
Gross Domestic Product Contributions

Gross domestic product (GDP) is defined as the total market value of all goods and services produced within a state and measures the 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 41%. The businesses in these tech subsectors are responsible for 5.5% of the state's 2019 total GDP of $54 billion. This equals more than $3 billion in contributions.

[Figure 1]

GDP: Tech Subsectors (2010-2019)

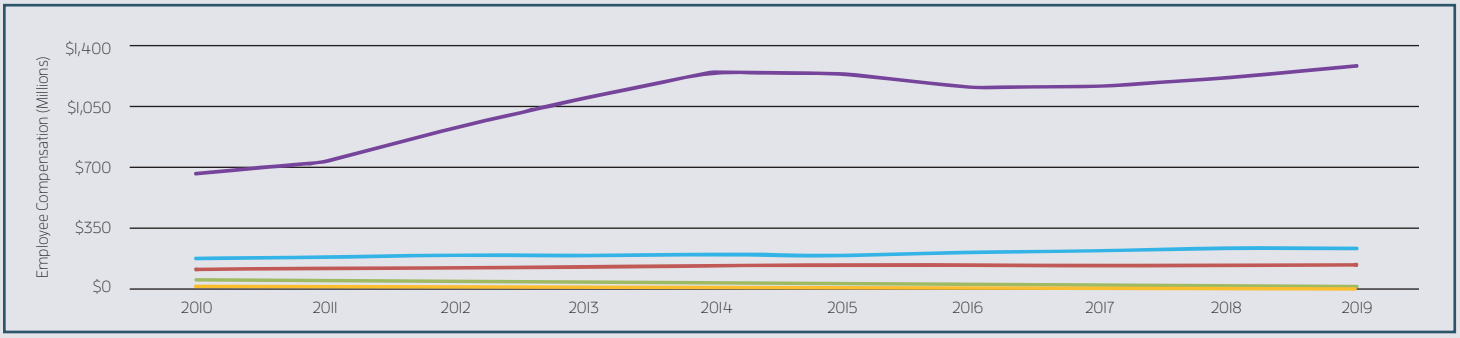


Publishing Industries, except Internet (includes Software)
Broadcasting and Telecommunications
Data Processing, Internet Publishing and Other Information Services
Professional, Scientific and Technical Services

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

Employee Compensation Contributed to the Economy (2010-2019)

[Figure 2]



Publishing Industries (except Internet)
Telecommunications
Data Processing, Hosting and Related Services
Other Information Services
Professional, Scientific and Technical Services

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

Pay Contributed to the Economy

Total contributions to North Dakota's economy over the past decade by technology sector employees account for $14.2 billion in spending.

> **"Technology is really the driver in North Dakota. Across industries, the economic impact the tech sector has is a force multiplier for North Dakota."**
>
> – Justin Forde, Senior Director of Government Relations, Midco

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 came at a rate below that of the nation, with a 17% increase in employment in North Dakota's tech subsectors from 2010 to 2019, while there was a 22.5% increase in the nation's tech subsector employment as a whole.

North Dakota's growth was in the professional, scientific and technical service subsector while the remaining subsectors declined.

Tech Subsector Job Growth (2010-2019)

[Table 2]

NAICS	Subsector	ND 2010	ND 2019	US 2010	US 2019	ND % Change	US % Change
511	Publishing Industries (except Internet)	2,969	2,366	755,311	755,453	-25.5%	0.0%
517	Telecommunications	1,777	1,735	904,067	715,462	-2.4%	-26.4%
518	Data Processing, Hosting and Related Services	1,027	565	248,025	348,933	-81.8%	28.9%
519	Other Information Services	207	182	277,117	472,880	-13.7%	41.4%
541	Professional, Scientific and Technical Services	12,727	17,029	7,567,186	9,652,432	25.3%	21.6%
	Total	**18,707**	**21,877**	**9,751,706**	**11,945,160**	**17%**	**22.5%**

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

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Career & Technical Education (CTE) prepares students for career pathways in the global marketplace by offering experiential learning, post-secondary credits and industry certifications. Students gain technical and high-level academic skills, equipping them to be lifelong learners.

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, Certiport IC3 or Microsoft Technology Associate (MTA) Industry Certifications.

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North Dakota cte Career and Technical Education

Status of the Workforce

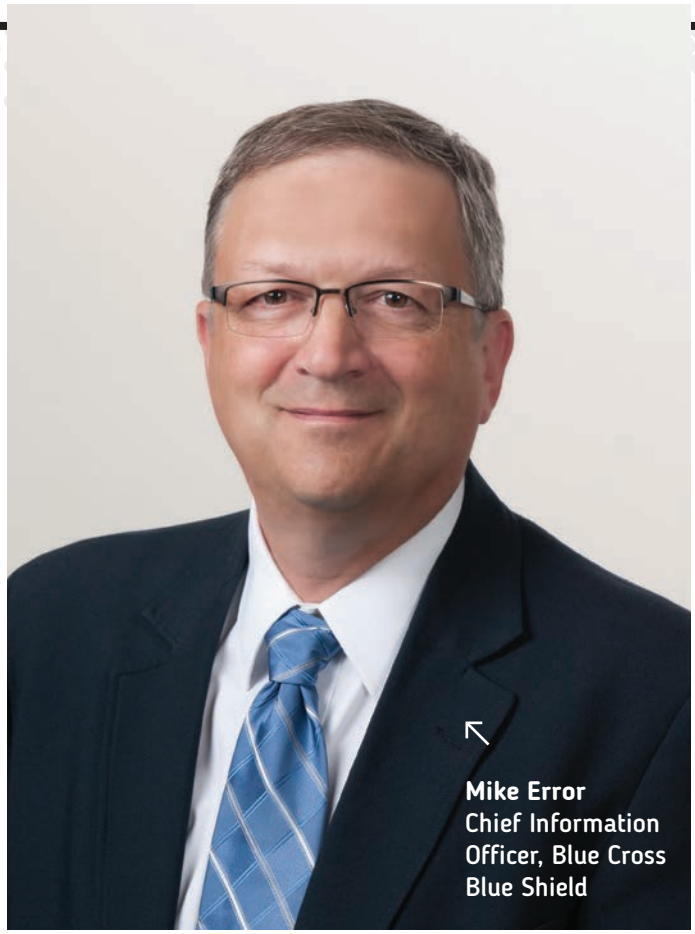
North Dakota has one of the top economies in the nation thanks to numerous successful industries, including technology. The state offers many opportunities for business start-ups and expansions and consistently boasts one of the lowest unemployment rates in the country. Through the cooperative efforts 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.

Job growth in North Dakota's technology subsector increased by more than 17% over the last decade. North Dakota's five technology subsectors employ 21,877 individuals, and these subsectors include the state's tech businesses. There are 7,620 North Dakotans with technology occupations (Table 3). Some are employed by technology companies, but many are employed in other industries, including agriculture, energy, finance, and health care.

"When we are recruiting new employees, we look for those who share our passion and energy in building a positive experience for our members," said Mike Error, chief information officer at Blue Cross Blue Shield. "While health care industry knowledge is a plus, we look for strong analytical talent with deductive reasoning skills who can bring it all together to support the organization's technology needs."

New innovations and emerging technologies are consistently being incorporated into workplaces, requiring agility and adaptability from businesses to stay a step ahead.

"Digital transformation is where the IT world is headed," a representative at Doosan said. "Since this is new and developing, we aren't exactly sure what our workforce is going to look like or what we will need to fill the gaps and positions at this time."



Mike Error
Chief Information Officer, Blue Cross Blue Shield

Ryan Goellner
Executive Vice President of Technology and Project Management, Gate City Bank

Current and Future Growth

Ryan Goellner, executive vice president of technology and project management at Gate City Bank, spoke on how changing technologies impact the workforce. "As the bank innovates and transitions to cloud technology, the up-and-coming workforce must be able to understand the cloud, cloud security and infrastructure, and be familiar with navigating the challenges encompassed within this completely digital platform," said Goellner.

In the past few years, many businesses have had to change the way their technical team supports business operations to keep up with the pace of advances in technology.

"The way we do our work has evolved to one of collaboration and partnership in how we provide technical solutions to our business teams," said Error. "Because of this, there is a growing need for employees who can balance understanding the business needs with providing the right technical solutions that ultimately drive a positive member experience."

Technology Occupations

"Our goal as an IT organization is to be one that is adaptable and continuously learning to ensure we are offering the most modern solution to what we are trying to solve," said Error. "We need employees with broad technical skills who can fit across multiple areas where technology is leveraged. Given the pace of change, employees need to become both a technology generalist at the same time as having deep expertise in a functional area. Employees need to be technical, but also nimble to keep up with the ever-changing needs of our business."

As the need for improved technological literacy grows in the workplace, businesses must ensure employees are proficient in the relevant technologies.

"Currently, the bank is well-positioned in its technology department," said Goellner. "As we pivot on what technology we implement, we make sure team members are educated and trained. Continual education is essential for our team members in all departments – and especially so with all of the technological advancements made recently."

ND Tech Occupations (2019)

[Table 3]

SOC	Occupation	2019 Employment
11-3021	Computer and Information Systems Managers	480
15-1211	Computer Systems Analysts	450
15-1212	Information Security Analysts	120
15-1251	Computer Programmers	600
15-1256	Software Developers and Software Quality Assurance Analysts and Testers	1,430
15-1257	Web Developers and Digital Interface Designers	200
15-1245	Database Administrators and Architects	120
15-1244	Network and Computer Systems Administrators	590
15-1241	Computer Network Architects	110
15-1232	Computer User Support Specialists	1,850
15-1231	Computer Network Support Specialists	690
15-1299	Computer Occupations, All Other	850
25-1021	Computer Science Teachers, Postsecondary	130
	Total	**7,620**

Source: Occupation Employment Statistics, Job Service North Dakota

[Table 4]

Change in Tech Occupations (2010-2019)

SOC	Occupation	2010 Emp	2019 Emp	Number Change	% Change
11-3021	Computer and Information Systems Managers	520	480	-40	-8.3%
15-1211	Computer Systems Analysts	910	450	-460	-102.2%
15-1212	Information Security Analysts	**	120	**	**
15-1251	Computer Programmers	550	600	50	8.3%
15-1256	Software Developers and Software Quality Assurance Analysts and Testers	**	1,430	**	**
15-1257	Web Developers and Digital Interface Designers	**	200	**	**
15-1245	Database Administrators and Architects	150	120	-30	-25.0%
15-1244	Network and Computer Systems Administrators	560	590	30	5.1%
15-1241	Computer Network Architects	**	110	**	**
15-1232	Computer User Support Specialists	**	1,850	**	**
15-1231	Computer Network Support Specialists	**	690	**	**
15-1299	Computer Occupations, All Other	N/A	850	N/A	N/A
25-1021	Computer Science Teachers, Postsecondary	100	130	30	23.1%

***Due to changes in the SOC system, some occupations prior to 2018 are no longer a 1:1 match with the updated occupations*

Source: Job Service North Dakota

[Table 5]

Average Pay (2010-2019)

NAICS	Subsector	2010	2019	% Change
511	Publishing Industries (except Internet)	$56,056	$94,848	69%
517	Telecommunications	$57,980	$74,724	29%
518	Data Processing, Hosting and Related Services	$41,600	$51,584	24%
519	Other Information Services	$27,144	$33,800	25%
541	Professional, Scientific and Technical Services	$51,740	$75,608	46%

Source: Job Service North Dakota

[Table 6]

Projected Tech Workforce Needs (2018-2028)

SOC	Occupation	% Growth	Total Openings	Annual Average Wage	Growth Openings	Replacement Openings
11-3021	Computer and Information Systems Managers	9%	482	$120,860	50	432
15-1211	Computer Systems Analysts	10.4%	618	$68,080	78	540
15-1212	Information Security Analysts	29.2%	196	$87,090	57	139
15-1251	Computer Programmers	-12.4%	383	$76,820	-82	465
15-1256	Software Developers and Software Quality Assurance Analysts and Testers	19.3%	1,566	$82,930	337	1,229
15-1257	Web Developers and Digital Interface Designers	4.9%	214	$56,230	13	201
15-1245	Database Administrators and Architects	9%	116	$78,110	13	103
15-1244	Network and Computer Systems Administrators	6.3%	508	$74,750	42	466
15-1241	Computer Network Architects	12.4%	132	$91,030	20	112
15-1232	Computer User Support Specialists	10.9%	1,751	$47,870	206	1,545
15-1231	Computer Network Support Specialists	8.2%	660	$66,930	60	600
15-1299	Computer Occupations, All Other	10.8%	842	$69,080	109	733
25-1021	Computer Science Teachers, Postsecondary	-3.4%	93	$88,160	-4	97
	Total		**7,561**		**899**	**6,662**

Source: Job Service North Dakota

Quality of Jobs

The average annual wages across all technology positions increased 41% over the past decade. The average annual wage for technology positions in North Dakota is $66,113, which is 27% higher than the state average for all occupations.

Projected Workforce Needs

North Dakota is projecting an 11% increase in technology positions for the next 10 years. It is estimated more than 7,500 new and replacement technology positions will be needed in North Dakota over the next decade to support the growing tech industry. This includes 900 employees to fill new positions, with the remaining being replacements.

"With the rapid pace of change in the technology world, experience with analytics, the ability to stay current with technologies and methodologies, and adaptability are critical needs," said Error regarding what they look for to fill new positions. "Experience is always a plus, but we are also willing to provide on-the-job learning to those college graduates new to the industry. We also provide annual internships to help students gain hands-on technical experience."

Doosan noted the company is seeing a lot more students in colleges and universities choose the coding/developing/cybersecurity route, and while those are critical needs in an IT organization, Doosan is seeing a lack of desktop support/infrastructure students.

"The bank has been focusing on process automation," said Goellner. "To support this initiative, we created several business process improvement positions and a specialist in robotic process automation. In the near future, along with process automation, we will be investing in cloud services. We will inevitably be seeking professionals that are familiar with cloud and cloud security principles, and we're excited to move toward growth in our knowledge and our team."

As new technologies become available, new job positions will soon follow. With 7,620 technology positions currently in the state, this projected growth means replacement and new positions will equal 99% of the state's current technology workforce.

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The North Dakota Technology Awards recognize those individuals, entities and businesses that have played a vital role in technology development in North Dakota and are an inspiration to others in the industry. The program acknowledges the state's technology leaders, improves public awareness of North Dakota's many effective technology companies and applauds innovative companies and business ideas.

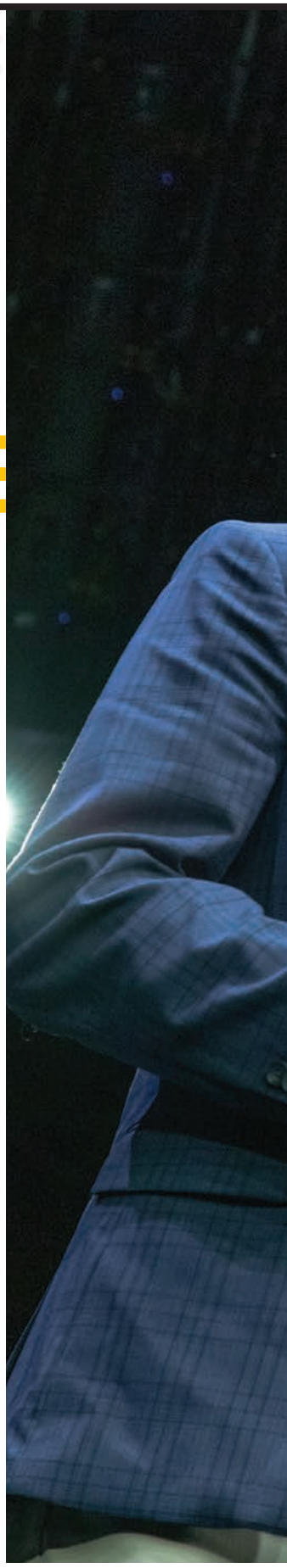
North Dakota Technology Champion: Vern Dosch

Premier Technology Business: Aldevron

Technology Innovator: SkySkopes

Vern Dosch

Receives North Dakota Technology Champion Award



ern Dosch, CEO and president of National Information Solutions Cooperative (retired), received TechND's 2020 North Dakota Technology Champion Award. This award recognizes an individual who championed the development of a North Dakota tech company, the promotion and use of technology in the academic realm or the delivery of technology to citizens of North Dakota.

"Dosch's lifelong commitment to service and significant contributions to the technology industry has benefited North Dakota, the nation and the world," said Justin Forde, TechND's president and senior director of government relations at Midco. "His contributions to North Dakota's technology industry and its citizens are outstanding and make him very worthy of this award."

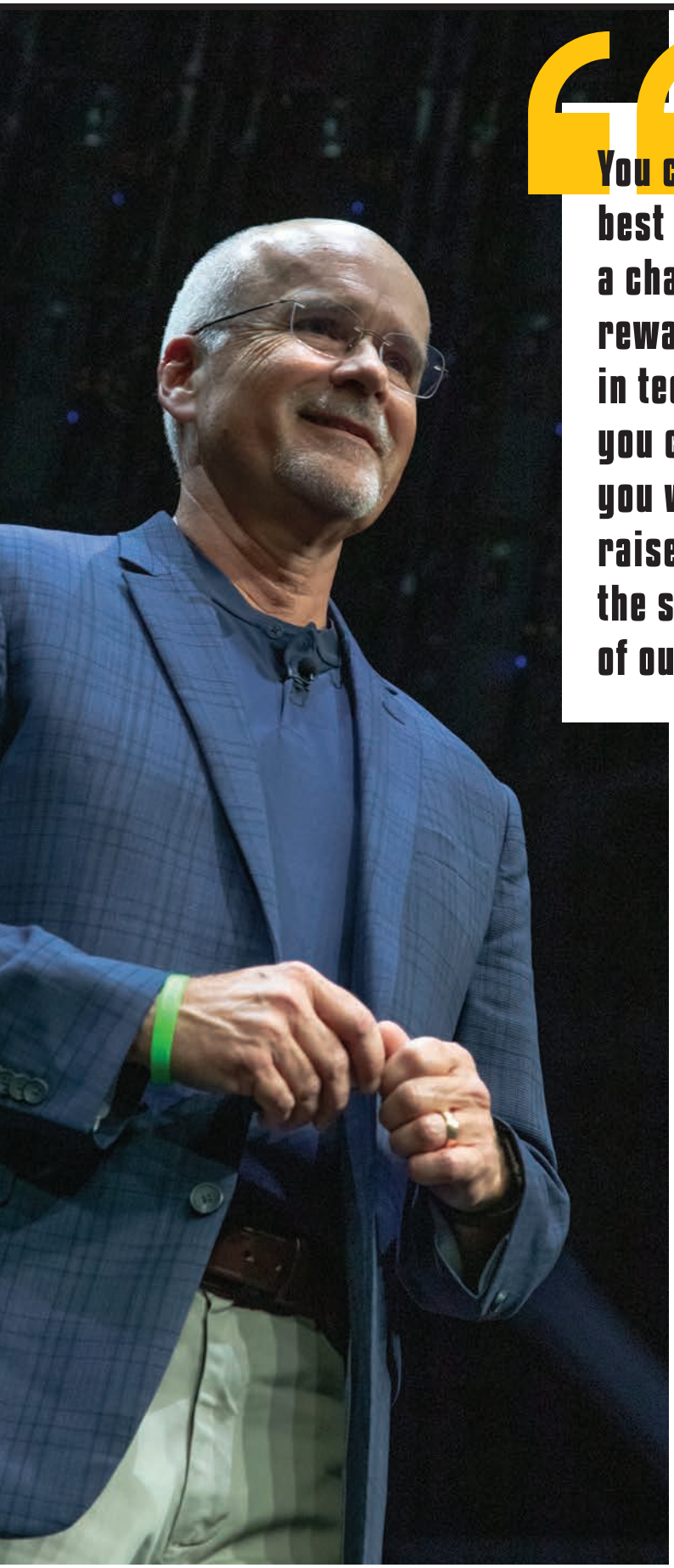
Dosch was the president and CEO of the National Information Solutions Cooperative (NISC), Mandan, N.D., since 2002 before retiring in January 2020. Prior to his appointment, Dosch served as chief operating officer from 2000-2002 and general manager/CEO of North Central Data Cooperative (NCDC) from 1993-2000. NISC is the resulting organization created by the July 1, 2000, consolidation between Central Area Data Processing (CADP) and NCDC. NISC began in the 1960s when Dosch recognized a need to automate rural electric and telecommunication systems in North Dakota.

"'Necessity is the Mother of Invention.' This phrase was truly the genesis of NISC. Back in the early 1960s, there was a pressing need to automate rural electric and telecommunication systems in the state of North Dakota," Dosch said. "Initially, because the population was very sparse in our state, the economic feasibility was challenging at best. True to the North Dakota sense of determination and tenacity, these modest rural utilities formed a technology cooperative (NISC) to serve the technical requirements of these small but burgeoning utilities."

The need for automation in North Dakota was real and imperative. Additionally, programmers and technical resources were difficult to come by in the state. But Dosch recognized the potential in Wahpeton, N.D., which was home to the North Dakota State School of Science, the only school in the state offering a technical degree.

"Building the staff that was required to develop billing, accounting and engineering software for these utilities was accomplished by recruiting heavily in Wahpeton, doing a significant amount of on-the-job training and, when possible, hiring former military personnel who had technical training in the service," Dosch said. "Building the required staffing was a slow and arduous process."

Now 50 years later, NISC has 1,400 employees and customers in all 50 states, with offices in Mandan, N.D., St. Louis, Mo., Austin, Texas, Blacksburg, Va., and Shawano, Wis., claiming 50% of the utility market share in the United States. The tremendous growth of NISC has also allowed Dosch to give back to the institutions that gave him his start.



Vern Dosch, Chief Executive Officer and President, National Information Solutions Cooperative (retired)

> **You can have the best of both worlds, a challenging and rewarding career in technology, and you can live where you want to live and raise your family in the safety and beauty of our state.**

"My educational background included Light of Christ for grade school and high school, Bismarck State College and the University of Mary for my undergraduate and graduate degrees," Dosch said. "These institutions provided such an important start to my life and career, and built the foundation of my education, planting the seeds of servant leadership that I would embrace for my entire career."

In honor of Dosch's retirement, NISC created the Vern and Lynne Dosch Scholarship to honor the tremendous impacts the Dosch's have had in the Bismarck-Mandan community, the NISC family and the rural electric and telecom industries.

"When it came time for my retirement, establishing a scholarship at these institutions was a way of giving back, saying thank you for the profound impact they had in my life and hopefully making it possible for other students to benefit from the same quality education," Dosch said.

Dosch's commitment to serving members and taking care of employees set the tone for NISC's business structure and culture. Under his guidance and servant-style leadership, NISC has had long-standing recognition by "Computerworld Magazine" as one of the nation's top places to work in information technology.

In April 2020, the State of North Dakota requested Dosch facilitate the integration of the state's technology solutions for COVID-19 testing and contact tracing efforts.

"COVID has taught the business community what NISC has known for many years, that is, you can live in a rural area of the country and still build a company that competes successfully in the national arena," Dosch said. "You can have the best of both worlds, a challenging and rewarding career in technology, and you can live where you want to live and raise your family in the safety and beauty of our state."

A life-long resident of Bismarck-Mandan, Dosch works closely with the University of Mary's Leadership North Dakota Program, mentoring young professionals. He serves as a board member for the Bismarck State College Foundation and Starion Bank. In 2007, Dosch received the North Dakota Chamber of Commerce Community Leadership Award, one of the Chamber's highest honors in recognition of the economic and community advancement that he brings to Bismarck-Mandan. He is also a recipient of the University of Mary and Bismarck State College Alumni Recognition Award.

Aldevron

Receives Premier Technology Business Award

Aldevron, a Fargo-based biotechnology company, received the 2020 Premier Technology Business Award. This award recognizes a technology business that achieved outstanding success by developing and/or delivering tech-based business solutions, taking into consideration the business's long-term growth, profitability and sustainability; impact on the industry and market and role as an outstanding corporate citizen.

"It is an honor to be recognized as a premier technology business by TechND," said Kevin Ballinger, CEO of Aldevron. "It means that we are living up to our mission and values as a company, both as a member of the technology business community in North Dakota but also as a global partner to thousands of clients that impact millions."

Aldevron's mission is to serve patients and save lives. Aldevron relies on continual innovation to serve clients with the latest technological advancements in the biotech industry.

"Aldevron produces the critical raw materials needed to solve many of the world's most challenging problems. Whether its vaccine development, immunotherapy, agricultural biotech, gene therapy, veterinary medicine, molecular diagnostics, or cell therapies, Aldevron has been part of the industry's greatest achievements."

- Kevin Ballinger, Chief Executive Officer, Aldevron

"Aldevron has grown to be one of the leading biotechnology businesses in the nation and has been part of the industry's greatest achievements," said Justin Forde, TechND's president and senior director of government relations at Midco. "Aldevron is very deserving of the Premier Technology Business Award."

In 1998, Aldevron started in a small lab at North Dakota State University and now has nearly 550 employees at its 14-acre headquarter campus in South Fargo and its site in Madison, Wis. Aldevron is the largest biotech firm in North Dakota and the region, serving the global biotechnology industry with custom plasmids, RNA and gene editing enzymes.

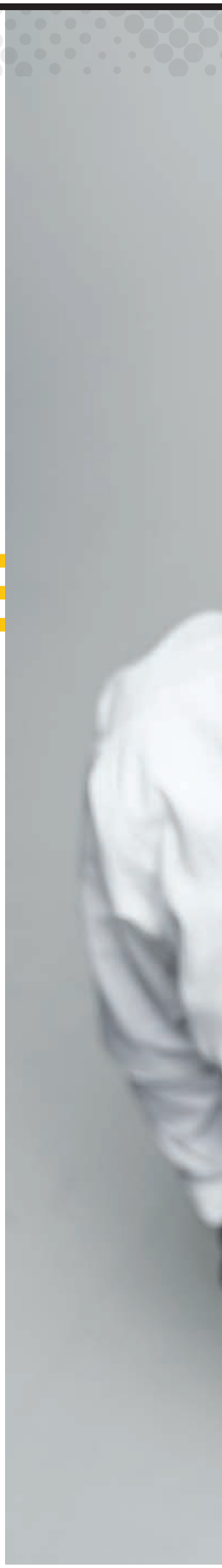
"Aldevron produces the critical raw materials needed to solve many of the world's most challenging problems," said Ballinger. "Whether its vaccine development, immunotherapy, agricultural biotech, gene therapy, veterinary medicine, molecular diagnostics, or cell therapies, Aldevron has been part of the industry's greatest achievements. The entire world is experiencing a biotech revolution and the genetic material developed here in Fargo is enabling the industry to have a significant impact on patients with severe unmet medical needs."

Aldevron serves thousands of clients worldwide in its efforts to solve the world's most challenging problems, including the COVID-19 virus. As a leading manufacturing organization with deep adeno-associated virus (AAV) expertise, Aldevron recently entered into a manufacturing agreement with Massachusetts Eye and Ear and Massachusetts General Hospital's AAVCOVID vaccine program. The experimental vaccine uses an AAV vector to deliver and express the Spike gene of the SARS-CoV-2 virus, which causes COVID-19, to elicit an immune response.

"At its core, technology is the use of scientific knowledge to create tools that help solve a problem," said Forde. "Aldevron is using its technology, right here in North Dakota, to help lead the way for more breakthroughs around the world."

SkySkopes

Receives Technology Innovator Award



kySkopes received the 2020 Technology Innovator Award, which recognizes a non-technology specific entity that is a leader in the use of innovative technology to serve its primary customer.

SkySkopes, headquartered in Minot, N.D., is an unmanned aircraft systems (UAS) company founded in 2014 that has grown from a few employees to several dozen. It has achieved international recognition with offices in Grand Forks, N.D., Fargo, N.D., Minneapolis, Minn., Fort Worth, Texas and Los Angeles, Cal. SkySkopes also has satellite offices in Houston, TX, and Portland, Ore.

SkySkopes' innovative use of UAS and sensor technology has increased safety for workers in several industries and allowed companies to make informed business decisions that were once made by estimation or through processes that required significant time and effort.

"As different industries consider the use of UAS, North Dakota is fortunate to have companies like SkySkopes, whose knowledge and expertise show how UAS can be used to improve business operations in any industry," said Justin Forde, TechND's president and senior director of government relations at Midco.

"We are thrilled to be this year's recipients of the prestigious Technology Innovator Award from the Technology Council of North Dakota," said Matt Dunlevy, CEO and chairman of SkySkopes. "North Dakota is synonymous with UAS excellence, and UAS are one of the most remarkable emerging technological megatrends in the present day. This award validates our decision to stand up in North Dakota, and the innovation we see every day from our pilots and professional staff. We are truly grateful to TechND and so many others in the state."

SkySkopes has been on the cutting edge of UAS, improving efficiency and safety across several industries. The use of various drone-mounted sensors allows SkySkopes to collect data in a safe and efficient manner, which can then guide business decisions. SkySkopes drones have inspected utility infrastructure for damage. The drones use light detection and ranging in the Bakken to monitor oil assets to provide safe and accurate information to companies operating there. The company flies missions across the U.S. inspecting wind turbines for wear, allowing wind power companies to make informed decisions to repair and replace turbines without having to manually inspect them. SkySkopes pilots have flown disaster recovery missions in flooded areas throughout the U.S., and a search and rescue mission for a missing child in Minot. The company has also worked commercially with ESPN to safely shoot video of NFL quarterback Carson Wentz in Fargo and has flown in Beyond Visual Line of Sight (BVLOS) aerial inspection missions in the Bahamas, Finland and Norway.

"We became the first North Dakotan startup to receive a Section 333 Exemption from the FAA to fly UAS for business purposes," Dunlevy said. "Since then we've been

Matt Dunlevy, Chief Executive Officer, SkySkopes

Dunlevy (right) with former UND President, Mark Kennedy (left)

part of numerous historical 'firsts' around the state and nation, including executing the first commercial UAS mission on a military base in the U.S., gaining permission to fly UAS at night in North Dakota, and SkySkopes was the first to fly beyond-visual-line-of-sight (BVLOS) commercially in North Dakota. Our history within North Dakota's UAS history is part of the impact we've had. Also as far as economic stimulation, and keeping a skilled, diverse and unique UAS workforce in the state, I'm happy to say we've definitely been contributors."

In partnership with the Northern Plains UAS Test Site at the UND and Grand Sky Business and Aviation Park, SkySkopes executed the first commercial flight involving multiple aircraft on a military installation and led pilot teams that have flown BVLOS research missions for NASA. SkySkopes also partnered with UND to conduct energy audits on-campus buildings to determine levels of heat loss and provide actionable data for plant management. Most recently, the company has been involved in research to fight COVID-19, working on the feasibility of using drones to spray disinfectant to kill the virus.

"SkySkopes' commitment to implementing technology to innovatively enhance everyday operations makes it an outstanding leader in the field," said Forde. "SkySkopes is very deserving of the Technology Innovator Award."

2019 Award Winners

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Each year, the Technology Council of North Dakota (TechND) presents awards to businesses and/or individuals who have made huge waves in North Dakota's tech landscape. While we highlighted 2020's award winners, we wanted to look back at the three 2019 award recipients who where recognized during the August 2019 State of Technology event in Fargo.

Premier Technology Business Award: Bushel

The 2019 winner of the Premier Technology Business Award was Bushel, an ag software company for grain retailers and growers. The Premier Technology Business Award recognizes a business that has achieved outstanding success by developing or providing technology business solutions, which Bushel certainly has achieved.

Formerly known as Myriad Mobile, Bushel was founded in 2011 in the North Dakota State University Incubator in Fargo. Since its humble beginnings, the agriculture technology company has grown and expanded to become a leader in software technology for the grain industry.

Bushel has become one of the leading technology businesses, not only in North Dakota, but in the nation. Bushel was named one of the Inc. 5000 Fastest Growing Companies in the U.S. three times and was named on Inc. Magazine's list of Best Places to Work in 2018. Having benefited more than 100 grain and agronomy companies in the United States and Canada and more than 14,000 farmers who utilize its service every month, this upward growth and continuous recognition is expected.

With this growth, Bushel has successfully raised more than $9 million in investments and is continuing to raise capital to help accelerate the brand as one of the nation's leading ag-players. In just the past three years, the company has had two successful acquisitions and exceeded its revenue growth by more than 300%.

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Technology Innovator Award: WEX Health

Winning the 2019 Technology Innovator Award is West Fargo-based company WEX Health. The Technology Innovator Award recognizes a non-technology specific entity that is a leader in the use of innovative technology to serve its primary customer. The winner, WEX Health, is a global leader in financial technology solutions, serving more than 28 million consumers and more than 343,000 employers across the United States and Canada. WEX Health takes the complexities of payment systems and simplifies them for ease of use.

In March 2014, WEX Health integrated Partner Central, a secure, self-service portal for WEX Health Partners, which provides sales, marketing and operations support. Since its implementation, more than 85 percent of WEX Health's hundreds of partners have enrolled in the portal and have enjoyed the many benefits from the portal. Such benefits include logging-in with personalized credentials, accessing hundreds of marketing materials, viewing and registering for events and webinars, accessing the WEX Health Cloud Mobile App reports, entering new or accessing existing technical and business operations support requests, quickly connecting with their partner account executive, and sharing ideas with the WEX Health product team.

By utilizing technology, what used to be a complex and robust system is now user-friendly and enhances everyday operations.

North Dakota Technology Champion Award: John J. Simmons, Carbontec Energy Corporation

The North Dakota Technology Champion Award recognizes an individual or entity that has championed the development of a North Dakota technology company, the promotion and/or use of technology in the academic realm or the delivery of technology to North Dakota citizens. In 2019, this award was presented to John J. Simmons of Carbontec Energy Corporation in Bismarck.

Founded in 1988 by John J. Simmons, Carbontec Energy Corporation has led the way in developing clean-energy and environmentally-friendly technologies for the energy industry. With more than a dozen patents in energy, coal, carbon dioxide reduction, iron nuggets production, wood products, chemicals, oil spill cleanups, and more, Simmons has certainly earned the recognition of being the Dakota Technology Champion Award recipient.

Under Simmons' leadership, Carbontec has developed technologies for the energy industry that have been commercialized in plant facilities producing more than $1.3 billion in bottom-line earnings. As a result, Carbontec's synthetic coal technology has been utilized to produce more than 12 million tons of synthetic coal per year. Carbontec is credited with developing the low carbon footprint E-Iron™ Process, in cooperation with Michigan Technological University, to use organic biomass in the place of coke or coal, minimizing the negative environmental impact of iron making.

Before Carbontec, Simmons graduated summa cum laude from Michigan Tech with a bachelor's degree in metallurgical engineering. He is a former director on the Theodore Roosevelt Medora Foundation Board of Directors and a former director on the University of Mary Board of Directors. He also received the North Dakota Entrepreneur of the Year Award from the University of Mary in 2005.

With environmentally-charged innovations at the forefront, Simmons' ability to identify a problem and use technology to solve it certainly has been beneficial to North Dakota, the nation and the globe.

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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*).

Matt Dunlevy
Chief Executive Officer, *SkySkopes*

Jake Joraanstad
Chief Executive Officer, *Bushel*

Areas of Growth in North Dakota

Two primary strategic areas of growth for North Dakota are agriculture and drone technology. While agriculture's impact on the tech industry dates back many years, it still maintains a critical role in being a training ground for further technological advancements.

"Advancements in agriculture will continue to be born and grow in North Dakota," said Jake Joraanstad, CEO of Bushel. "Technology companies are creating software and hardware solutions for agriculture and are allowing even more growth for agriculture in North Dakota."

This drive toward innovation originated among the bonanza farms of the North Dakota prairie as the region provided particular advantages for technological advancement.

"Many bonanza farms demonstrated new, cutting edge technologies that were in the early stages of development at the time," Joraanstad said. "Because of the flat land and deep, rock-free soil, machine manufacturers used bonanza farms to test new developments including the gang plow, large combines, various drills, and large steam tractors."

Bushel's mission is to connect and enhance the grain industry through digital infrastructure. Bushel is the only software company focused specifically on developing the digital infrastructure to standardize data in the grain industry.

"This increased standardization will breed innovation," Joraanstad said. "We've created software products and solutions that empower 35,000 farmers (and growing) across the U.S. and Canada to make critical decisions on their farm. And we're just getting started."

Emerging technologies are also playing a critical role on the prairie as drones have taken center stage. SkySkopes, based in Minot, has a mission to increase the reliability and efficiency of the national energy grid through unmanned aircraft systems (UAS).

"I see it as one of the most strategic areas of growth for any state as a mega-trend and a compelling one," said Matt Dunlevy, CEO of SkySkopes.

Dunlevy notes that the potential for drones is explosive and one of the most important industries for the state. With quantifiable success on multiple missions, North Dakota stands at the forefront of the drone industry.

"Our main mission sets are wildfire mitigation and using drones to do orbits around the transmission and distribution poles for utilities out on the west coast," said Dunlevy. "We're also using Lidar sensors to serve a lot of the assets in the oil and gas sector, particularly out in the Bakken. We've done different types of search and rescue missions in Minot. We used drones to help locate a missing child. We've also done UAS-based line stringing. So that's the robotic side to string a line, like a power line. We've even used drones to fight the virus by spraying disinfectants from the air."

Technologies, both traditional and emerging, are putting North Dakota at the forefront of technology innovation across the nation. These technological innovations set North Dakota apart from other states in regard to wages and sector growth.

Median Hourly Wage

With a median hourly wage of $33.25, North Dakota's technology employees receive wages competitive with several surrounding states, including Montana and South Dakota, but still fall behind Minnesota and the national average.

Median Hourly Wages (2019) [Table 7]

SOC	Occupation	ND	SD	MT	MN	US
11-3021	Computer and Information Systems Managers	54.01	65.44	48.20	68.45	70.37
15-1211	Computer Systems Analysts	31.86	35.33	34.49	44.57	43.71
15-1212	Information Security Analysts	40.84	43.35	33.32	48.76	47.95
15-1251	Computer Programmers	33.98	28.23	35.93	40.62	41.61
15-1256	Software Developers and Software Quality Assurance Analysts and Testers	40.53	35.96	39.92	49.37	51.69
15-1257	Web Developers and Digital Interface Designers	26.28	23.96	25.65	37.09	35.46
15-1244	Network and Computer Systems Administrators	34.87	29.59	32.16	40.80	40.15
15-1241	Computer Network Architects	41.14	49.97	42.73	54.86	54.18
15-1232	Computer User Support Specialists	22.07	18.29	21.36	26.67	25.13
15-1231	Computer Network Support Specialists	30.93	22.05	26.21	30.34	30.51
15-1299	Computer Occupations, All Other	31.27	37.13	31.16	39.54	42.57

Source: U.S. Bureau of Labor Statistics

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"Recently, NISC partnered with DCN to co-locate our data centers. During the transition to DCN's facilities, our Members saw absolutely no down time. We are very pleased to have such a safe, secure, and protected place for our Member's valuable data, and are grateful to have a partner we can count on. We look forward to a strong partnership with DCN into the future."

Dan Wilbanks
President/CEO, NISC

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Regional Competitive Growth

The regional competitive effect growth 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, and postsecondary computer science teachers. 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 8).

Regional Competitive Growth (2010-2019) [Table 8]

SOC	Occupation	National Growth	ND Growth	Regional Competitive Growth
11-3021	Computer and Information Systems Managers	145,300	-40	-145,340
15-1211	Computer Systems Analysts	93,260	-460	-93,720
15-1251	Computer Programmers	-134,080	50	134,130
15-1245	Database Administrators and Architects	21,380	-30	-21,410
15-1244	Network and Computer Systems Administrators	21,240	30	-21,210
15-1299	Computer Occupations, All Other	210,050	650	-209,400
25-1021	Computer Science Teachers, Postsecondary	-1,280	30	1,310

Source: Job Service North Dakota

Tech Occupation LQ

Location Quotient (LQ) compares an area's business composition to that of a larger area (Table 9). 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.

Tech Occupation LQ [Table 9]

SOC	Occupation	LQ 2019
11-3021	Computer and Information Systems Managers	0.38
15-1211	Computer Systems Analysts	0.27
15-1212	Information Security Analysts	0.33
15-1251	Computer Programmers	1.05
15-1256	Software Developers and Software Quality Assurance Analysts and Testers	0.35
15-1257	Web Developers and Digital Interface Designers	0.47
15-1245	Database Administrators and Architects	0.33
15-1244	Network and Computer Systems Administrators	0.58
15-1241	Computer Network Architects	0.25
15-1232	Computer User Support Specialists	0.99
15-1231	Computer Network Support Specialists	1.29
15-1299	Computer Occupations, All Other	0.75
25-1021	Computer Science Teachers, Postsecondary	1.42

Source: Occupational Employment Statistics, Job Service North Dakota

NORTH DAKOTA A LEADER IN TECHNOLOGY EDUCATION

Computing occupations are the number one source of all new wages in the U.S. and make up more than half of all projected new jobs in science, technology, engineering, and mathematics 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. North Dakota has been a national leader in many tech education initiatives.

COMPUTER AND CYBER SCIENCE EDUCATION INITIATIVE

The mission of the Computer and Cyber Science Education Initiative (CCS Initiative) is the widespread provision of these foundations for students. The CCS Initiative also strives to dramatically increase the number of high school students studying computer science and number of college graduates in the computer sciences area, including computer science teachers for North Dakota schools.

The CCS Initiative provides a foundation within K-12 institutions for students to acquire the base technology and security knowledge vital for the state's future workforce, no matter what career path is pursued. TechND's role is to advocate support for the CCS Initiative among its members.

TechND is a partner in the North Dakota CCS Initiative, which is led by the North Dakota Department of Public Instruction (DPI). TechND supports DPI's efforts to ensure all North Dakota students have a foundational understanding of computer science and security fundamentals based on new K-12 computer and cyber science standards and to integrate these fundamentals into other aspects of standard curriculum.

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, EduTech, Department of Career and Technical Education (CTE), Education Standards and Practices Board (ESPB), North Dakota University System (NDUS), and key legislative leaders.

HOW TECHNOLOGY DRIVES GROWTH AND INNOVATION IN NORTH DAKOTA

"Throughout history, technology has improved efficiency everywhere, especially here," said Lee Schwartz, director of marketing at Emerging Prairie, an organization that connects and celebrates the entrepreneurial ecosystem. "For example, improvements to the technology of extracting oil (fracking) made North Dakota one of the world's top oil producers and made our economy boom."

These advancements in technology also necessitate retaining the workforce in order to meet the needs of new technologies.

"North Dakotans have always proven to be adaptable," Schwartz said. "Our state's modern focus on agtech, aerospace, oil production, and software development have all brought job growth and innovation to North Dakota."

A comprehensive education in computer science and security fundamentals is crucial to fulfilling the responsibilities of new tech-focused jobs in North Dakota. Lisa Johnson, vice chancellor for Academic and Student Affairs at NDUS, detailed the knowledge required by those entering the tech industry.

"Individuals with a strong background in computer science are especially well-positioned to design solutions in response to new needs and opportunities stemming from the technological disruptions our society faces today," said Johnson. "In addition, individuals must be able to translate

Lee Schwartz
Director of Marketing, Emerging Prairie

Lisa Johnson
Vice Chancellor for Academic and Student Affairs, North Dakota University System

those ideas into successful entrepreneurial efforts through creativity, innovation and leadership. This requires an interdisciplinary approach to developing strong analytical, technical and computing skills as a means of expanding the next generation of innovators and an adaptive, resilient workforce."

PREPARING STUDENTS FOR THE WORKFORCE

Twenty years ago, only technology companies hired computer science roles. Now computer code is utilized in everything we do and every business interacts with computer science and cybersecurity.

"Nearly every large company now has a critical dependency on computer science," Schwartz said. "This has created a demand of over 700 open positions in North Dakota alone and our schools and universities only graduate a fraction of that amount each year, so the skills gap is increasing."

As new technologies arise, so does the need to educate the incoming workforce about how to best utilize these technologies. The curriculum is constantly changing as it adapts and accommodates to new discoveries and innovations in the tech industry.

"Due to the ever-changing needs in the workforce, digital literacy skills are now incorporated into more and more programs," said Wayde Sick, Career and Technical Education state director. "CTE programs are designed to teach students workplace skills, both present and future. CTE instructors incorporate digital literacy not only in their classrooms and labs but into Career and Technical Student Organization leadership events."

The increased emphasis on developing K-12 students' computer science skills has immensely benefited the NDUS. Students are now entering secondary education institutions with a proficient understanding of digital literacy.

"The NDUS encourages a continuation of best practices associated with digital literacy and has taken additional steps to safeguard student information including the use of dual authentication, single sign-on, tutorials, and a library of instructional modules that can be accessed by faculty, staff or students," said Johnson. "In the classroom, students routinely locate, assess and incorporate sources of information as it relates to their field of study. In partnership with the student association, the NDUS has implemented policies protecting students' personally identifiable information as well as the assurance of digital accessibility for all students. In short, by modeling the best practices in digital literacy, students should be more comfortable leading digital literacy efforts in the workforce based on their own educational experiences."

PROMOTING DIGITAL LITERACY AMONG THE INCOMING WORKFORCE

Several organizations across the state are taking the initiative to better prepare those entering the workforce. For Emerging Prairie, improving the human condition means upscaling the workforce.

"We host events that bring those interested in technology together and those collaborations have a multiplier effect of outcomes," Schwartz said. "We bring those interested in becoming entrepreneurs together to make them collectively better. Currently, a major part of that mission is to grow and nurture North Dakota's tech community."

In 2019, Emerging Prairie launched the Emerging Digital Academy, North Dakota's first and only software engineering boot camp that trains students for software engineer positions over 20 weeks. "Our first class of 12 students placed 11 into high paying, North Dakota jobs," Schwartz said. "Emerging Digital Academy is growing and will graduate 45-50 software engineers onto the teams of North Dakota employers."

NDUS also offers undergraduate and graduate-level degrees in computer science and entrepreneurship, in addition to certificate programs at both degree levels that are shorter in length and narrowly tailored to specific topics.

Wayde Sick
Career and Technical Education State Director

67%
of all new jobs in STEM are in computing

11%
of STEM bachelor's degrees are in computer science

90%
of parents want their child's school to teach computer science, but only 47% of high schools teach it

60%
of teachers believe students should be required to learn computer science

84% **PARENTS**

71% **TEACHERS**

believe offering computer science is just as important as required courses like math, science, history and English

Source: Code.org

Building the Workforce

There are plenty of resources offered by the state to prepare students entering the workforce and promote the continued education and advancement of the state's current workforce. The initiatives seek the betterment of North Dakotans and can be utilized by anyone seeking increased opportunity at any stage of their career.

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 ensure all North Dakota students have a foundational understanding of computer science and security fundamentals based on new KI2 computer and cyber science standards and integration of these fundamentals into other aspects of standard curriculum. TechND's role is to provide the industry voice, outreach on workforce needs and leadership on required policy changes.

K-20W Initiative

TechND is a strategic partner in the North Dakota K-20W Initiative, a statewide, comprehensive approach to cybersecurity education and workforce training. Code-named "K-20W" to reflect every student from kindergarten through Ph.D. and workforce, the K-20W coalition is comprised of more than 40 public and private sector participants, including TechND, who share a common goal of "Every Student. Every School. Cyber Educated."

Secondary Technology Education www.cte.nd.gov

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

"TechND has provided a much-needed industry voice to the K-20W Initiative," said Shawn Riley, North Dakota chief information officer. "The K-20W Coalition's focus on addressing the workforce needs of the tech industry is vital to developing the workforce of the future. This whole-of-government approach leveraging public sector and industry partners has resulted in national recognition and grassroots support that is unparalleled."

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 2019-20 school year, IT courses were offered in 64 schools serving 1,981 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.

The 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.

"Technology is ubiquitous in every occupation, in every profession, in almost everything we do in today's modern world," said Kirsten Baesler, North Dakota state superintendent of schools. "Our students must have an understanding of computer science and cybersecurity and know how to develop and apply computational thinking skills to solve problems. I have appreciated working with TechND to advance the Computer and Cyber Sciences Education Initiative."

Post-Secondary Technology Education www.ndus.edu

To help fill the workforce demand for individuals trained in computer science and related fields, 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 2018 – 2019, 482 students graduated with computer science or IT-related degrees in North Dakota.

The state legislature authorized $6 million in funds from the Bank of North Dakota to match contributions of private dollars for the ND Career Builders Scholarship and Loan Repayment programs for students willing to live and work in the state following graduation. The scholarship and loan repayment programs target in-demand occupations like computer science and related fields.

WORKFORCE TRAINING PROGRAMS

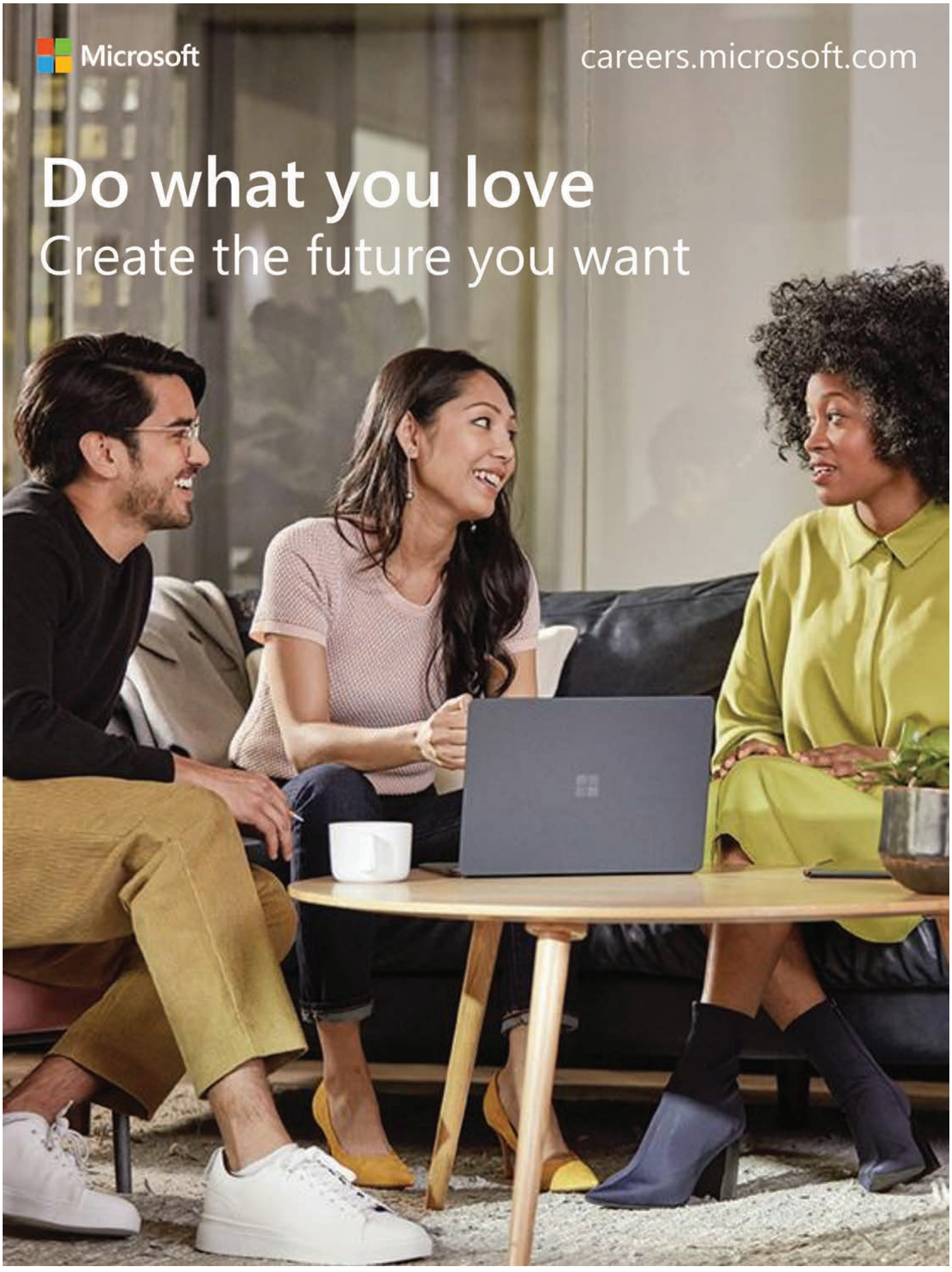
Job Service North Dakota www.jobsnd.com

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 2018 and 2019, 28% 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 years 2018 and 2019, WIOA provided 15 (PY2018) and 22 (PY2019) individuals with training opportunities in IT-related careers.

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 the fiscal year 2019, a total of 730 businesses were served by the program with 14,649 employees participating in training activities. TrainND has a loyal business base, with over half of businesses served in 2019 indicating a need for repeat or additional training. Training events and the reported responsiveness of TrainND to meet industry needs received a 98% satisfaction rate or higher at each of the four service regions in the state.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Soaring to New Heights: North Dakota a Leader in UAS Airspace Integration Efforts

Unmanned Aerial Systems (UAS) are rapidly changing the future of business in North Dakota. In 2019, North Dakota invested $33 million in UAS infrastructure to support a statewide beyond visual line of sight (BVLOS) operation, one of the largest UAS investments in the U.S. Today, drones are deployed across the state to aid in law enforcement search and rescue efforts, detect early signs of flooding, and provide safe and efficient means of inspecting oil pipelines and wind turbines.

Xcel Energy was one of the first energy companies to secure approvals from the Federal Aviation Administration (FAA) to conduct unmanned aircraft system (UAS) missions and is breaking new ground in the use of the technology. Xcel Energy was the recipient of the Technology Council of North Dakota's 2018 Technology Innovator award for its innovative use of technology to serve its primary customers.

At Xcel Energy, drones are being integrated into operations to enhance public and worker safety, improve reliability to customers and capture maximum efficiency gains. The company's UAS Program Office works within the company to deploy the technology across operations. Some examples include inspections of transmission lines, substations, gas pipelines, power plant boilers, wind farm components and other applications.

Xcel Energy's UAS missions over the past five years have demonstrated and proven that UAS technology can enhance inspection and maintenance processes, reduce customer costs and improve response times.

Xcel Energy operates and inspects 320,000 miles of electricity and natural gas infrastructure, more than 1,400 substations and dozens of power plants in its eight-state service area. While UAS are not expected to completely replace other inspection methods, they will be an essential tool. In a variety of circumstances, UAS have advantages over trucks, helicopters or fixed-wing aircraft, and they provide improved safety for workers, greater efficiencies and flights that are less intrusive to communities.

Prior to the FAA publishing rules for commercial use of drones, commonly known as "Part 107," the FAA granted individual exemptions and waivers that permitted limited drone operations within the operator's line of sight and within 400 feet of the ground. In 2016, Xcel Energy received the needed FAA permissions to fly research flights beyond those levels, becoming the first utility to conduct a "beyond the visual line of sight of the operator" (BVLOS) UAS mission. Those flights provided valuable data that enabled Xcel Energy to secure more complex BVLOS commercial approvals.

"The use of drones beyond the visual line of sight is a game-changer for Xcel Energy," said Eileen Lockhart, UAS program manager. "This innovative technology is revolutionizing our work by improving the safety, efficiency and cost-effectiveness of maintaining and protecting the grid for our customers."

In addition to using drones to inspect important infrastructure, Xcel Energy has also worked to test and demonstrate how drones could be used following a disaster, reducing the time for emergency and utility crews to respond and restore power. In North Dakota, Xcel Energy worked closely with the University of North Dakota, the Northern Plains UAS Test Site and many others as partners in researching possible solutions for such disasters. As a result of this partnership, Xcel Energy launched a live disaster response demonstration over Mayville, N.D., that coincided with the Drone Focus conference in Fargo during the summer of 2017. The research partnership includes Xcel Energy, the University of North Dakota, Elbit Systems of America,

General Electric, Northern Plains UAS Test site, SkySkopes and others.

This conference also played a key role in North Dakota and Xcel Energy being selected to participate in the FAA sponsored Integration Pilot Program (IPP). The IPP program was an opportunity for state, local and tribal governments to partner with private sector entities, such as UAS operators or manufacturers, to accelerate safe UAS integration. The North Dakota Department of Transportation (NDDOT), Xcel Energy and other key partners focused on addressing safety issues and developing protocol for beyond visual line of sight flights, unmanned operations over people and night flights within urban environments. Now that the IPP has concluded, NDDOT, Xcel Energy and others are looking forward to participating in the FAA's new Beyond Program, which will focus on enabling repeatable, scalable UAS BVLOS operations for critical infrastructure and package delivery.

"WE'RE EXCITED TO USE DRONE TECHNOLOGY TO BRING VALUE TO OUR CUSTOMERS BY IMPROVING ENERGY RELIABILITY AND SAFETY. THIS WORK INVOLVES COLLABORATION BETWEEN PUBLIC AND PRIVATE PARTNERS THAT WILL BENEFIT THE STATE, THE ECONOMY, OUR CUSTOMERS AND WORKERS, AND THE ENVIRONMENT FOR YEARS TO COME."
- Mark Nisbet

"OUR SUCCESS IN UAS RESEARCH ALLOWS US TO ADVANCE TECHNOLOGY WHILE KEEPING SAFETY AT THE FOREFRONT. WE LOOK FORWARD TO CONTINUE WORKING IN PARTNERSHIP WITH NORTH DAKOTA UAS LEADERS AND BUILDING A SAFER AIRSPACE WHILE DEVELOPING ECONOMIC BENEFITS FOR THE STATE."
- Bill Panos

What's Next

Thanks in part to North Dakota's existing UAS activities and investments, the United States Department of Transportation recently announced the NDDOT was selected as one of the participants in the UAS BEYOND Program.

BEYOND is the next phase of the UAS Integration Pilot Program (IPP), which will extend the federal program over the next four years. The pilot program was initially launched in 2017, to shape the future of UAS in America and enable agencies to work on policy to safely advance UAS operations, including BVLOS, flights over people and night operations.

Using innovative strategies, the IPP Lead Participants crafted successful safety cases to operate under the Federal Aviation Administration's existing regulations to conduct UAS operations that included package delivery, law enforcement support, infrastructure inspections, disaster damage assessments, agricultural applications and other missions. The data from these flights have informed ongoing rulemaking, policy and guidance and will continue to support future efforts.

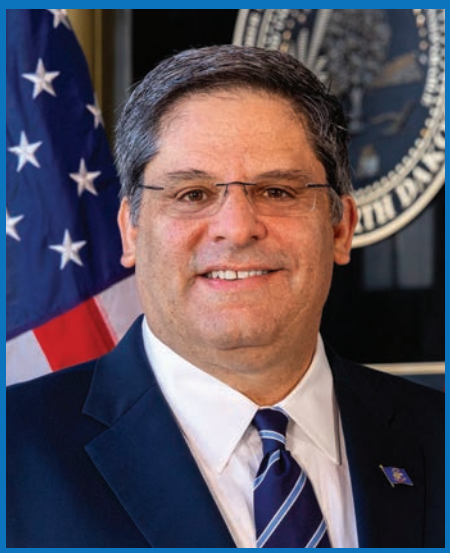
The UAS BEYOND program will focus on the steps necessary to facilitate scalable, repeatable and economically feasible BVLOS operations. This will involve leveraging Vantis, North Dakota's statewide UAS network. This first-of-its-kind network will facilitate safe and efficient BVLOS flights, giving North Dakota expanded capacity for complex operations. Key site implementation for Vantis is already in progress and, as it is built out to cover the entire state, UAS BEYOND will inform that development.

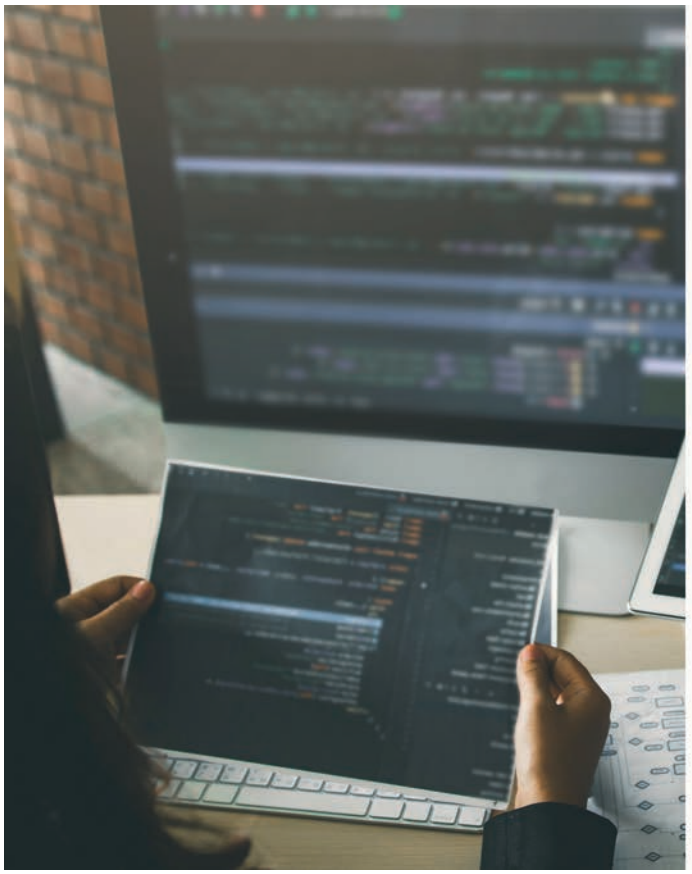
The BEYOND program will focus on advancing UAS BVLOS operations by performing three mission types:
- Infrastructure inspection,
- Public safety operations and
- Small cargo/package delivery.

BEYOND is an opportunity for state, local and tribal governments to partner with private sector entities, such as UAS operators or manufacturers, to accelerate safe UAS integration. BEYOND is expected to foster a meaningful dialogue on the balance between local and national interests related to UAS integration and provide actionable information to the U.S. Department of Transportation regarding the expanded and universal integration of UAS into the National Airspace System.

MARK NISBET
North Dakota Principal Manager, Xcel Energy

BILL PANOS
Director, North Dakota Department of Transportation





Helping North Dakota

FINANCE THE TECH INDUSTRY

ND-based Software as a Service (SaaS) companies can apply for the Accelerated Growth Loan by contacting their local lender.

You may use the loan to finance the acquisition of real property, remodel or expand an existing business if owner-occupied, purchase equipment, provide working capital or refinance an existing loan with a maximum amount that may not exceed 30 percent of the new loan.

BND.ND.GOV/BUSINESS

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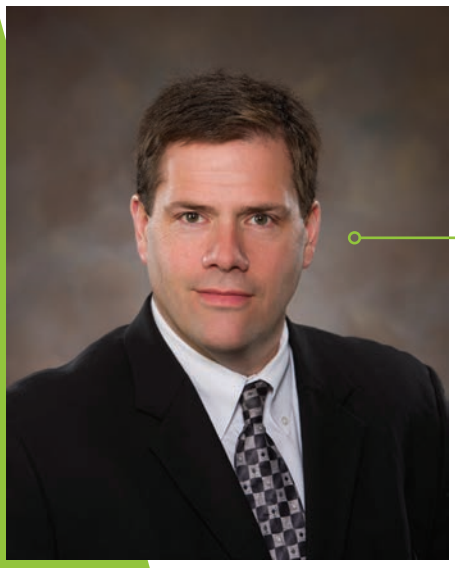

KURT SCHMIDT

Vice President of Information Technology, *Capital Credit Union*

Top 5 tech trends based on TechND membership polling:

I) Artificial Intelligence/Machine Learning
2) Cybersecurity & Data Privacy
3) 5G
4) Cloud Computing
5) Robotics & Automation

SHAWN RILEY

North Dakota Chief Information Officer

TechND polled its membership to determine what those working in the tech industry perceive to be the next big emerging trends affecting business, education and government operations in the future. With an increased reliance on infrastructure to keep us connected in this increasingly remote work environment, it's incredibly important to be one step ahead.

EMERGING

"The future of our state and our organization depends upon our ability to adapt to continual change and embrace transformational technologies like artificial intelligence (AI), machine learning, robotics, and automation. We have an opportunity as a state to not just modernize ancient technology infrastructure – we have an opportunity to entirely transform the citizen experience, to automate routine, mundane, commodity tasks through the adoption of emerging technologies, and by doing so, to secure and enable continued economic growth across sectors."
– Shawn Riley, North Dakota Chief Information Officer

1. ARTIFICIAL INTELLIGENCE MACHINE LEARNING

North Dakota technology leaders identified artificial intelligence (AI) as the top trend impacting their business or organization. The ability of machines to learn and act intelligently is one of the largest forces in emerging technology. AI is already very present in our daily lives and its potential is continually being evaluated. Navigation apps, streaming services, smartphone personal assistants, and ride-sharing apps are utilizing AI to perform tasks such as recognizing human speech and decision-making. AI can also be used to improve energy efficiency, predict maintenance and assess business risk.

So what's next for AI? Machine learning, a subset of AI, essentially programs computers to do something they were not programmed to do. The machines learn by discovering patterns in data. This technology can then be used in a variety of industries, such as data analytics and data mining. Machine learning can also be utilized for consumers to power web search results and detect network intrusions. According to Forbes, machine learning ranks among the top emerging jobs on LinkedIn.

"Cybersecurity and data privacy have always been important to us. With the increase in criminal cyber activity and phishing attempts, including an increase in COVID-related attacks, we are dedicated to spending more time and effort to ensure our systems and data are safe and secure. The privacy and security of our members and employees are our top priority, and that will require more resources in the future."
– Kurt Schmidt, Vice President of Information Technology, Capital Credit Union

2. CYBERSECURITY & DATA PRIVACY

Although cybersecurity isn't a new technology, it remains a fundamental tool to avoid ever-evolving threats. Businesses will continue to face new and unprecedented threats to cybersecurity well into the future as hackers develop new strategies. Mitigating these attacks will be critical to success in the next decade and beyond.

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"Midco has invested private capital in bringing Gig Internet and state of the art connectivity options to communities all across North Dakota. Additionally, we have invested in advanced fixed 5G wireless technology that allows us to reach farms, homes, and businesses up to 30 miles away from our fiber network."
- Justin Forde, Senior Director of Government Relations, Midco

3. 5G

The development of 5G will make supporting emerging technologies like augmented reality and autonomous vehicles possible. 5G builds upon 4G by offering ultra-low latency, increased network capacity, more reliability, and improved availability. This fifth-generation cellular network's faster and more reliable service will likely provide the opportunity for advances in many other emerging trends.

"[Gate City] Bank has been focusing on process automation. To support this initiative, we created several Business Process Improvement positions and a specialist in Robotic Process Automation. In the near future, along with process automation, we will be investing in cloud services. We will inevitably be seeking professionals that are familiar with cloud and cloud security principles."
- Ryan Goellner, Executive Vice President of Technology and Project Management, Gate City Bank

4. CLOUD COMPUTING

Cloud computing has become a mainstream technology in recent years, gaining popularity as more businesses migrate to cloud solutions. As the amount of data being stored on the cloud increases, the need for a new solution to the shortcomings of cloud computing becomes more pressing. In this sense, cloud computing has paved the way for the development of edge computing.

Designed to bypass the latency of cloud computing, edge computing uses a decentralized processing power, which enables users to process time-sensitive data in locations with limited or no connectivity. The use of edge computing will increase as the use of the Internet of Things becomes more widespread.

"Technology causes the workforce to retrain and upscale to meet the needs of the new technology, and we're seeing that here more than ever. Robotics and better technology don't eliminate jobs, it simply forces everyone to become good at something new."
- Lee Schwartz, Director of Marketing, Emerging Prairie

5. ROBOTICS & AUTOMATION

Robotics, once utilized primarily in industrial settings, are now becoming more common in commercial settings like package delivery. The commoditization of robotic technology may lead to future work being done by humans and robots collaboratively. Researchers are able to program robots that can perform tasks and interact with their environment independent of human intervention.

EXPANDING AND ATTRACTING BUSINESS

As the tech industry thrives in North Dakota and more businesses move into the state, more resources have become available to aid the continued growth of this industry. The North Dakota Department of Commerce and the North Dakota Tax Department offer several incentives that can be an asset for both new entrepreneurs and established businesses alike.

North Dakota Department of Commerce

www.ndcommerce.com

Innovate ND awards dollars to North Dakota-based entrepreneurs and innovators working on a new concept and wanting access to Entrepreneur Center resources (North Dakota State University, University of North Dakota, Bismarck Center for Technology and Business, Jamestown Regional Entrepreneur Center), assistance on the Business Model Canvas, business planning tools, prototype development and an entrepreneurial ecosystem. Innovate ND awards dollars through a voucher and grant system. Vouchers are issued in Phase I, II and III, and grants are issued in Phase IV. 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 three phases. More information about the program can be found at www.InnovateND.com.

Innovation Technology Loan Fund (LIFT) - LIFT is an innovation loan fund to support technology advancement put in place by the 2019 legislative session. LIFT is a $15 million fund established for the purpose of providing financing for the commercialization of intellectual property within the state of North Dakota. The legislation outlines the following industries as appropriate uses for these funds: advanced computing and data management, agriculture technology,

autonomous and unmanned vehicles and related technologies, energy, health care, value-added agriculture, value-added energy and any industry or area specifically identified by the committee as an industry that will contribute to the diversification of the state's economy.

North Dakota Tax Department

www.nd.gov/tax

Income Tax Incentives

Angel Investor Investment Credit – (Note: This program replaced the angel fund investment credit program, effective July 1, 2017.) Qualified early- or mid-stage private, non-publicly 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 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 of 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/Expanding Business Income 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 North Dakota Commerce Department certifies as producing new wealth in North Dakota by using 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 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. For tax years 2019 and after, the credit may be calculated under an alternative simplified method with lower credit percentages.

Seed Capital Investment 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 the 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/Expanding Business Income 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 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 Tech 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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