Center on Rural Innovation

RURAL AMERICA'S TECH EMPLOYMENT LANDSCAPE:

HOW TO INCREASE TECH TALENT AND TECH EMPLOYMENT

EXECUTIVE SUMMARY

Technological innovation and its corresponding employment have been strong drivers of economic growth over the last 15 years. Yet most of this growth has occurred in metro areas and been especially concentrated in a few superstar cities. Even with the rise of remote work during the COVID-19 pandemic, rural and micropolitan areas are lagging behind metro areas in tech employment. There is more and more digitalization across occupations and industries as technology is adopted throughout different roles and sectors, but current evidence suggests that rural areas will not increase their share of tech employment without intentional efforts to grow both the demand for tech workers and the supply of tech talent in rural places. This challenge and opportunity becomes especially urgent when considering that tech jobs provide significantly higher wages than many non-tech jobs in rural places, and fostering opportunities in tech can help to diversify local economies, contribute to the creation of jobs across sectors, and offer greater economic opportunities to rural households. Without a concerted effort to grow tech economies in rural areas, the economic disparity and opportunity gap between rural and urban places will only continue to grow.

> Tech jobs refer to jobs in which people help to design, build, and maintain computer hardware and software systems, such as web developers, cybersecurity specialists, and database administrators.

At present, historic levels of federal funding are available to help expand rural broadband and boost innovation and economic growth. By developing a focus on tech-based innovation and job growth that leverages broadband, local and federal leaders working to strengthen rural communities can also strengthen our national economy by making two key strides. First, they can promote a more geographically equitable distribution of economic opportunity which, in turn, can decrease regional inequality and make it possible for all kinds of people to live and thrive in rural communities. Second, they can leverage the talent and perspectives of rural people to strengthen the labor supply, boost productivity, and contribute to innovation, ultimately supporting wealth creation in the long term. Yet, so far, there is too little attention paid to understanding the current tech employment landscape in rural America. This begs the question, from the perspective of employers, workers, training providers, and tech students, what is the current state of tech employment in rural places? And how can rural communities increase participation in tech training and careers to grow the local talent pool?

This report, created by the Center on Rural Innovation (CORI) with support from the Ascendium Education Group, seeks to answer these questions and identify how rural communities can foster local economic development through the growth of tech-based businesses and tech employment. Through a national survey of rural adult residents, a regional survey to rural employers, economic analysis of labor market data, and more than 50 conversations with rural residents connected to the tech field, we seek to build foundational knowledge for rural leaders, local training providers, policymakers, and funders on how to create strategies to ensure that rural areas have a way to reap the economic benefits of contributing to the tech economy. The findings in this report fall under four major themes about the demand for tech work and the supply of tech talent in rural places:

1. The role of rural employers is critical:

Rural employers in non-tech industries employ a significant portion of rural residents — yet they could be employing more because they are understaffing people in tech roles.

2. Rural Americans are interested in tech:

Rural residents express a high level of interest in tech jobs and careers, but people who have more awareness of and exposure to tech work are more likely to act on this interest.

3. Rural tech workers take a variety of paths into the field:

Rural learners and employers benefit from having access to a combination of different training methods and programs to develop tech skills that meet industry needs.

4. Lowering barriers for rural learners is essential:

Rural learners find that the two largest barriers to tech training are cost and time commitment — lowering these barriers helps to grow and diversify the tech talent pool.

Based on the findings from this study, we set forth recommendations for different stakeholders who all have a role to play in boosting tech employment in rural areas:

Priorities for local leaders:	Priorities for local training providers and partners:	Priorities for policymakers and funders:
ADDRESSING THE DEMAND FOR TECH TALENT IN RURAL MARKETS		
Identify where there is untapped potential for tech employment in the region.	Provide career support and connections to employers.	Create and advocate for federal policies and programs that encourage tech adoption and direct more federal funding to support the growth of tech employment in rural tech-based businesses and rural firms in core non-tech sectors.
Invest in efforts designed to increase tech-based innovation and entrepreneurship.		Incentivize federal agencies to contract with rural tech firms, incentivize federal contractors to source talent in rural areas and establish tax credits for firms that employ rural tech workers.
		Commission additional research to better understand why rural employers in core non-tech industries are not investing in tech staff at the rate that national data suggests they should be.
ADDRESSING THE SUPPLY OF TECH TALENT IN RURAL PLACES		
Identify industry leaders and employers willing to partner with local institutions on work-based learning and non-traditional training programs for tech workers.	Build in intentional efforts to diversify tech trainees from the start.	Invest in industry-driven training models that are more accessible to rural adults.
Increase the visibility of the local tech community through both virtual and physical spaces.	Create collaborative, cohort-based learning models to optimize the learning outcomes for rural tech learners.	Invest in elementary and secondary school programs that expose young people to working with technology and introduce them to various tech roles and concepts.
	Make training more accessible to working adults or those reentering the workforce to widen the talent pipeline.	Fund the development of physical coworking spaces and onsite programming in highly visible downtown locations to support the growth of a tech ecosystem.

This report does not have all the answers, nor did we expect it would. Rather, we hope that the insights and questions presented here provoke further study as well as active, funded collaborations aimed at expanding demand for tech talent in rural places as well as the supply of a diverse, rural tech workforce. This will require support for rural leaders, employers, and learners, along with a national-level commitment to boosting tech employment and diverse tech talent in rural places. We hope this report sets us on a path to do so.

CONTEXT: RURAL ECONOMIES, TECH JOBS, AND TECH-BASED ECONOMIC DEVELOPMENT

Year after year, technological innovation proves to be a driver of prosperity for regional economies across the U.S. in terms of job creation, wealth creation, and higher earnings. The U.S.' digital economy[1] grew 3.5 times faster than the overall economy between 2005 and 2019, and today accounts for 7.7 million jobs and $2 billion in the U.S. GDP.[2] Computer occupations are expected to grow about three times as fast as the national average,[3] creating outside economic impact in part because for every one high-tech job created, three to five additional jobs are created by other firms locally.[4] [5] Yet, growth in technology jobs has been predominantly centered on a small number of "superstar" major metro areas like Silicon Valley, California, Boston, Massachusetts, and Seattle, Washington (Figure 1), although, since the COVID-19 pandemic, tech employment has also grown in number of mid-sized cities and college towns.[6] [7] When — and if — this type of economic growth happens in rural communities, it can be a catalyst for both households and broader communities because of the financial benefits that tech jobs and scalable tech businesses offer, which is particularly true for rural places that have faced disproportionate hardship in the years following the 2008 recession.

1 In its definition of the digital economy, the Bureau of Economic Analysis (BEA) includes three major types of goods and services: "Infrastructure, or the basic physical materials and organizational arrangements that support the existence and use of computer networks and the digital economy, primarily information and communications technology (ICT) goods and services; E-commerce, or the remote sale of goods and services over computer networks; and priced digital services, or services related to computing and communication that are performed for a fee charged to the consumer."

2 Bureau of Economic Analysis (BEA). (2021). Updated digital economy estimates — June 2021. Digital Economy. Special Topics.

3 Zilberman, A., & Ice, L. (2021). Why computer occupations are behind strong STEM employment growth in the 2019—29 decade. Computer, 4(5,164.6), 11-5.

4 Moretti, E. (2012). The new geography of jobs. Boston: Houghton Mifflin Harcourt.

5 Bartik, T., & Sotherland, N. (2019). Local job multipliers in the united states: Variation with local characteristics and with high-tech shocks. Upjohn Institute Working Papers.

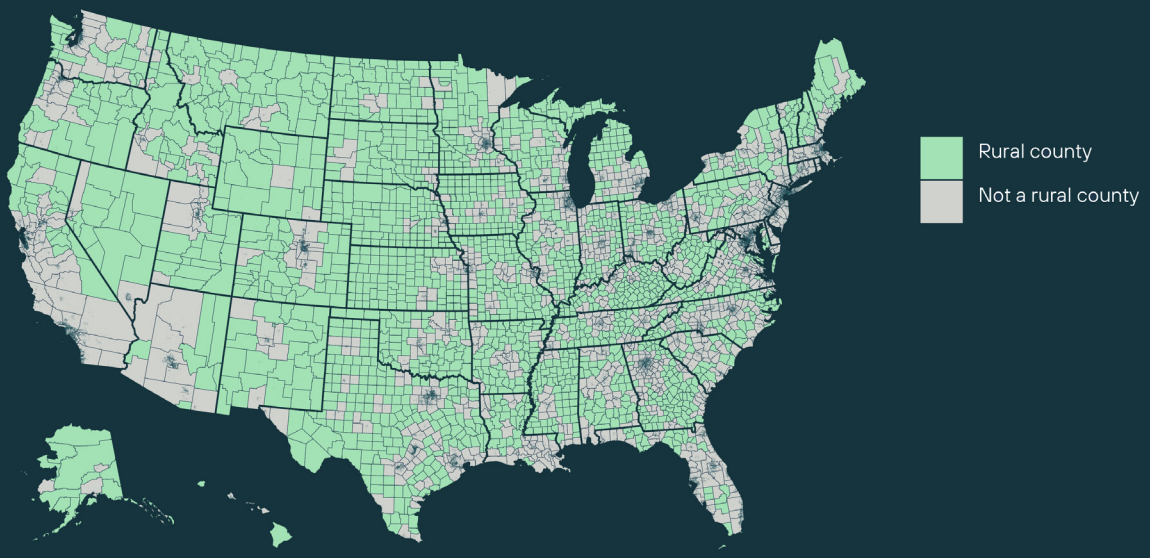
6 Muro, M. & You, Y. (2022). Superstars, rising stars, and the rest: Pandemic trends and shifts in the geography of tech. Brookings.

7 For more information, see Center on Rural Innovation. (2022). The Geography of Innovation in Rural America.

Figure 1

Geographic distribution of computer and math jobs, 2019

Dots shaded according to number of computer and math jobs in census tract



(Source: American Communities Survey 2019 5-year estimates)

Employment in tech jobs (see "Definitions," Page 5) offers individual workers a pathway to higher earnings and stronger employment prospects over time. The median earnings for tech jobs are more than double the national median earnings of all jobs,[8] and technology's impact on earnings transcends tech occupations. Workers in non-tech jobs that use a greater degree of technology (highly digital jobs) to perform their jobs earn more than workers in jobs that use less technology (low-digital jobs). In 2016, the average annual wage for those in highly digital jobs, like software developers and financial analysts, was $72,896, relative to $48,274 for middle-level digital jobs (like sales managers and nurses). For low-digital roles (like construction workers and personal care aids) the average annual wage was $30,393.[9] The wage differential holds up in rural markets as well. In rural areas, 2019 data showed that the average median income for highly digital jobs was $54,831 compared to the average median income of $25,273 for low digital roles in rural areas (Figure 2).[10] This stark difference in earnings exemplifies why access to local tech jobs and skills development is so important to elevate local economies in rural places.

8 American Communities Survey (2019). Occupation by sex and median earnings in the past 12 months (in 2019 inflation-adjusted dollars) for the civilian employed population 16 years and over. 2019 1-Year estimates Subject Tables.

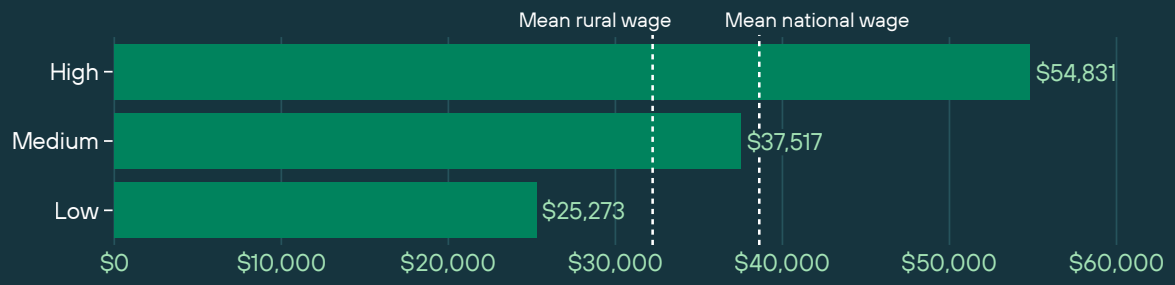
9 Muro, M., Liu, S., Whiton, J., & Kulkarni, S. (2017). Digitalization and the American Workforce. Metropolitan Policy Program at Brookings.

10 CORI analysis using Muro et. al. (2017) classifications, ACS 2019 data.

Figure 2

Mean annual wage of rural workers by digitalization level

Avg. median earnings in the past 12 months in 2019 inflation-adjusted dollars



(Source: CORI analysis using Muro et. al. (2017) classifications, ACS 2019 data)

DEFINITIONS

There are a wide array of definitions used around tech employment and skills. Sometimes terms are used by government agencies in their statistical analyses, and other times they are used by training programs to describe offerings. In this report, we want to be clear about exactly what we are referring to when we use them:

- Tech jobs refer to jobs in which people help to design, build, and maintain computer hardware and software systems, such as web developers, cybersecurity specialists, and database administrators. These jobs exist both within companies in the tech sector that sell technology products and services, and across all industries that use different sorts of technologies, i.e., non-tech sectors. In this report, we use the "computer and mathematical occupation" grouping from the Bureau of Labor Statistics Occupational Employment Statistics (OES) and the American Communities Survey (ACS) to understand the prevalence of tech jobs in rural places.[11]
- Tech skills refer to the skills that are necessary to perform tech jobs, i.e., to design, build, and maintain computer hardware and software. These skills include data analysis and management, software development, computer programming, and digital security and privacy. In addition to tech skills, tech jobs also require an array of "business enabling" skills, as well as "human skills" around communication, collaboration, and creativity.[12] These human skills are critical, as emotional intelligence, adaptive learning, and creative problem solving are far more difficult to automate and help employees differentiate themselves from the jobs of computers.[13]
- Digital skills refer to the basic skills required to use technology to perform a task. While the level of digital skills required to perform a task or succeed in a particular occupation varies, there is widespread understanding across occupations and industries that workers lack digital skills.[14] Examples of digital skills can range from basic email literacy to utilizing Microsoft Office tools, to using an online software application, and problem-solving when you encounter challenges.

11 U.S. Bureau of Labor Statistics. (2020). Occupational Employment and Wages, May 2020. Occupation Employment and Wage Statistics.

12 Burning Glass Technologies. (2015). Crunched by the Numbers: The Digital Skills Gap in the Workforce.

13 Muro, M., Liu, S., Whiton, J., & Kulkarni, S. (2017). Digitalization and the American Workforce. Metropolitan Policy Program at Brookings.

14 Bergson-Shilcock, A. (2020). The New Landscape of Digital Literacy. National Skills Coalition.

Historically, rural economies and workers have been left out of the economic benefits created by the growing tech economy. Between 2014 and 2019, 96% of tech jobs created were in metropolitan areas, while only 4% were in rural counties.[15] [16] And even though 12.5% of the current American workforce lives in rural areas, these rural areas only account for 5% of tech workers.[17] This is important, because not only are tech jobs high paying, but they are also tied to the creation of new technology products and services that can generate economic growth. As of today, computer and math occupational forecasts project that rural areas will gain low-wage service jobs while missing out on their share of more lucrative tech job growth (Figure 3). Notably, the industries that are projected to have the largest growth in computer and math occupations make up a relatively low share of rural employment, meaning rural areas are not expected to benefit from the tech job growth in these industries (Figure 4). This differential signals that the economic disparity and opportunity gap between rural and urban places will continue to increase without a concerted effort to grow tech-intensive businesses and jobs in rural areas. In other words, rather than just passively experiencing new automated technology as a disruptive force or working in lower-level technology support jobs, rural people and places need to be part of actually creating the technology that can lead to new business starts, business growth, and strong job prospects locally.

This idea of having rural places as technological innovators is feasible and realistic — rural places and people are rich in innovative ideas and potential. Across rural counties, technology jobs were the third fastest growing occupation between 2014 and 2019,[18] [19] and venture capital in rural areas grew from $3.2 billion to $42.5 billion between 2017 and 2021 – an increase from 0.5% to 2.5% of total venture capital across the U.S.[20] Furthermore, rural communities are increasingly making tech-based economic development a central part of their local economic development efforts. In Red Wing, Minnesota, a local nonprofit has been building out regional collaboration efforts to provide support to tech entrepreneurs across southeast Minnesota — which to date has reached nearly 350 entrepreneurs.[21] In Ada, Oklahoma, local leaders from the governments of city of Ada and the Chickasaw Nation have committed money and time to developing opportunities in tech jobs;[22] and in Cape Girardeau, Missouri, Codefi's Youth Coding League has engaged nearly 2,500 students in computer science and coding after school programs to build a tech talent pipeline across a rural region.[23] There are talented people in rural communities who could be contributing to the economy more productively through tech, but many have not had access to the tools and support to get there.

15 American Communities Survey (2019). Occupation by sex for the civilian employed population 16 years and over. 2019 1-Year estimates Subject Tables.

16 American Communities Survey (2014). Occupation by sex and median earnings in the past 12 months (in 2014 inflation-adjusted dollars) for the civilian employed population 16 years and over. 2014 1-Year estimates Subject Tables.

17 American Communities Survey (2019). Occupation by sex for the civilian employed population 16 years and over. 2019 1-Year estimates Subject Tables.

18 Ibid.

19 American Communities Survey (2014). Occupation by sex and median earnings in the past 12 months (in 2014 inflation-adjusted dollars) for the civilian employed population 16 years and over. 2014 1-Year estimates Subject Tables.

20 Robb, A. (2021). Rural Entrepreneurship and the Challenges Accessing Financial Capital. U.S. Securities and Exchange Commission.

21 Center on Rural Innovation. (2022). The Case for Rural: Red Wing, Minnesota.

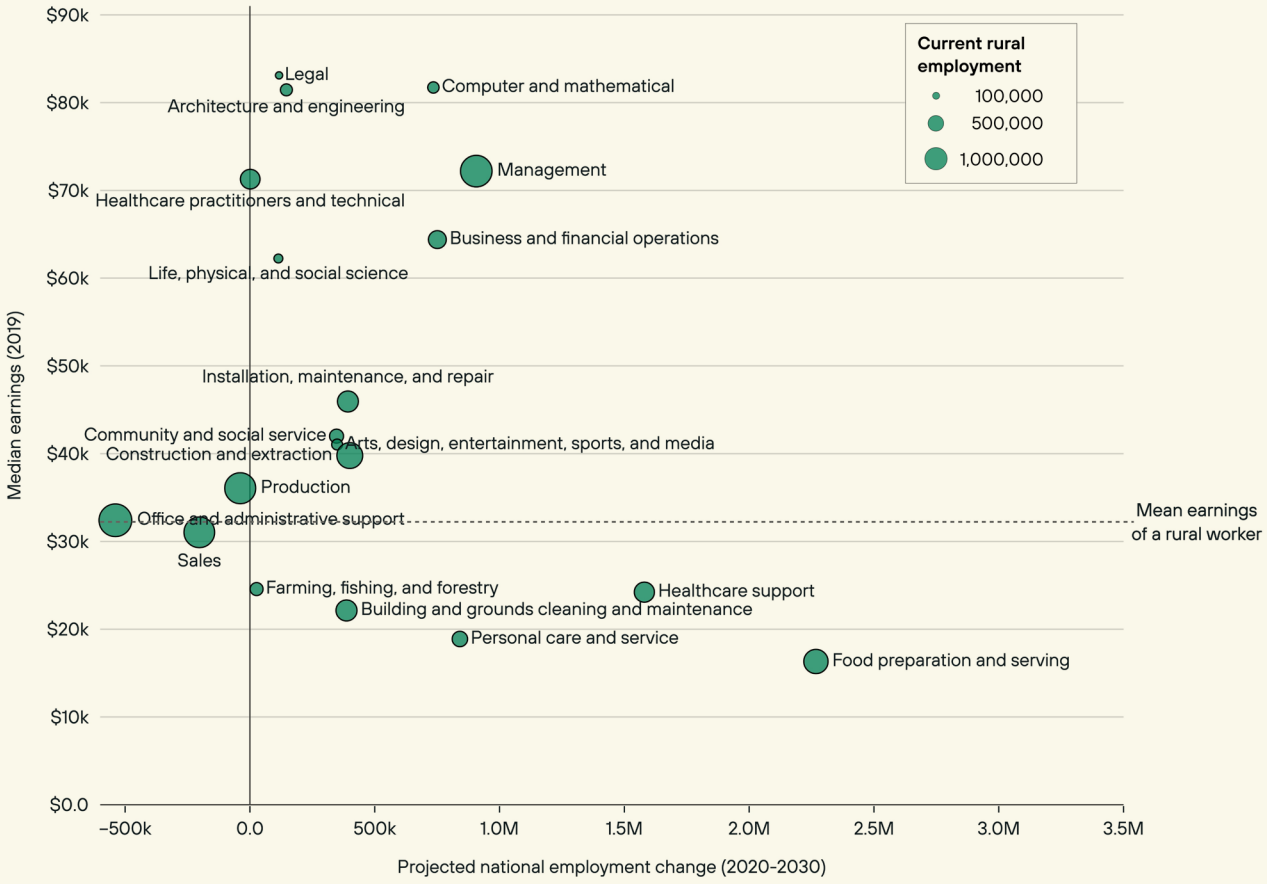
22 Center on Rural Innovation. (2021). The Case for Rural: Ada, Oklahoma.

23 Codefi. (2022). Youth Coding League.

Figure 3

Rural areas projected to gain low-wage service jobs while missing out on lucrative tech job growth

Projected national employment change (2020-2030) vs. median earnings (2019) by occupation

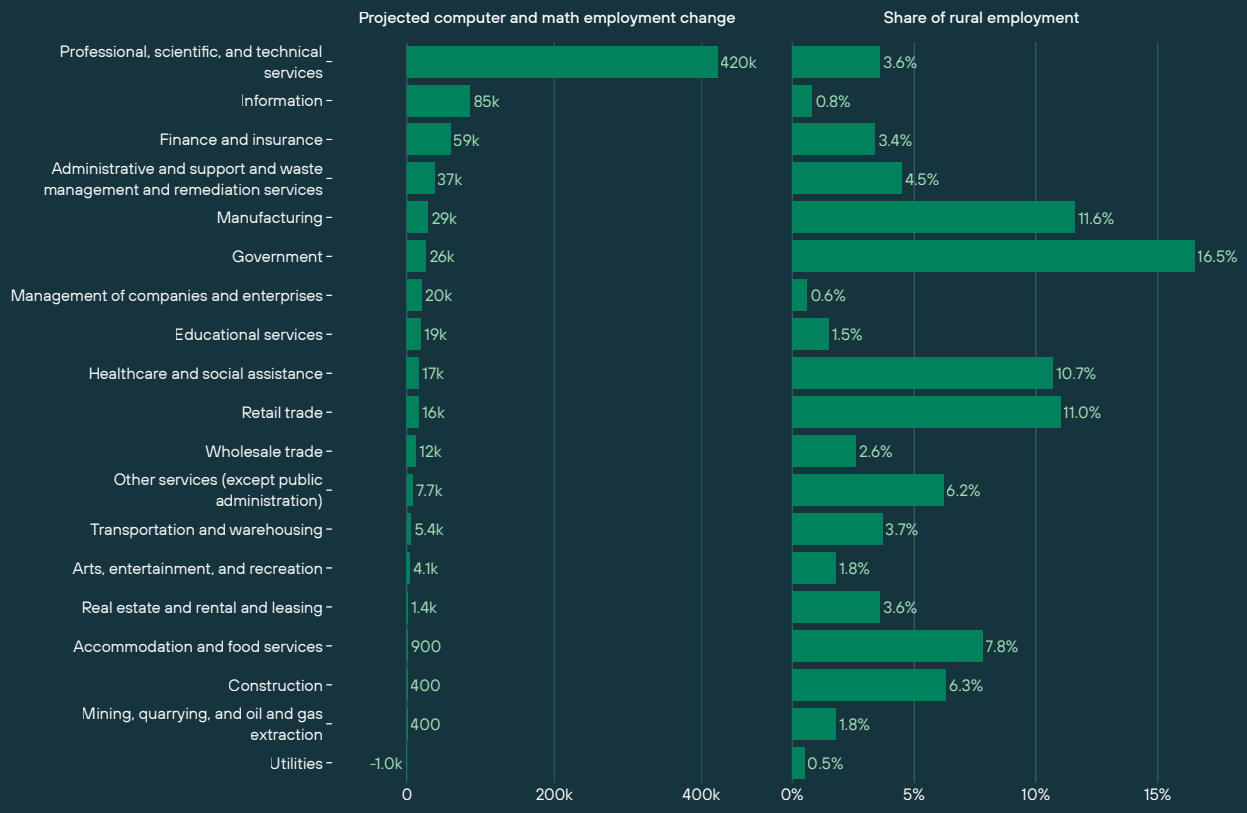


(Source: CORI analysis of American Communities Survey 2019 5-year estimates and Bureau of Labor Statistics employment projections)

Figure 4

Large rural industries projected to miss out on growth in computer and math employment

Projected computer and math employment change (2020-2030) compared to the share of rural employment (2019) by industry



(Source: CORI analysis of American Communities Survey 2019 5-year estimates and Bureau of Labor Statistics employment projections)

This report, created by the Center on Rural Innovation (CORI) with support from the Ascendium Education Group, seeks to build knowledge around how rural communities can foster local economic development and support the livelihoods of rural residents through the growth of tech-based businesses and tech employment. This study centers on answering two foundational questions:

- **What is the current state of tech employment in rural places, and how does it inform understanding about what is needed to increase rural tech employment?**
- **How can rural communities increase diverse participation in tech training and careers to grow the local talent pool?**

The report draws on a several streams of research, including a national survey to rural adult residents and regional surveys to rural employers, analysis of labor market data, and conversations with rural tech workers, employers, educators and training providers in three specific communities: Portage County, Wisconsin; Bulloch County, Georgia; and Cape Girardeau County, Missouri.

Establishing clear answers to these questions can offer new insights into economic development strategies and contribute to reversing downward trends in rural employment and wages. As leaders at the national and local levels seek to understand how to strengthen rural economies, it is important to consider how technology impacts economic development.

What types of leaders are engaged in growing rural tech jobs and training — and who should be engaged?

In conversations about economic development, the term "leader" is thrown around quite often. But it is important to understand the specific types of professionals who have a stake, or should have a stake, in rural tech-based economic development on the local, state, and national levels.

STATE AND LOCAL LEADERS	NATIONAL LEADERS
• Economic development agencies • Regional planning officials agencies • Local chambers of commerce • Workforce development professionals • Municipal and county elected officials • Higher education officials • K-12 public school leaders • State-level economic development and business officials • State departments of commerce • State education leaders • Philanthropic leaders	• Congressional staffers and federal agency staff at: o Department of Commerce o Department of Agriculture o Department of Labor o Department of Education o Department of Treasury o National Science Foundation o Cybersecurity and Infrastructure Security Agency (CISA) o Small Business Administration o Office of Management and Budget, and Domestic Policy Council • Private sector tech employers • Philanthropic leaders

In this report, we consider two ways in which technology-based economic development strategies can strengthen rural economies.

First, we focus on the challenges and opportunities for increasing employment in core tech jobs that design, build, and maintain technology — such as software or computer systems. As noted, businesses and jobs that create technology have had an outsized impact on regional economic prosperity. Technological innovation also has an impact on employment and wages. While automation technologies can create significant economic benefits through increased productivity, automation is also associated with a decline in middle-income jobs and wage polarization.[24] Because of industry and occupation composition in rural places, rural counties and rural workers are more susceptible to the negative impacts of automation, including declining employment and stagnant wages: The occupations most likely to be impacted by automation (food preparation, production, office and administration support, farming, transportation, and construction) accounted for 43% of

24 Autor, D.H., (2015). Why are there still so many jobs? The history and future of workplace automation. Journal of Economic Perspectives, 29(3), 3-30.

total employment in rural areas in 2019, compared to just 34% in metro areas.[25][26] Thus, rural areas need strategies that enable them to reap the economic benefits of the creation of new technology, including automation, instead of merely experiencing the adverse impact of automation.

THE 'WHERE': WHAT WE MEAN WHEN WE SAY 'RURAL'

The U.S. federal government has over 15 definitions that it uses across policies, programs, agencies, and departments to define rural. In this report, we generally consider "rural" to be counties defined as non-metropolitan by the U.S. census that have an urbanized population of 50,000 or less. This broad definition encompasses a lot of diversity, from small towns to remote areas far from a major metro area. Yet, this is an imperfect definition, and there are areas that fall just above the "rural" threshold that are "rural in nature." For example, we include Cape Girardeau, Missouri, a town of 40,000 people, in this study even though it is technically in a metropolitan county that just exceeds that rural definition.

The second way that we consider how tech-based economic development strategies can strengthen rural economies is by considering the broader impact that technology has on non-tech jobs as a result of "digitalization," or the expansion and use of digital technologies in all different types of jobs, industries, and facets of life.[27][28] Nationally, employment in occupations that used a high level of digital skills increased from less than 5% to 23% of employment between 2002 and 2016, and in occupations that involved low amounts of technology declined from almost 56% to less than 30% of employment.[29] In other words, digital skills are becoming increasingly essential for jobs across nearly all industries and geographies. This digitalization of non-tech jobs and industries has important implications for rural economic development. In order to stay competitive, rural businesses and industries will need to leverage technology, which means they will need a digitally skilled workforce to do so. Likewise, rural workers who are better able to use technology in their work will earn more and have greater job prospects. To prepare rural workers for the jobs of the future, they will increasingly need skills related to using technology, even if they are not working in a tech job creating, building, and maintaining technology — and tech training and education are at the center of this challenge. In thinking about how to accomplish these objectives, it is important to first develop a solid understanding of the realities of tech employment in rural places, from the perspective of tech workers, employers, and training providers.

Increasing economic opportunity through technology-driven development in rural areas doesn't just matter for rural people and places, it is also vitally important to our national economy. Economic research suggests that within high-income countries, regional inequality is detrimental to economic growth.[30] The regions that lag behind are less equipped to respond to negative economic shocks,

25 CORI analysis of Muro et. al. (2019) and American Communities Survey (2019).

26 For more information on automation, see Center on Rural Innovation. (2022). Automation in Rural America.

27 Muro, M., Liu, S., Whiton, J., & Kulkarni, S. (2017). Digitalization and the American Workforce. Metropolitan Policy Program at Brookings.

28 Gartner, Inc. (2022). IT Glossary: Digitalization.

29 Muro, M., Liu, S., Whiton, J., & Kulkarni, S. (2017). Digitalization and the American Workforce. Metropolitan Policy Program at Brookings.

30 Brueckner, M., & Lederman, D. (2018). Inequality and economic growth: the role of initial income. Journal of Economic Growth, 23(3), 341-366.

which includes those shocks driven by technological change.[31] As Treasury Secretary Janet Yellen recently remarked when making the case for "modern supply side economics," forecasts suggest that U.S. economic growth will be sluggish, hindered by slow productivity gains and a restricted labor supply.[32] To address this reality, she and others argue for the need to invest in infrastructure and human capital, particularly in places and people that have experienced historic underinvestment, in order to boost labor supply and raise labor productivity. By ensuring that a diverse array of rural people and places are fully contributing to tech-based economic growth, there can be a more equitable distribution of opportunity to strengthen the national economy, as well as its social and political cohesion.

METHODOLOGY

When seeking to understand how to grow a diverse talent pool of tech workers and strong tech employment in rural places, it is essential to turn to those who best know the context: the workers, employers, learners, and training providers living and working in rural places. Following preliminary data analysis and a series of discovery interviews with stakeholders in multiple rural regions around the country, we conducted both qualitative interviews to capture lived experience, and quantitative surveys to capture the breadth of views across rural adults and rural employers. In addition, to explore tech employment among non-technology sectors in rural areas, we obtained a custom data set for analysis through the labor market research firm EMSI Burning Glass (EMSI BG).

We fielded two surveys. First, the Rural Adult Survey was designed to measure rural adults' awareness of and interest in tech jobs and training. In December 2021, a representative panel of 1,213 rural residents over the age of 18 from across the U.S. completed this online survey. The results from the survey are generalizable. The second survey, the Rural Employer Survey, was designed to gather insight into rural employers' views on technology and their talent needs. We fielded the Rural Employer Survey in nine communities, including many that are part of CORI's Rural Innovation Network. In January 2022, 110 rural employers across many industries completed the Rural Employer Survey.[33] Although this second survey provides important insight into employer perspectives, particularly when viewed in context with our qualitative interviews, its limited scope makes the results non-generalizable.

To enrich the insights from the survey data, we held 56 interviews with a range of stakeholders in rural communities, most heavily in Stevens Point, Wisconsin (Portage County); Statesboro, Georgia (Bulloch County); and Cape Girardeau, Missouri (Cape Girardeau and Scott counties). This involved in-depth conversations with the staff of rural organizations involved with tech training and employment institutions, including Code Labs in Cape Girardeau, Southern Automation Logistics and Technology (SALT) in Statesboro, and University of Wisconsin-Stevens Point. We also interviewed rural learners and program managers affiliated with two rural pilot programs run in partnership with national training providers to gain insight into tech training programs that are not place-specific.

For more information on methodology, see Appendix C.

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31 Bluedorn, J., Weichen, L., Novta, N., Timmer, Y. (2019) Widening Gaps: Regional Inequality within Advanced Economies. IMFBlog.

32 Yellen, J. (2022, March 4). Remarks by Secretary of Treasury Janet L. Yellen at Stanford Institute for Economic Policy Research's 2022 Economic Summit. U.S. Department of the Treasury.

33 It is important to note that 74% of responses came from two rural communities combined: Taos, New Mexico and Emporia, Kansas.

STUDY FINDINGS: THE STATE OF RURAL TECH EMPLOYMENT, AND HOW TO GROW AND DIVERSIFY LOCAL TECH TALENT

Across the data, four main themes emerged that help us better understand how to support strong tech employment and tech-based business growth in rural places, as well as which actors contribute to and enable equitable pathways to tech skills and tech jobs in rural areas:

1. The role of rural employers is critical:

Rural employers in non-tech industries employ a significant portion of rural residents — yet they could be employing more because they are understaffing people in tech roles.

2. Rural Americans are interested in tech jobs:

Rural residents express a high level of interest in tech jobs and careers, though people who had more awareness of and exposure to tech work were more likely to act on this interest.

3. Rural tech workers take a variety of paths to enter the field:

Rural learners and employers benefit from having access to a combination of different training methods and programs to develop tech skills that meet industry needs.

4. Lowering barriers for rural learners is essential:

Rural learners find that the two largest barriers to tech training are cost and time commitment — lowering these barriers helps to grow and diversify the tech talent pool.

This section will interweave the findings from across the interviews, the surveys, and tech employment data analysis.

Research from Burning Glass, Brookings, the National Skills Coalition, and many others show that digitalization and the use of technology is growing across a broad array of industries.[34] [35] [36] Many of these industries have a strong presence in rural areas, especially those that are not considered to be "tech industries" like manufacturing, healthcare, banking, government, and postsecondary education institutions. Of the 244,808 rural workers employed in computer and math occupations in 2019, about 30% were employed in these types of non-tech industries. Yet little is known about the behavior of non-tech businesses and organizations in rural areas and how they impact rural tech employment. To better understand why rural areas lag behind metropolitan areas in terms of employment in tech jobs — specifically those in the computer and math occupations category[37] — we wanted to explore data across a range of these "core non-tech industries."[38] To do so, we obtained a custom data set through the labor market research firm EMSI Burning Glass (EMSI BG) that provided detailed, county-level data on tech staffing patterns across these rural core non-tech industries.

> *"We refer to this gap between the expected and the actual number of rural tech jobs as the "missing tech jobs."*

Core non-tech industries in rural areas do not employ tech workers at the same rate as the national average for these industries. In fact, there are only about 50% of the number of tech jobs that one would expect: Given national tech employment patterns in these industries, there should theoretically be an additional 81,871 rural tech jobs (Figure 5). We refer to this gap between the expected and the actual number of rural tech jobs as the "missing tech jobs." Simply put, rural non-tech industries are generally behind the national average in tech staffing, which means they are likely lagging on technological adoption which could make them less competitive in the long run.

34 Burning Glass Technologies. (2015). Crunched by the Numbers: The Digital Skills Gap in the Workforce.

35 Muro, M., Liu, S., Whiton, J., & Kulkarni, S. (2017). Digitalization and the American Workforce. Metropolitan Policy Program at Brookings.

36 Bergson-Shilcock, A. (2020). The New Landscape of Digital Literacy. National Skills Coalition.

37 See see 'Definitions' on page 5 for more detail.

38 See Appendix C: Extended Methodology for a more detailed description of core non-tech industries.

Figure 5

Missing tech employment by core non-tech rural industry

Comparison of the rate of tech employment within core non-tech rural industries to the national rate of tech employment for the same industries

Industry	Current rural tech employment	Missing rural tech employment
Manufacturing	14,634	42,836
Government	23,971	17,654
Banks	7,547	5,741
All other finance and insurance	3,822	5,172
Mining	2,296	2,336
Colleges, universities, and professional schools	15,940	2,307
Hospitals	3,733	2,185
Insurance carriers	2,496	1,930
Utilities	2,124	1,482
Elementary and secondary schools	579	228
Total	**77,143**	**81,871**

(Source: CORI analysis of EMSI BG data)

As reflected in Figure 5, this gap was most pronounced in the manufacturing sector. If rural manufacturers employed tech workers at the same rate as the national share of tech workers for the manufacturing industry, one would expect to see an additional 42,836 rural tech jobs. Absent further study, it is difficult to know what is driving this difference in employment behavior among rural manufacturers. One possibility is that rural manufacturers are outsourcing their tech needs to firms located outside of their local market. Additionally, lower-than-expected staffing in tech roles could suggest an underinvestment among rural firms in advanced technologies. Given the significant gap between expected and current tech employment among rural tech manufacturers, the behavior of rural manufacturers related to technology adoption and talent needs further study, because there is evidence to suggest that among manufacturers "the acquisition of new technology drives and precedes the search for skills" to operate the technology.[39] This apparent underinvestment in tech talent raises important questions about the long-term viability of the rural manufacturing industry, a sector that figures prominently in local rural economic development strategies.

The analysis likewise revealed there are 17,654 missing tech jobs among government employers in rural areas. It is possible that this gap is driven by a combination of outsourcing technology services and significant underinvestment in technology among local governments in rural areas. Here too, the potential for increased tech employment in rural governments should be further explored. With increased tech talent, state and local governments could modernize services and improve cybersecurity defenses, improving services and creating new pathways for rural residents to enter tech careers.

39 Berger, S., Sanneman, L., Traficonte, D., Waldman-Brown, A., Wolters, L. (2020) Manufacturing in America: A View From the Field. MIT Work of the Future, Research Brief 16.

One sector that shows encouragement when it comes to rural tech employment is higher education. Rural postsecondary education institutions are more likely than any other non-tech industry considered in this analysis to employ tech workers at a rate similar to the national average. There were just 2,307 missing tech workers in postsecondary education in 2019, which underscores that institutions of higher ed are not only critical anchor institutions for rural areas,[40] but they are also critical tech employers that growing tech ecosystems in rural communities continue to leverage. Local leaders can learn from rural higher ed's comparative success with employing tech workers as a model for how to do this in other non-tech industries.

The Rural Employer Survey hinted at a connection between the adoption of technologies and local tech talent in a number of select regions. When employers — the majority of whom were in non-tech industries — were asked what barriers they faced to implementing new technology, their number one barrier was cost, but they ranked "lack of internal tech literacy" and "lack of local tech service providers" the second and third largest barriers, respectively. A majority of employers reported that their industry had a medium (50%) or high (28%) rate of technological change. They expected that new technology would lead to increased demand for software and IT skills, the creation of new roles, and the need to upskill existing workers. However, fewer than half (45%) had active plans to prepare their workforce for changes introduced by technology. While we acknowledge that the Rural Employer Survey is not generalizable to the broader population, these initial findings signal a need for further exploration and focus on rural employers' perspectives on technology adoption and local tech talent.

Rural employers tend to employ tech workers in less specialized roles.

Focusing on specific tech occupations across rural core non-tech industries, the EMSI BG analysis showed that rural firms are more likely to understaff people in the more advanced or specialized roles, like software developers, cybersecurity engineers, or computer systems engineers or architects. For less specialized roles like computer user support specialists or network and computer systems administrators, their tech employment rates are closer to the national average. In fact, about 75% of the missing tech jobs in the core non-tech rural industries are in three occupations (Figure 6):

- **Software developers and software quality assurance analysts and testers**
- **Computer occupations, all other, which includes occupations like cybersecurity engineers and computer systems engineers and architects**
- **Computer systems analysts**

40 Ehlenz, M. (2017). Defining university anchor institution strategies: Comparing theory to practice. Planning Theory & Practice, 19(1), 74—92.

Figure 6

Most common missing tech occupation group for each core non-tech rural industry

Occupation group with the largest gap between the current rate of tech employment and the national rate of tech employment for each core non-tech rural industry

Core non-tech rural industry	Most common missing tech occupation group	Current tech employment by occupation group	Missing tech employment by occupation group
Manufacturing	Software developers and software quality assurance analysts and testers	4,869	25,867
Government	Computer cccupations, all other	4,739	10,421
Banks	Software developers and software quality assurance analysts and testers	1,388	2,451
All other finance and insurance	Software developers and software quality assurance analysts and testers	1,277	2,115
Mining	Computer systems analysts	758	1,402
Hospitals	Computer systems analysts	907	952
Insurance carriers	Software developers and software quality assurance analysts and testers	813	613
Colleges, universities, and professional schools	Software developers and software quality assurance analysts and testers	1,110	595
Utilities	Computer systems analysts	630	578
Elementary and secondary schools	Computer user support specialists	305	73

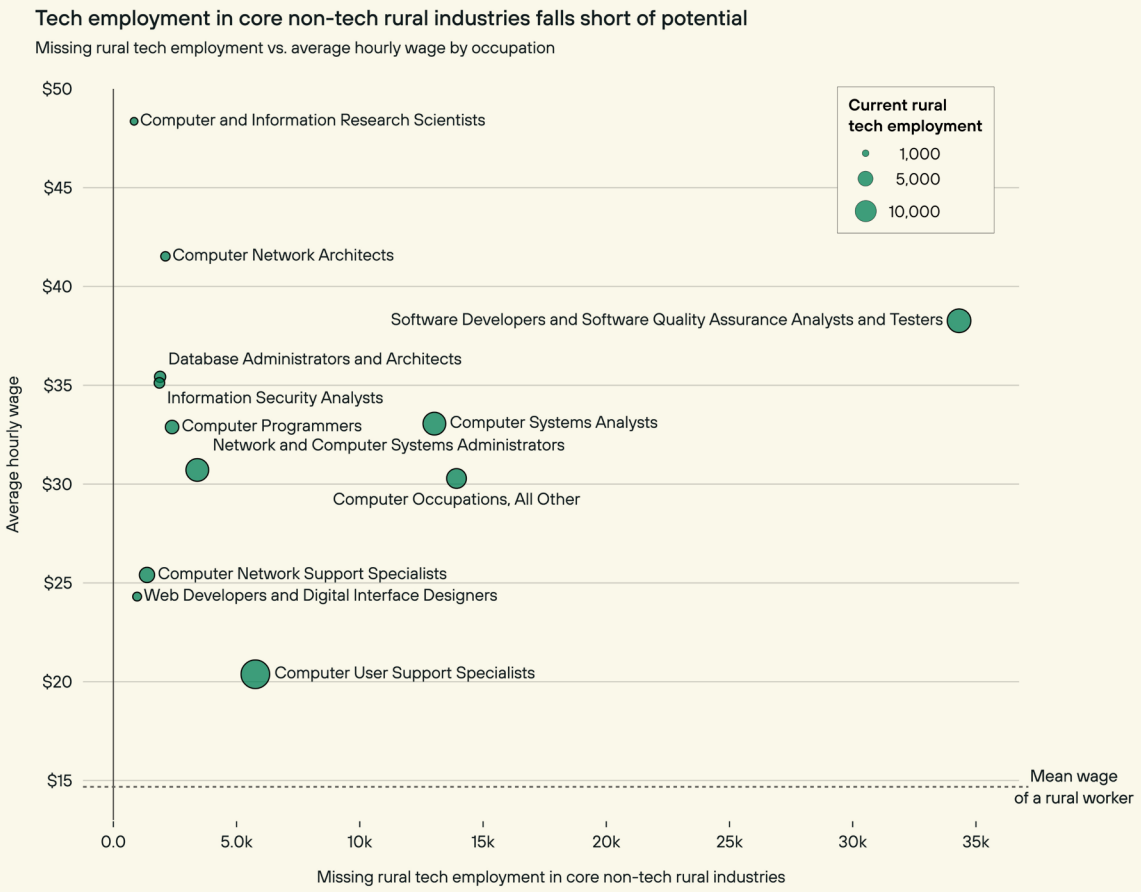
(Source: CORI analysis of EMSI BG data)

Software developers and quality assurance analysts represent the largest gap between current and expected employment. In 2019 there were 11,682 rural software developers, compared to 45,997 expected workers in these roles, suggesting that as many as 75% of software developer jobs are missing among these non-tech industries in rural areas. These missing jobs represent a significant lost opportunity for high-paying employment for rural workers. Software developers in rural areas earn an average of $38 per hour, more than twice the median hourly wage for the average rural worker ($14.68)[41] (Figure 7). Software developers are usually engaged in creating new technology or applications, which suggests that not enough of this innovation is occurring within rural core non-tech industries.

When it comes to less specialized or more standard tech roles tied to maintaining computer systems — including network and computer systems administrators, computer user support specialists, and computer network support specialists — rural employers in the core non-tech industries employ workers at three-fourths the national rate. While these occupations do not pay as much as the software developers, they do pay significantly more than the median rural worker earns, and often require just an associate degree or industry certification (BLS). The fact that rural industries are employing people in these roles at higher rates suggests that rather than hiring people to create new technologies, rural employers prioritize hiring talent who can maintain and support existing systems and technologies.

41 CORI analysis of EMSI BG data

Figure 7



(Source: CORI analysis of EMSI BG data)

The Rural Employer Survey reinforced these findings. Employers cited that they currently employ (or plan to employ) tech workers in IT support, database administration, and e-commerce roles more, as opposed to workers in more specialized roles such as cybersecurity, software coding and engineering, and cloud computing. Some interviews confirmed this pattern. For example, a student in Bulloch County, Georgia, shared that most of the tech roles available locally were limited to "maintenance and small things" as opposed to the more "rewarding" or exciting tech work.

Likewise, rural employer interviews reinforced that although there is certainly understaffing of local tech workers, there are alternate reasons to explain why. The head of the IT department for a midwest regional healthcare insurance company shared how the company learned that when it was benchmarked against similar regional health plans from across the country, it was in the 25th percentile for IT staffing levels. This disparity appeared to be the result of underinvestment in tech-enabled functions within the company, because it did not outsource a significant amount of IT work. On the other hand, another midwest healthcare company embraced outsourcing, and recently switched almost entirely to a managed services model for its IT services. The company maintained its higher-level management and systems architecture roles responsible for driving strategy in-house, but contracted with a global managed service provider to hire workers to run its day-to-day operations, including field technicians who are on-site at healthcare clinics and hospitals to maintain

Stacey Roach

Chief Operating Officer for Inventure IT, co-founder of the tech apprenticeship program SALT in Statesboro, Georgia,

equipment. Interestingly, there was some indication from the Rural Employer Survey that employers who outsourced tech work were more likely to use a local firm or individual than to contract with someone outside of their region. These examples point to the need for local leaders to understand the motivations driving local employers' tech hiring decisions, and how to support more local hiring.

This study just begins to illuminate tech employment patterns in rural industries, including how local tech talent relates to technology adoption and outsourcing tech roles. Stacey Roach, chief operating officer for Inventure IT and co-founder of the tech apprenticeship program SALT in Statesboro, Georgia, explicitly focuses on the link between technology adoption and growing local demand for tech workers. As the owner of a software development firm, Roach asks the question: "How do I help more companies utilize tech to bring more tech workers into a region?"

When rural employers have access to a stronger supply of local tech talent, they hire more locally.

As evidenced by interviews across regions, having a strong supply of local tech talent can lead to employers hiring more tech workers locally. Some employers interviewed in Portage County, Wisconsin, noted they were hiring talent as fast as the local colleges and universities could produce it. The industry founders behind both the Code Labs program in southeast Missouri and the SALT program in Statesboro, Georgia, were motivated to create local tech talent to fuel local business growth. After several years of training entry-level software developers, Code Labs is starting to see this strategy pay off. Chris Carnell, Code Labs founder, shared that one of their top employer partners, Vizient, analyzed options for how to expand its tech operations and ultimately decided to invest further in the Cape Girardeau area rather than larger markets like Dallas, Texas. The Code Labs program was a decisive factor in this decision — Vizient has grown roughly a third of its tech team through the Code Labs program.

Local officials should understand the different types of tech skills required by different industries and occupations

Rural economic and workforce development professionals usually have a pretty good grasp of the types of jobs available locally, the skills required to obtain those jobs, and the terminology used in the industry — such as in the manufacturing and healthcare sectors that are big employers in rural places. But when it comes to "tech jobs" there is less understanding among these local officials about what types of jobs and skill requirements exist locally. Just as they have done with other sectors, local officials should take time to develop a baseline understanding of the tech roles and tech skills that local employers across industries require.

Rural employers in the tech sector or in non-tech industries that employ a larger share of tech workers — such as insurance or healthcare — revealed a nuanced understanding of both tech roles and tech talent needs. First, these employers emphasized the diversity and breadth of the tech field. The tech field involves a wide array of different roles ranging from software developers, to data scientists, to product managers, to user experience (UX) designers. Even within one occupation — such as software development — there is a tremendous range of specializations and skill sets. For example, software developers can specialize in front-end development — the part of the technology that customers and technology users interact with, such as the visual interface for applications and websites, or back-end development — which, as the name suggests, relates to what happens behind the scenes to develop the application itself, engaging data held in a database and servers. Front-end and back-end developers generally require experience with different programming languages. And different companies use different "tech stacks," or the combination of technologies, programming languages, tools, and databases that are used to build and operate an application. This speaks to why tech training programs that are tightly aligned with local employers are more likely to have the right skill development match for what employers need. College computer science majors now in entry-level tech jobs or tech apprenticeships marveled at how little they understood about the diverse array of tech roles or the range of specializations within the field. They prized how much they learned about the various roles from being embedded into software development teams, a type of work-based learning that was not possible to access through a traditional computer science curriculum. As Matt Volmer, CEO of Arbre Technologies in Portage County described:

> *"A dot net software engineer is not going to have the same specialty or expertise as a data scientist or someone who works in AI or someone who works in machine learning. I think a lot of people make the mistake of thinking that, 'Oh, they're a software engineer. They can do anything with data and software', when in reality it's more like in the technical space, there's a lot of specialized roles within the category."*

While technical skills are important, employers value the ability to learn and collaborate — skills that are not necessarily reflected by higher education credentials.

Understanding local employer demand for tech talent also requires recognizing what types of skills they need. Because technology is always evolving and different employers use different combinations of technology, rural employers, training providers, and tech workers underscored the importance of having exposure to a variety of technical programs, and most importantly, a strong aptitude for self-directed learning and adaptability. While employers value prior coding experience and familiarity with specific programming languages, employers consistently emphasized the non-technical skills, including "desire and willingness to learn" and "positive attitude" and ability to "collaborate with a team" as being more important than technical skills for entry-level workers. Employers acknowledge that a university's computer science program may not teach the exact set of programming languages they use on-site, but any familiarity and experience can be a foundation to build on. As one employer and computer science professor put it, if people have a general understanding of how technology operates and an analytical mind, coupled with willingness to learn and a positive attitude, they can easily make the transition from one programming language or tech stack to another.

The recognition that entry-level roles in tech do not always require a high degree of prior experience or education is sometimes at odds with how recruiting and hiring works in practice. In core non-tech industries like insurance and healthcare, there were numerous large employers interviewed whose human resources departments required a bachelor's degree, even though the IT division advocated to hire qualified candidates who lacked a four-year degree but had relevant experience and/or a two-year associate degree. The Rural Employer Survey revealed that the majority of rural employers had not hired from non-traditional programs, and most were either not interested in recruiting from these programs or were "maybe" willing to do so, and tech workers and trainers corroborated that they had experienced this sentiment first-hand. These types of concerns led the Central Wisconsin Information Technology Alliance (CWITA),[42] a consortium of employers in central Wisconsin dedicated to enhancing the image of IT careers, to spearhead conversations among employers. These conversations centered on updating job descriptions to allow for two-year degrees rather than four-year degrees, and supporting the development of articulation agreements between the region's community and technical colleges and universities.

42 CWITA is a specifically targeted workforce development effort staffed and sponsored by the North Central Wisconsin Workforce Development Board using federal Workforce Investment Act resources (WIA).

Remote work should be part of a broader strategy to help rural regions retain and attract tech workers

There has been much interest in understanding how the rise of remote work during the pandemic could lead to the redistribution of tech jobs to rural markets and the opening of new opportunities for rural tech workers. Across the Rural Adult Survey, almost two-thirds of tech workers report working remotely, either from home (42%) or a coworking space (22%), while just around one-third currently work in an office setting. And, almost all of the rural tech workers surveyed (90%) reported confidence they could find a remote job. In our interviews with tech workers, students, employers, and professors we heard how the growth in remote work opportunities was impacting rural tech labor markets. Tech workers reported a dramatic increase in recruiting activity on LinkedIn from companies all across the country. Employers reported the difficulty they faced matching salaries from tech companies in larger markets. As Matt Vollmer, the head of the ag tech startup Arbre Technologies put it, "People that can work from anywhere, especially software engineers, they can live in a rural area at a super low cost of living, but they can make Chicago or New York wages. And for our small startup, like ours, that's extremely hard to compete with."

Similarly, some of the professors we spoke with acknowledged the shift to remote work that has built over time and accelerated during the pandemic. One professor estimated that 20 to 30% of the university's computer science alumni were working remotely from central Wisconsin, as opposed to 15 years ago when virtually none of them were. We interviewed some tech workers who left metro tech hubs and moved back home to central Wisconsin or southeast Missouri. At least one of these individuals acknowledged that it was possible he would start his own company one day from his current location. This interest was in part motivated by the desire to be working on-site with colleagues, a sentiment that was broadly shared. While many tech workers, students, and employers appreciated the flexibility and options that remote work opened up, many also viewed remote work as a less rewarding and productive work experience. Several people commented on the sense of focus, collaboration, and accelerated learning that happens when people are working together in-person versus remotely.

These trends suggest the importance of remote work to a local tech ecosystem and the need for local economic development officials to have a remote work strategy, including the development of physical spaces and programming that could attract remote workers.[43] While remote work can help rural regions retain and attract tech workers — and these people earn comparatively higher salaries that get fed back into the local economy —- those higher salaries can also make it harder for local employers to compete for talent. Local economic development officials should proactively identify and engage remote tech workers and connect them to the local ecosystem. As an example, local leaders can encourage these tech workers to utilize local coworking spaces and to interact with other tech workers and local employers through meetups and networking events. In Stevens Point, Wisconsin, the CREATE Portage County's IDEA Center is a coworking space designed to serve this exact purpose. "Most tech companies in the big tech hubs are very one-dimensional in their opinions and worldviews," said Jeremy Nikolai, a tech worker who left a coastal tech hub for Stevens Point and now works out of the IDEA Center. "And [for] tech workers in rural communities, being a part of that has the potential to add a lot of diversity to what the tech climate looks like." By raising the visibility of the talent in the local ecosystem and by building relationships between remote tech workers and local companies it is possible that remote workers could transition to working for local companies, or even team up with others to start a new venture.

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43 For more information about remote work, see Center on Rural Innovation. (2021). The Rise of Remote Work in Rural America.

Jeremy Nikolai

Tech worker

The conversations, data analysis, and surveys showed the importance of understanding demand for local tech talent, having a grasp on the dynamics of how different types of industries use tech talent, and where there is room to grow tech employment in different regions. The research also showed the need to better understand why we see lower-than-average tech employment in many non-tech sectors in rural areas. Whether or not tech employment patterns stem from the lack of technology adoption within non-tech sectors, and/or the lack of local tech sector companies, can inform the type of strategies that should be built into economic development plans.

2

RURAL AMERICANS ARE INTERESTED IN TECH JOBS:

Rural residents express a high level of interest in tech jobs and careers, though people who have more awareness of and exposure to tech work are more likely to act on this interest.

The vast majority of our findings are centered on the supply of tech talent and issues related to training programs and the experiences of workers and learners. Our second, third, and fourth themes delve into this side of the equation. Strategies aimed at increasing tech employment must consider both the labor demand dynamics — the decisions made by rural businesses and organizations to staff tech positions — and the labor supply dynamics — the desire among rural workers to pursue tech jobs, and their ability to develop the skills required for those jobs. Understanding the motivations and constraints driving behavior on both the demand and supply side is critical for designing interventions.

The Rural Adult Survey revealed that rural residents express a high level of interest in tech jobs and careers, but that their interest in tech work outpaces general confidence in securing a tech job locally. Fifty-nine percent of working age rural adults find the idea of "working with computers,

analyzing data and information, engaging in analytical and critical thinking and creative and complex problem solving" to be appealing. Notably, women (59%) are just as likely as men (58%) to find tech work appealing. A significant portion (41%) have also engaged in some sort of tech-centric education, the majority of whom participated in employer-provided training, self-training, or an online course. And, in the next two years, about one-third (35%) of working age rural adults say they are at least somewhat likely to pursue training related to working with computers and software.

Furthermore, the data showed that workers who are aware of tech jobs locally — meaning that they have heard of opportunities existing in their area — feel more confident that they can actually attain one of these jobs, as compared to those who are unaware of local opportunities. Of those who were aware of a tech job in their community, 44% felt optimistic about getting a tech job locally; whereas among those who are unaware of local tech jobs (56% of respondents), only 15% believe they could get hired into a tech job locally. This presents an opportunity: Given the high amount of interest in tech, and evidence that being more aware of tech jobs makes it more likely someone will pursue tech training and careers, then making existing local opportunities more visible can tap into the latent interest in the local labor supply.

Social capital and personal connections play a strong role in how rural residents become aware of tech jobs, and exposure to tech contributes to interest in pursuing tech training and jobs.

Rural residents' awareness of tech jobs tends to stem from personal connections and experiences, in part because relationships are the spark of an interest in tech. Nearly half of working age adults (46%) in rural communities know of family members or friends with a tech job, and 42% know of someone in their local community with a tech job. As noted above, this baseline awareness of local tech jobs — as indicated by rural residents' personal knowledge of someone in their community with a tech job, appears to contribute to a higher confidence in getting a tech job locally. We encountered two main groups among those interested in tech: those who got into tech as teens, and those who were introduced to tech later in life. For those who became aware of tech at a younger age, it tended to be through exposure from family members or family friends, in school-related activities, or early college classes. Some had watched their parents transition into tech, others started dabbling in HTML in the early days of MySpace with their siblings; some spent time at a parent's workplace, and others were inspired by a parent's career in engineering. Joshua Vaughn, a tech student at SALT in Bulloch County expressed, "I remember [my grandpa] wanting to build a computer, and then watching him do it and it just being very fun. And yeah, while I've loved technology from a very young age, I don't think I started programming until I was older, 19 or 20." Many tech students depicted how their love of video games and movies made them explore technology more in-depth, although early exposure through gaming did not always immediately translate into more hands-on learning. One woman described having to lobby her parents repeatedly in high school to allow her to take a coding class because they didn't think it was an appropriate course of study for girls.

Educators expressed a similar trend when reflecting on the experiences of their students. Tim Krause, department chair and professor in the Department of Computing and New Media Technologies at University of Wisconsin-Stevens Point, shared that several years ago the school partnered with the Central Wisconsin IT Association (CWITA), to interview its computer science and web development students to learn what drew them to the technology field. CWITA was interested in understanding these motivations because the organization is focused on growing the region's IT workforce. They found that roughly half of UWSP students, as Krause framed it, said, "they grew up with someone in their family who they described as a tinkerer, someone who liked to just tear

Tim Krause

Department Chair and Professor in the Department of Computing and New Media Technologies at University of Wisconsin-Stevens Point

things apart and figure out how they work — and I mean, that's programming right?" He described the other half as students who come from a more artistic, musical, or design background.

But not everyone who pursues tech has exposure to it from an early age. In other cases, for those who don't have family members or close connections involved in tech, it takes personal experimentation and repeated exposure to different technologies to demystify tech and help see it as a viable career option. Bri Grimsley, a learner at Code Labs, described how her experience fell into this category:

> *"I didn't have any family that was really involved, and my parents didn't go to college...my brother was the only other person who was going to college. So for some reason, I just thought, I'm just going to go for business — the computer industry wasn't even on the table for me. And I just started a blog because I had a lot of extra time. Then I started delving into HTML because I didn't like the way my templates looked. That's when I realized, I wonder if I could actually make this a job."*

These findings suggest both the importance of early exposure to tech and the importance of demystifying tech work, particularly for women and underrepresented groups in tech. Indeed, both Code Labs and SALT quickly realized they needed to start earlier to build tech awareness. Code Labs has launched a successful Youth Coding League in partnership with middle schools, and SALT is planning to begin engaging high school students.

Rewarding work and financial stability motivate learners to pursue a tech career.

As Grimsley expressed, there is a difference between becoming aware of how technology is used, and being motivated to take the steps to pursue tech as a career path. When it comes to the actual motivation to pursue a tech job or tech training, the majority of rural tech workers and students referenced two main factors: the rewarding nature of the work and the stability of a higher salary. This consistent theme from our interviews was reinforced by the Rural Adult Survey, which found that the top reasons rural tech workers chose to pursue a career in the field are because they like the work (41%), and because of the good pay and benefits available (34%). Students who studied computer science or a related field in college and adult learners who came to the field later in life both described being motivated by how rewarding the tech field is, as they love to create, problem-solve, and continually learn. They reference fascination with technology, design, and "making something from nothing," along with seeking to understand how the computers — and the world — operate. One Code Labs student, Connor Thompson, who was working as a bartender when he entered the program, described his motivation to understand how tech works. Since no one in his social network could explain it to him, he was determined to learn on his own:

> *"It's just fascinating. To me, this idea that because people have figured out how to configure electrons and make them act like ones and zeros, you and I can speak face to face from thousands of miles away. It's literally like magic and you know, the more you learn about it, the less magical it becomes. So I'm determined to understand all of these things that people write off as just oh, that's there's a wizard in a basement somewhere, and he makes Zoom happen, and that's it. So everyone gives money to the wizard. I want to be the wizard."*

Megan Dean

Web Developer and Graduate from Code Labs

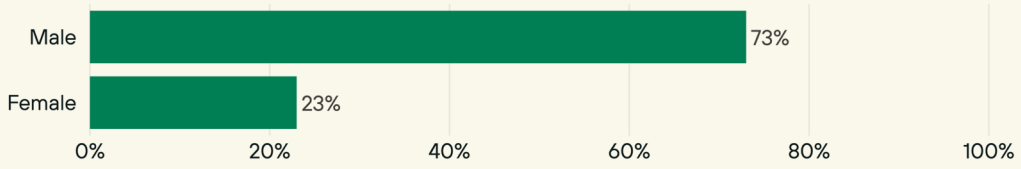
For many — particularly those coming from more low-income backgrounds — finances, higher salaries, and stability are central factors in the decision to pursue a tech job or tech training. The Rural Adult Survey found that nearly one third of rural tech workers earn over $100,000 annually, whereas just 10% of rural adults employed outside of tech earn an equal amount. Some tech workers recognized tech jobs as an avenue for financial stability as early as high school. "I was looking for something that I enjoy, but also that can be a more stable source of income and kind of career path," said Wallace Norman, a tech worker in Bulloch County. In Cape Girardeau, Megan Dean enrolled in Code Labs at the same time that she was pregnant and working full time. She had several years of college under her belt, but did not want to incur the expense to complete her undergraduate degree. She successfully graduated from Code Labs and transitioned from administrative and retail jobs into tech, and is now working as web developer. When reflecting on her experience she shared similar motivations:

> *"Code Labs brought free learning, including a certificate for people in a rural area where it's harder to access that sort of thing. And maybe we aren't financially able to, like it was just perfect for adults who maybe don't have a college degree or have a degree that they're not using. I found that most of my class consisted of people in that demographic, and it really changed my life. Now I have a job that I really enjoy and I can provide for my family."*

Figure 8

Based upon the responses of the Rural Adult Survey, most surveyed rural tech workers are men...

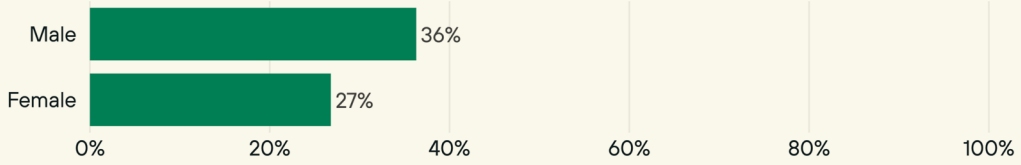
What gender do you identify with?



...and are slightly more likely to know about rural tech jobs

Are you aware of the types of tech jobs that are available locally?

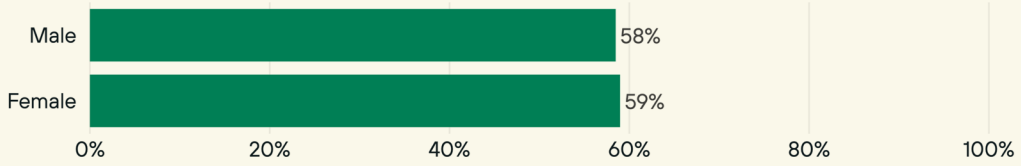
Percentage of respondents who answered "Yes" by gender



...yet surveyed rural women and men find tech jobs equally appealing

How appealing do you find tech jobs?

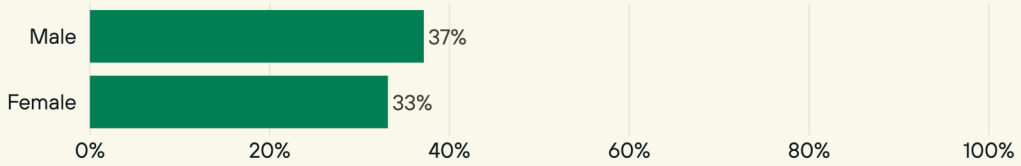
Percentage of respondents who answered "Very appealing" or "Somewhat appealing" by gender



...and are likely to pursue tech training at similar rates

How likely are you to pursue tech training?

Percentage of respondents who answered "Very likely" or "Somewhat likely" by gender



(Source: Rural Adult Survey)

Gracie Smith

Executive Director, SALT

There are significant differences across genders when it comes to participation in and awareness of tech jobs.

Given that, nationally, over 70% of all tech workers are male, the fact that there is gender inequality in the rural tech field does not come as a surprise: The Rural Adult Survey found that 73% of rural tech workers are male. Furthermore, there is a significant difference between rural men and women when it comes to awareness of tech jobs. Despite expressing nearly equal levels of interest in tech jobs, there is a 10-point gender gap among men and women regarding awareness of tech jobs (Figure 8).

Our interviews revealed that once adult learners are engaged in learning how technology works, they start to see how it's possible to work in the field. This is especially important for women, who, given the male-dominated nature of the tech field, may not have considered tech as a viable career path. One woman who had worked in sales before experimenting with website development and switching to pursue tech full time noted, "I never really understood that the computer field was an option for me — the only people I knew in the field were middle-aged men."

Several training providers faced similar challenges with gender parity in their programs. When SALT first started in 2020, the program's cohort was 90% male. After the first year, program leaders realized that by prioritizing recruiting computer science students, they were ending up with a predominantly male cohort, reinforcing the patterns seen across the tech industry. SALT Executive Director Gracie Smith had gone through the SALT program herself, and recognized more could be done to reach women who may not be computer science majors, but are still interested in technology. Through targeted recruitment efforts — including through collaboration with sororities on the Georgia Southern University (GSU) campus — SALT's program is now about 50% female.

Code Labs similarly faced a gender imbalance among its participants, but through a combination of experimenting with and implementing a combination of different outreach tactics, 40% of program participants are now women. For example, two of these tactics were, first, shifting the structure of its recruitment, and in 2021, implementing a strategic digital marketing campaign that uses analytics to track engagement and hone advertising. Both of these programs have achieved a gender balance that is notably better than that of the rural tech workforce, which, as noted, is 73% male.[44]

The impact of exposure to tech work and tech jobs points to the need for intentional efforts to educate people about tech work. This education can include fostering an awareness that tech job opportunities exist in rural communities, and that all kinds of people can do these jobs with the right preparation. Randomized control research finds that when women have negative misconceptions about tech jobs, it reduces the likelihood that they will participate in tech training — and that when interventions are designed to share examples of women in tech and that address misconceptions about tech work and earnings potential, it significantly increases women's participation in tech training programs.[45] This idea can be applied beyond just women, and be structured to address rural people more broadly. It is important to note that while our surveys and interviews did address race and ethnicity – as Black, Indigenous, and people of color have been historically underrepresented in tech – the responses across different racial groups were too small to draw meaningful insights about the relationships between race and rural tech employment. By making tech work more visible in rural places, we can more readily tap into the latent talent pool in rural communities and help them acquire the skills, experience, and connections needed to enter the field.

44 Rural Adult Survey

45 Del Carpio, L., & Guadalupe, M. (2021). More women in tech? Evidence from a field experiment addressing social identity. Management Science.

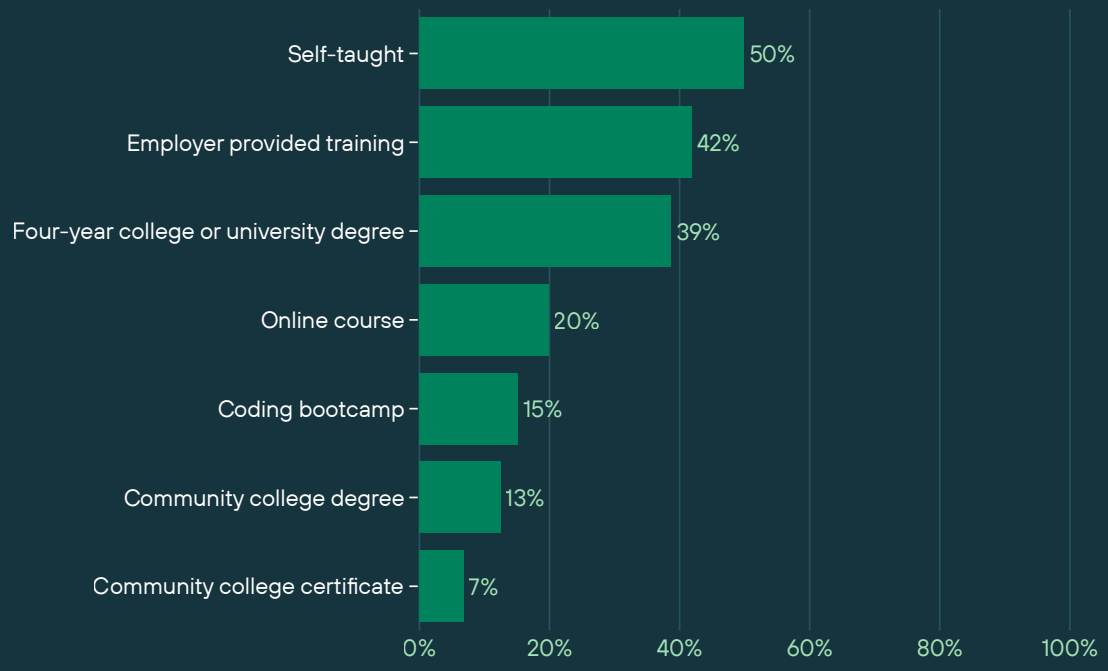
3

RURAL TECH WORKERS TAKE A VARIETY OF PATHS INTO FIELD: Rural learners and employers benefit from having access to a combination of different training methods and programs to develop tech skills that meet industry needs.

Rural tech workers pursued different paths to acquiring skills and entering tech employment. The Rural Adult Survey and the interviews revealed that workers often leverage a combination of sources for training — ranging from traditional college and university courses and degrees, to online resources and self-teaching, to non-traditional boot camps and online courses. In the Rural Adult Survey, 48% of rural tech workers reported having at least a college degree (compared to 23% of rural residents in our survey), yet only 39% reported gaining tech training through college. Rather, 50% of rural tech workers reported they were self-taught and 42% received employer-provided training, while only 20% learned through an online course, 15% through a bootcamp, 12% through a community college degree, and 6% through community college certificates (Figure 9). It is possible that those who identified as "self-taught" acquired some of their skills through online resources, even if they didn't enroll in an online course. In interviews, employers and tech workers expressed how "self-teaching" or "self-directed" learning is prevalent and an essential skill in the tech field. Often tech learners and workers use online resources such as tutorials on YouTube, subscription service learning platforms, blogs, and tech forums to learn a new skill or acquire knowledge about a new programming language, tech platform, or tech challenge they have encountered. Supporting access to these multiple methods and training pathways — from traditional, to self-directed learning, to non-traditional programs — can be incredibly beneficial for learners and employers alike.

Figure 9

How did you obtain your computer and software training?



(Source: Rural Adult Survey)

Traditional training programs are an important part of tech talent ecosystems, and tend to provide more theoretical knowledge that is supplemented with work-based learning.

In "traditional" training programs, students gain credentials at a college, community college, or university which offer formal degree programs and short-term certificates. In 2019, over 18,000 people graduated from a rural postsecondary institution with a degree or certificate in a tech-related field, equivalent to about 10% of the total rural population with a degree in a tech related field in 2019.[46] It raises interesting questions about where these students end up working, given that the EMSI BG analysis revealed that many rural core non-tech industries are understaffing tech workers as compared to national staffing patterns for these industries. We did see evidence that a strong postsecondary tech ecosystem can contribute to strong local tech employment. For example, part of this research centered on Portage County in central Wisconsin because data revealed that compared to other rural counties it had a higher-than-average number of computer and math graduates, and higher-than-average computer and math employment. Indeed, central Wisconsin has a number of rural-serving higher ed institutions that provide computer science degrees and certificates. These institutions range from the University of Wisconsin-Stevens Point to Mid-State Technical College, and each has more than one campus in central Wisconsin as well as online course offerings. Traditional college programs are anchored in the classroom instructional model. Computer science programs offer different tracks, some that are more theoretical and some that are more applied. These programs provide students with strong foundations in computer science, but given the instructional model, are more limited in offering practical, work-based skills, such as granular but important tasks (finding and fixing bugs or merging code) or collaborative work practices used in software development, such as agile or scrum methodologies.

Students and tech workers we interviewed who had majored in or taken computer science classes in college appreciated the theoretical grounding they gained from their coursework, but they consistently highlighted work-based learning as being critically important to acquiring the practical skills and familiarity with practices that dominate the field. As one student put it, many higher ed students only see "snippets of software," whereas when working with a company on a software development project you see "software development at scale" including the full lifecycle from design to production. A Code Labs student described making websites in a college web development class that were essentially flat files, not live websites, and being frustrated with not getting to understand from the coursework how to actually develop and maintain a live, functioning website. Similarly, SALT Executive Director Gracie Smith noted that she learned all her practical everyday tech skills from her SALT experience because her undergraduate computer science coursework was "all theory-based, and you never actually see how to manage an item or even look for a bug." Zack Amis, a trainer at Code Labs, emphasized how timing plays into this: When you have 20 weeks to cover materials as opposed to four years, you are going to prioritize teaching students basic concepts and how to build tools, as opposed to all the background theory. "As a result of that, we're going to focus on the things like, 'here is what you need to get an entry level job — and if you can do these things, and make these apps and honestly understand these concepts, you can start working,'" Amis said.

Higher education institutions recognize the gaps between theoretical and practical knowledge, and in response are seeking to align their course offerings with employer needs and cultivate work-

46 CORI analysis of Integrated Postsecondary Education Data System (IPEDS) College Scorecard Data, (2020).

based learning opportunities for students. Faculty and administration at the various institutions we studied all sought input from alumni and local tech-focused employers about their talent needs as a way to tailor their academic programs. In some cases, these conversations have led to the creation of co-op and internship opportunities for students, a major avenue used by employers we spoke with in central Wisconsin for recruiting local talent. In other instances, these conversations resulted in the creation of new course offerings. For example, the educational software firm Skyward opened an internship center on campus at University of Wisconsin-Stevens Point (UWSP) so that students can work there with Skyward managers. At UWSP, local companies affiliated with CWITA provided seed funding to create a new faculty position at the university within the computer science department. This faculty position helped support expanded course offerings, and a partnership with the local insurance company Sentry led to the creation of an interdisciplinary data analytics program that incorporates capstone projects. This demonstrates how higher ed institutions can partner with local employers to expand tech offerings to increase the local talent pool.

Non-traditional training programs and their partners directly incorporate work-based learning and "real world" experiences into coursework.

Although higher ed institutions are an essential part of the tech talent ecosystem and at least 39% of rural tech workers reported gaining relevant training through college, many rural adults prefer shorter-term, lower-cost training programs — and designing programs in this way has the potential

to draw more rural residents into the tech field. In the Rural Adult Survey, non-tech workers report they are more likely to seek training from online courses, self-training, and employer training than from more traditional forms of education from colleges and universities, including community colleges. Similarly, a 2021 study from the Education Commission of the States found that when it comes to evaluating the investment of education and training, 64% of rural respondents said that getting an educational certificate is worth the cost, as compared to 43% for a bachelor's degree and 46% for an associate degree.[47] In fact, only 39% responded that they are likely to enroll in higher ed or training in the next five years.[48] From a practical perspective, it makes sense that working adults who likely have existing financial and family obligations might be hesitant or unable to commit to the cost and time required for a traditional higher ed degree program, and potentially time away from paid employment. Indeed, some higher ed institutions have adjusted their offerings to account for this reality. Through the University of Wisconsin's "extended campus" program, residents can access a number of online offerings, including technology courses, degrees, and coding bootcamps. A UWSP faculty member reported that these online offerings have attracted non-traditional students, like working adults and returning veterans, who are eager to get practical training that would translate into better job opportunities.

Some non-traditional tech training programs are actively partnering with colleges and universities to provide practical skills-focused instruction and work experiences to complement the traditional classroom experience. For example, in 2020, Stacey Roach and his business partners established SALT: Southern Automation Logistics and Technology in Statesboro, Georgia, in partnership with Georgia Southern University to bring industry and academia together to provide work-based learning experiences to college students. SALT offers a software engineering apprenticeship program, which provides a structured way to engage computer science students in "real world" projects with local employers while gaining exposure to a variety of software development roles. SALT students are embedded within professional software development teams that are building and maintaining applications for participating employers, and student apprentices are treated as junior members of the team. They are given assignments and fully integrated into team practices, and as Fletcher described, "[We] actually get them involved in real stuff — real projects, real software, real things that are going out and people are actually using." SALT instructors also lead "Tech Talks" where they cover key topics that students need to understand in order to work in software development, topics they may not have learned in the traditional classroom. As a result they are gaining skills and insights that make them significantly more experienced and employable than a student that has only classroom-based experience. (For an extended case study on SALT, see Appendix B.)

To meet the needs of employers and give students directly applicable skills, a major focus of Code Labs in Cape Girardeau, Missouri, is embedding learners in software development projects with and for local companies. In 2014, Chris Carnell and James Stapleton opened Codefi, a coworking space and technology incubator, in downtown Cape Girardeau, Missouri. Carnell and Stapleton, both technologists and entrepreneurs, met at the local university and recognized the need to diversify the local economy by intentionally cultivating an ecosystem that could support the launch and growth of tech startups. They quickly realized that to achieve this goal, they needed a stronger tech

47 Keily, T. & McCann, M. (2021). Perceptions of Postsecondary Education and Training in Rural Areas. Education Commission of the States.

48 Ibid.

talent pool locally. In 2016, they introduced LaunchCode's Python training program. They recruited participants from the local area, covered the cost of their participation with grants, and provided instructors who worked as professional developers in the local area. The group quickly learned that rural communities needed a new approach to training a workforce, so in 2017 they designed their own program and launched Code Labs. To date, Code Labs offers a 20-week front-end development course and a 20-week back-end development course, and over the final four weeks of the program, students are paired with a local employer to complete a hands-on project as a way to simulate a job search and hiring process. This is part of what makes Code Labs so successful for students: Unlike traditional computer science courses or even self-paced online bootcamps, Code Labs offers students the opportunity to use tools, practices, and work in ways that mirror how tech gets done in the "real world." As Code Labs has expanded beyond Cape Girardeau into other rural communities in the region, it has partnered with local community colleges to promote the program and is exploring how to partner more formally with local community colleges. (For an extended case study on Code Labs, see Appendix A.)

Two major components of tech jobs are "learning how to learn" and collaborative problem-solving, and both are central to non-traditional training programs.

Perhaps the greatest advantage that non-traditional programs like Code Labs and SALT bring to aspiring tech workers is to equip them with both the skills and the work practices that define working in tech. Chief among these skills and practices are: self-directed learning or "learning how to learn," and collaborative problem-solving. Chris Carnell, the co-founder of Code Labs, emphasized learning enough to get employed, although the learning never stops: Once employed, tech workers are paid to continue developing their skill set, and self-directed learning is an extremely important piece of this. "We have this philosophy that we're not just teaching someone a computer programming language, but we're teaching them how to learn," Carnell said.

Ashley Lovette

Student at Code Labs

Through these types of non-traditional training programs, students are not only learning how to learn, but they are also becoming familiar with the online learning sources that tech workers use daily to solve problems and learn about new approaches. "Even with the in-person classroom time, you have to put in the time outside of class with assignments, YouTube videos, Google searches, and other self-directed learning in order to be successful," said Stephon Gant, a student at Code Labs. Similarly, in the SALT program in Bulloch County, students described using online resources like YouTube tutorials, Stack Overflow, and self-paced online learning platforms like The Odin Project, O'Reilly, and Pluralsight. In fact, some tech learners reported that "learning how to learn" boosted their confidence in their future career prospects in tech. Ashley Lovette grew up in a small town in Missouri where she had limited exposure to computers and no formal computer science coursework in school. Later, while working as a bartender, she heard about Code Labs and the more she learned, the more she realized how well coding aligns with her natural interest in problem-solving, puzzles, and being creative. Though being a software developer had "never been on her radar" before Code Labs, Lovette described feeling "confident in what I've learned. I also consider myself a lifelong student. So I'm willing to keep learning, which I think is important in this trade."

> *"I also consider myself a lifelong student. So I'm willing to keep learning, which I think is important in this trade."*

Stephon Gant

Student at Code Labs

Another important feature of non-traditional programs that mimics real-world tech work is collaborative problem-solving. Trainers are keen on incorporating this tenet in their programs. At SALT, apprentices are encouraged to actively raise issues and work with each other and mentors to solve problems. To support this process, apprentices are paired with a developer that will serve as their "best friend" for the semester. Code Labs has students pair up for "live coding" as part of each classroom session, and they are paired with a lead software developer at a local company to work through a real project. "Our instructor from Vizient pointed out, 'You're not going to be memorizing codes. You're not going to be just writing lines and lines of code. A lot of it is collaboration and figuring out together,'" said Jacquelyn Kiefner, a current software consultant at Allata who went through the Code Labs training. The collaboration aspect is also a reason why many programs are structured into cohorts — they create a sense of community, commitment, a high-level engagement that contributes to a successful experience and valuable, practical learning. "The most surprising thing to me was being in the room with like-minded people like myself, many of us were parents. You know, many of us were older or have jobs that we were stuck in or, you know, some people tried college and dropped out and it didn't work out for them. Being in this room with people that were in a lot of the same situations that I am in wanting to better themselves, you could feel the energy in the room, it's just really motivating," said Gant, one of the students in the Code Labs program.

The self-taught path to rural tech work

Fifty percent of rural tech workers in our Rural Adult Survey reported that they taught themselves the computer and software skills they needed for their tech job. This is a significant percentage, and it speaks to how accessible tech learning can be to motivated and supported adult learners. Jill Murray, a senior user experience (UX) manager for an educational software firm in Stevens Point, Wisconsin, started off in the classroom as a teacher, then became a classroom tech specialist in schools before transitioning to the UX field at a local educational software firm. Murray described how she "knew nothing" about UX when she started and how she made the transition "all through experience and learning and doing my own research and self taught and any kind of workshop I could get my hands on." She described learning a lot from the firm's chief technology officer, who had come out of the Silicon Valley tech ecosystem, about the "iterative, collaborative, build, test, learn approach to software development." Murray said, "I just dove in, rolled up my sleeves and basically taught myself this role and realized what a perfect transition that really was for me, having this empathy as a teacher for students and being able to talk and communicate."

As our data shows, rural tech learners and tech workers engage in many learning and training pathways. And, in order to increase the tech talent pool, rural communities will likely need to make a combination of these pathways available to meet the needs of all kinds of learners as well as local employers. While some traditional higher ed programs are now more accessible through online offerings, to be most valuable to students they should be paired with work-based learning experiences. The non-traditional, industry-led programs that have emerged in rural communities are focused on providing the practical skills and software development work experience that traditional classroom programs lack. While technical skills tied to particular programming languages or tech stacks are important, the people we interviewed revealed just how important it is that aspiring tech workers be proficient in the non-technical skills, chiefly: the ability to pursue self-directed learning, to collaborate and problem solve with others, and to become familiar with the work practices and roles associated with software development.

LOWERING BARRIERS FOR RURAL LEARNERS IS ESSENTIAL: Rural learners find that the two largest barriers to tech training are cost and time commitment; lowering these barriers helps to grow and diversify the tech talent pool.

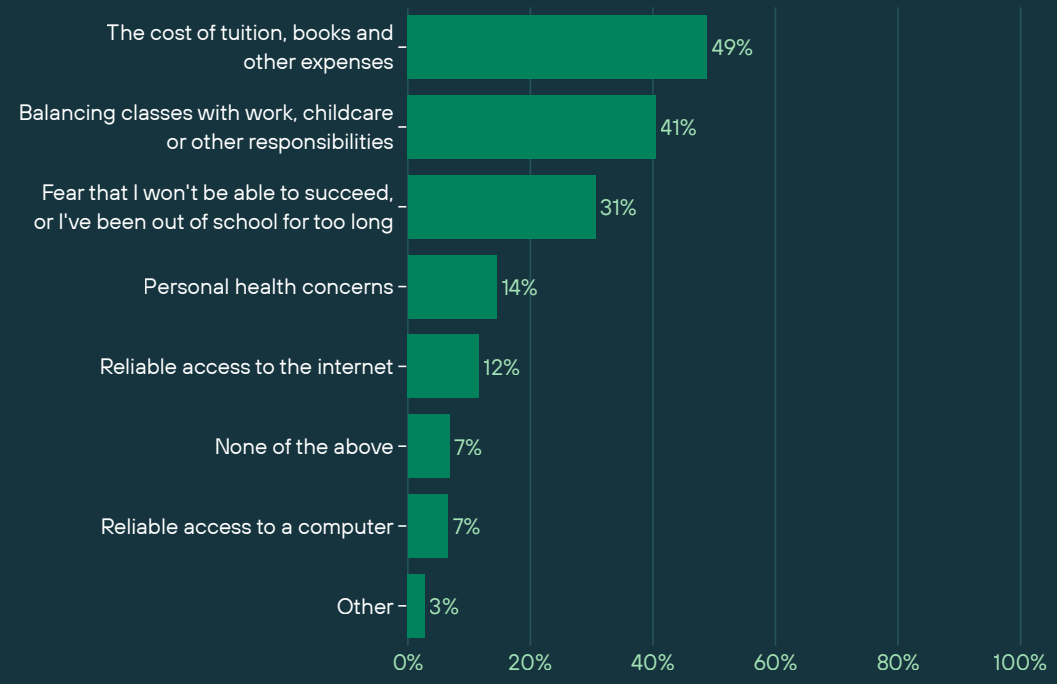
But growing a tech workforce is not as simple as just telling people to just go and self-teach themselves or just sign up for a training program. As demonstrated by the Rural Adult Survey and many of the tech learners we spoke with, rural adults face barriers to pursuing training to switch into tech jobs. Yet to meet the demand for tech talent nationwide, including in rural areas, lower barriers to entry into the field are needed to tap into the latent talent that exists in rural places across the country, including underrepresented populations in tech such as women, people of color, and those who lack a college degree. In parallel to the national demographics in tech, the Rural Adult Survey identified that the rural tech workforce is 73% male and majority white, despite the diversity that exists in many rural places. However, non-traditional training programs like SALT and Code Labs have shown progress with lowering barriers to entry and attracting diverse participants.

The two largest barriers to training programs: cost and time commitment.

The Rural Adult Survey respondents and many interviewees identified cost and time commitment as two major barriers to pursuing education and training (Figure 10). About half of all survey respondents cited the costs of tuition, books, and other expenses as a major barrier, and 41% cited the ability to balance class with work, childcare, and other responsibilities. A significant percentage (31%) reported a lack of confidence as a challenge. Given that this was an online survey, it's perhaps not surprising that only 12% indicated that access to the internet was the most challenging obstacle, and 6% cited access to a computer (though those interviewed did identify access to computer equipment, reliable internet, and transportation as barriers that students and adult learners who came to the field later in life had to overcome).

Figure 10

If you were to pursue education and training, which of the following might prove to be most challenging to you?



(Source: Rural Adult Survey)

Cost was a particularly decisive factor for adult learners. Many online bootcamps can cost upwards of $15,000, and college or university enrollment can be just as expensive, if not more. Some bootcamps have offered income-sharing agreements (ISAs) to help learners manage costs, as the Flatiron School did for a period starting in 2019 to support students in managing the $17,000 cost of its programs. Under these arrangements, students do not have to begin paying back the cost until they are gainfully employed, and even then the payback terms are indexed to their salary. But even ISAs may not be enough to mitigate the risk of a career change for adult learners, particularly if they are expected to enroll full time and have to forfeit income during that period.

Code Labs designed their programs with the intent of minimizing the cost barrier that so many aspiring learners face. Code Labs is completely tuition-free (as detailed in Appendix A: Code Labs Case Study). Stephon Gant, the Code Labs student who transitioned into tech via Code Labs, expressed how valuable this type of affordability is for career-changers. "If [Code Labs] wasn't so accessible the way that it is, then I probably wouldn't feel as comfortable taking the risk...whenever you put more barriers to entry into the program, it makes it more difficult to actually start," he said. At SALT, although the program is not free — students are engaged in work-based learning through their college or university, and are paying tuition and other higher ed costs — the program pays apprentices for their time. Students allocate 20 hours per week to the apprenticeship, and they are compensated accordingly by SALT, which acts as the employer for the apprentices. In other words, as one participant put it, they are getting "paid to learn."

Another barrier to entry among workers is the time commitment of training programs. Many potential tech workers are also working adults with family and financial obligations. This can preclude people interested in tech from returning to a four-year degree and may also preclude them from certain training programs whose time commitments make it impossible to hold down a job while enrolled. Code Labs structured its program so that it is part time, involving a time commitment of 20 to 25 hours per week. Although this is still a significant time commitment, it makes it possible for Code Labs participants to work part-time, take classes, and/or meet other family obligations while enrolled in the program. Many adult learners were attracted to Code Labs specifically for this reason. "I had looked into bootcamps, and I decided I wasn't going to spend the kind of money that you'd need to enroll and not be working for that time," said Connor Thompson, a Code Labs student. "So I was kind of just stuck waiting for something to show up, and then lo and behold, something literally right in front of me — you know, a big sign for free adult education web development bootcamp [at Code Labs]."

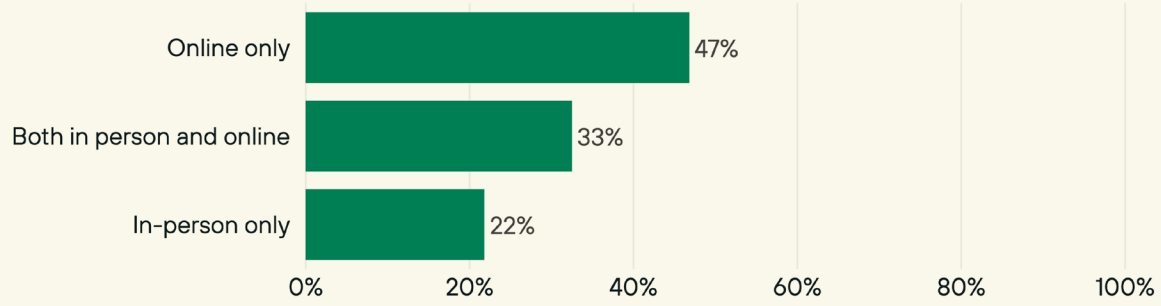
Once learners are enrolled in part-time training programs, they still sometimes need assistance in order to participate. A program director for a national coding bootcamp described how they work to remove barriers to participation, a sentiment that was echoed by Code Labs instructors. "If a learner is in need we try to find options to offer them support. One way that we offer support to our learners is through a microgrant fund. For example, if a learner needs help covering childcare costs or needs a laptop to be able to participate in the program, we will cover those costs. We believe in removing barriers for our learners and offer them support to do just that," said Megan Emacio, program director at Merit America. When training programs cater to the needs of their students — condensing the training program and offering a part-time option, offering financial support, or lowering costs — it makes training opportunities more accessible to a broader population.

Online and hybrid training options expand access to participation in rural areas.

A third barrier that is especially pertinent in the rural context is the format of the training: remote, hybrid, or in-person. The Rural Adult Survey revealed that of those considering tech training programs, many more prefer online-only (47%) or a hybrid format (33%) as compared to in-person only instruction (22%) (Figure 11).

Figure 11

What format would you prefer for your training?



(Source: Rural Adult Survey)

There are a number of reasons why rural adults might prefer online learning and self-training. The first relates to the barriers of cost and time: Enrolling in those traditional forms of training at higher ed institutions to get a degree or certificate can be expensive and time consuming. The second major reason relates to transportation. In rural areas, learners often have to travel significant distances to attend classes — eliminating travel can expand the pool of who can feasibly enroll in a training program. For example, the University of Wisconsin's "extended campus" online IT programs tend to attract working adults because they can be completed while also holding another job, and furthermore, they eliminate the barrier of the time, effort, and infrastructure needed to commute. Similarly, Code Labs expanded its 2021 programming beyond Cape Girardeau to reach nine other locations across rural Missouri and western Kentucky. One of these locations is Paducah, Kentucky. German Cruz, a Code Labs trainer, expressed the impact of transportation and distance for rural learners:

> *"Mainly, people travel 30 minutes to an hour to get to Paducah, and it's much easier for students to go to class virtually...I have a student who just moved two hours away, and it doesn't make sense for her to drive two hours out and back because I'd rather her just stay home and devote those four hours to either learning and such, doing some exercise, or creating a project in a virtual environment."*

But many adult learners and instructors in non-traditional programs also spoke of the value of in-person training and learning, even though they incorporate online or remote components as well. "Just being in the same room, sometimes you learn things from other people asking questions that you wouldn't if you were remote, and if you're working in a pair [online], you wouldn't hear the questions from other pairs," said Zack Amis, a current Code Labs trainer and former participant. "Just having to travel to the classroom gets you in the mindset of being there to learn and get something done." SALT co-founder Stacey Roach described the approach that SALT took: "Like any educator, you can see the difference between remote versus in-person. Some people are very much in-person learners...but we try to facilitate both. We have tech talks on-site, usually monthly, and every [session] besides that is remote." In short, there are an array of preferences when it comes to the formats of training, but having the flexibility to navigate across virtual and in-person environments demonstrates how it is possible to design accessible tech skilling programs in which working adults and those with college degrees or prior computer science experience can participate.

In sum, to increase participation in tech training and careers, rural organizations and employers should offer training opportunities that are, from the outset, accessible and feasible to rural residents regardless of financial status, race, gender, or location. Maximizing participation from diverse rural residents is necessary for rural places to build a local, sustainable workforce in the age of growing tech employment.

IMPLICATIONS FOR PROGRAMS, POLICY, AND RESEARCH

In order for rural areas to fully participate in the tech economy and benefit from the prosperity and opportunity it can generate, we need to pursue strategies that both boost demand for tech workers and the supply of tech workers in rural areas. Based on the findings from this study, we set forth recommendations for different stakeholders who all have a role to play in growing tech employment in rural areas: local leaders, training providers and partners, policymakers, and public and private funders.

Addressing the demand for tech talent in rural places

PRIORITIES FOR LOCAL LEADERS:

Identify where there is untapped potential for tech employment in your region. Given that our study suggests that many rural industries are understaffing their tech operations, rural communities should prioritize engaging existing local employers to identify promising pathways for increasing local tech employment. To do so, leaders can first use data from the U.S. census' American Community Survey to learn more about trends related to tech employment in your region by looking at employment in "Computer & Math Occupations." Second, by surveying, interviewing, and convening local employers in these sectors local leaders can develop a more nuanced understanding of employers' tech talent needs, as well as barriers and opportunities to grow tech employment. This knowledge can then be used to drive priorities for training initiatives and partnerships with local schools and higher ed institutions.

Invest in efforts designed to increase tech-based innovation and entrepreneurship. To build a strong base of demand for local tech talent and to cultivate the future employers of tomorrow's tech workers, local leaders should cultivate strong partnerships that can support the growth of existing businesses in both the tech and non-tech sectors that will employ tech workers. As demonstrated in the case studies in this report (see Appendix A and Appendix B), such partnerships can involve local employers, tech professionals, higher ed institutions, workforce development boards, industry associations, and local economic development entities. As we've highlighted elsewhere, in order to create an ecosystem that supports the growth of tech jobs, rural communities need to leverage a variety of assets, ranging from higher ed partnerships,[49] to broadband,[50] to access to capital,[51] and other support that startups and businesses need to grow.[52]

49 Center on Rural Innovation. (2021). Cultivating Entrepreneurship: Higher Ed's Role in Rural Innovation Ecosystems. Center on Rural Innovation and Sorenson Impact Center.

50 Center on Rural Innovation. (2021). Why broadband is essential to participate in the digital economy.

51 Center on Rural Innovation. (2021). Direct Driver: Access to Capital.

52 Center on Rural Innovation. (2021). Direct Driver: Scalable Tech Entrepreneur Support and Incubation.

PRIORITIES FOR LOCAL TRAINING PROVIDERS AND PARTNERS:

Provide career support and connections to employers. In order to maximize the likelihood that locally trained workers will stay local, it is essential to build local work-based learning opportunities and provide job search and career support services to participants. Ideally, the work-based learning is designed to enable participants to build a portfolio and work record that is relevant to local employers, and to prepare for technical interviews with employers. Program leads should dedicate staff time to recruiting and placement to ensure that graduating learners land good jobs. This is especially important for people new to the tech field, or from underrepresented populations who may not have the personal experience and networks to navigate a job search on their own.

PRIORITIES FOR POLICYMAKERS AND FUNDERS:

Create and advocate for federal policies and programs that encourage tech adoption and direct more federal funding to support the growth of tech employment in rural tech-based businesses and rural firms in core non-tech sectors. There are already a number of existing federal programs that could be leveraged more effectively to support the growth of tech-based businesses, and the adoption of tech to drive rural tech employment. These include:

- The Economic Development Administration (EDA) has several programs that are designed to support high-growth, tech-based sectors, including the Build to Scale program and the STEM challenge. In addition, EDA can leverage its existing planning and Economic Adjustment Assistance dollars to support rural Economic Development Districts in identifying how to boost tech-based business growth and employment in their region, and funding to implement strategies designed to do so.
- USDA's Rural Innovation Stronger Economy (RISE) grant program can fund "rural jobs accelerator partnerships"[53] in low-income rural areas that are designed to stimulate the growth of high-wage jobs and increase the formation of new businesses in specific sectors. Congress should fully fund this program to enable more rural communities to participate.
- There are a number of programs in the Infrastructure Investment and Jobs Act (IIJA) that can be leveraged to support technology adoption and expansion of the rural tech workforce. For example, the IIJA sets aside $1 billion in grants to strengthen state and local cybersecurity defenses — 80% of the funds must go to local units of government including 25% to rural areas.[54] Similarly, IIJA establishes a $250 million grant and technical assistance program to support efforts to strengthen rural and municipal utility cybersecurity defenses.[55] These investments should be paired with a rural cybersecurity workforce strategy to ensure that they create a rural tech workforce to sustain cybersecurity defense.

53 As defined in the 2018 Farm Bill, "a jobs accelerator center or program located in or serving a low-income rural community that may provide co-working space, in-demand skills training, entrepreneurship support, and any other services described in [7 U.S.C. §2008w] subsection (d)(1)(B)."

54 Text - H.R.3684 - 117th Congress (2021-2022): Infrastructure Investment and Jobs Act. § 2218 (2021, November 15). The grants that are part of the State and Local Cybersecurity Grant Program are to be administered by FEMA in concert with CISA (see link).

55 Ibid.

There is also pending legislation that could focus federal funding on the growth of tech-based innovation and employment in rural areas. If legislative language directs that rural areas must be included in these investments to support such geographic distribution, then the following could be impactful:

- U.S. Innovation and Competition Act (USICA) (passed the U.S. Senate) provides important investments in technology sectors that could support the growth of tech-based industries and employment in rural areas. For example, USICA directs the National Science Foundation (NSF) to fund university technology centers and innovation institutes to advance research, development, and commercialization in key technology sectors. The bill directed NSF to maximize regional and geographic distribution of university centers, including by considering "rural-serving institutions of higher ed."
- The Rural Partnership Program, included in earlier versions of the Build Back Better budget legislation, would establish a new $1 billion effort at USDA to create rural prosperity and rural innovation grants aimed at supporting multi-year, multi-sector collaborations at the local level. This new program would create avenues and funding to support regional economic development efforts that include a focus on tech-based sector growth and expansion of tech employment in rural areas.

Incentivize federal agencies to contract with rural tech firms, source contractor talent in rural areas, and establish tax credits for firms that employ rural tech workers. As a major purchaser of technology and IT services, the federal government can leverage its procurement system to increase contracting with rural tech firms and hiring of rural tech workers. The federal government already provides incentives for agencies to contract with HUBZone businesses, including those located in rural areas. This program, while small, provides an avenue for expanding tech procurement and hiring in rural areas, particularly when paired with other socioeconomic procurement preferences, such as women-owned and veteran-owned businesses. Likewise, the federal government could expand on "local hire" initiatives by incentivizing IT contractors to employ workers in designated rural areas. Aside from procurement, the federal government could incentivize tech companies to hire tech workers located in rural areas by offering employment subsidies in the form of tax credits. Under this type of program, firms would be eligible for a tax credit for each new hire into a tech role (computer and math occupation) in an economically distressed rural county. The positions could be remote, with the company's offices located outside of the eligible rural county.

Commission additional research to better understand why rural employers are not investing in tech staff at the rate that national data suggests they should be. This is a concerning finding because it suggests that rural businesses across various sectors will not be as competitive with those who are fully leveraging technology and employing tech workers to help them maximize gains. And, as job forecasts suggest, unless there is a concerted effort to grow employment in these sectors in rural areas, we will continue to see tech-based economic growth and employment concentrated in metro areas. The status quo path will further widen the geographic economic divide in our country and risks missing the opportunity to fully engage rural people and businesses productively in the economy.

Addressing the supply of tech talent in rural places

PRIORITIES FOR LOCAL LEADERS:

Identify industry leaders and employers willing to partner with local institutions on work-based learning and non-traditional training programs for tech workers. Since strong industry engagement and work-based learning is critical both to successful training and to connecting learners to jobs, local leaders should actively engage employers in talent development efforts. It is unlikely in rural areas that one or two employers could generate enough demand for certain positions to create a whole new training program, thus it will likely be necessary to aggregate demand across a few employers and industries and bring them into collaboration. As local leaders assess where there is an opportunity to have greater tech employment, they can actively identify which employers and local institutions could partner to create or improve tech training opportunities locally.

Increase the visibility of the local tech community through both virtual and physical spaces. Our study revealed that while rural adults have a high interest in tech learning and tech work, the people who act on this interest have a higher level of awareness of tech jobs and enough exposure that they've begun to see the career possibilities for themselves. Local leaders should make tech work and tech workers visible in the community by sponsoring tech meetups, networking, and professional development events. These activities should be designed to build connections and relationships, build visibility, and build knowledge about tech talent and tech opportunities locally, and ideally extend into local schools. Local leaders should use local networks and LinkedIn to identify local remote workers and pull them into the ecosystem. Coworking spaces have an important role to play here and should become the focal point for convening remote tech workers and other key businesses and stakeholders in the community. Indeed, all three communities we featured in this report — Stevens Point, Cape Girardeau, and Statesboro — used their local coworking spaces to support tech workers. Both Code Labs and SALT used the coworking spaces as the physical hub for their tech training programs. The SALT program was located at the downtown innovation space that was created through a partnership with the city's economic development organization and the university.

PRIORITIES FOR LOCAL TRAINING PROVIDERS AND PARTNERS:

Build in intentional efforts to diversify tech trainees from the start. Given the current and projected strong demand for tech talent and the comparatively higher wages and career stability these jobs provide, we need to make sure as many people as possible can join the tech workforce. This means tapping into underrepresented groups in the tech field, such as women and people of color. Since they may not see a place for themselves in the mostly white and male industry, it is important to intentionally design programs for inclusivity from the start so that we can grow the talent pool. These efforts should reach out to local K-12 schools so that young girls, students of color, and students in households with limited access to technology have exposure to computers and tech work, and can see others like them working in tech. Many local communities have started with after-school programs and special projects to engage students with technology before undertaking longer-term efforts to establish computer science teachers and curricula in schools.

Create collaborative, cohort-based learning models to optimize the learning outcomes for rural tech learners. Tech work is inherently collaborative and highly interactive. Training programs designed to mirror this work environment will accelerate learning among their participants and better prepare them for successful employment. By encouraging students to "learn how to learn" together and in collaboration with instructors and professional developers, students will gain confidence and comfort with problem-solving at a faster rate. Likewise, by building a strong sense of community within a cohort, program participants will have greater confidence and motivation to succeed.

Make training more accessible to working adults or those reentering the workforce to widen the talent pipeline. As detailed in this report, cost and time commitment were the two primary barriers that prevent working adults from pursuing additional tech education and training. Yet, we've seen that by subsidizing training so that it is low-cost or no cost, and making the training programs part-time with schedules that can accommodate working adults (including a mix of remote and in-person learning), it is possible to draw in a wider variety of tech learners, including lower-income individuals or people who never graduated from college. While costs can be defrayed through grants and employer sponsorships, it may also be possible to leverage public funding models, such as tuition or "earn and learn" subsidies through the community and technical college system. Additionally, local officials and economic development organizations (EDOs) should advocate for new funding pathways for local training — working with their local workforce development boards using federal funds from sources like the Workforce Innovation and Opportunity Act, American Rescue Plan Act, Economic Adjustment Assistance, or Infrastructure Investment and Jobs Act where possible, and/or funds from community foundations.

PRIORITIES FOR POLICYMAKERS AND FUNDERS:

Invest in industry-driven training models that are more accessible to rural adults. To engage the latent talent pool of rural adults who are interested in tech but reluctant or unable to enroll in traditional two- or four-year degree programs, we need to create more accessible pathways to obtain in-demand skills in shorter periods of time. Private funders, including private and corporate philanthropy, can fund these non-traditional programs, including ones that leverage existing community and technical college or university resources. Federal agencies,

including the Department of Labor (DOL) and EDA can use existing programs to prioritize funding tech training and tech jobs programs in rural communities. DOL has already done this through its Workforce Opportunities for Rural Communities (WORC) grant program in partnership with the Delta Regional Authority and the Appalachian Regional Commission. During the Obama administration, the DOL used H-1B visa program fees to fund a $150 million TechHire initiative to increase access to short-term tech skilling programs.

Fund the development of physical coworking spaces and onsite programming in highly visible downtown locations to support the growth of a tech ecosystem. Downtown coworking spaces can serve an important function in both creating demand for tech workers and building the supply of local tech workers. On the demand side, these spaces can provide a physical place to access resources and programming to grow tech-based businesses, as seen in both Codefi in Cape Girardeau and the Business Innovation Group (BIG) in Statesboro. On the supply side, coworking spaces can serve as a visible place for cohort-based tech training programs, for remote workers, and for programming that connects tech workers with each other and with local companies. Federal agencies including EDA, HUD, USDA, as well as regional entities like the Appalachian Regional Commission or the Delta Regional Authority, should prioritize funding both the development of the physical coworking infrastructure and onsite programming.

Invest in elementary and secondary school programs that expose young people to working with technology and introduce them to various tech roles and concepts. Our research found that exposure to technology and tech work was an important factor in motivating people to pursue tech learning and careers. To grow the rural tech talent pool, this exposure needs to happen much earlier than college or adulthood. The National Science Foundation (NSF) already has several programs that are focused on expanding access to computer science education among younger students (see for example, CS for All). Ideally, NSF can allocate 20% of such grants to rural communities, and encourage and support learning among rural grantees. In fact, the U.S. Innovation and Competition Act includes a Rural STEM program that would expand training and support for rural STEM educators (including computer science), support partnerships with 4-H and USDA Extension Service as well as community colleges to expand access to computer science and STEM learning opportunities.

CONCLUSION

This report shines a light on how broader trends related to tech employment and the digitalization of work are showing up in rural communities. We find concerning signals that rural areas are not employing their share of tech workers, and consequently, rural people and places are missing out on the prosperity and economic opportunity that tech employment and business growth brings. This trend is all the more concerning given that the technology adoption that drives digitalization of work and tech employment will continue at a rapid pace, yet rural industries are not projected to capture a significant share of this tech employment. So, what can we do?

First, state and local leaders in rural areas must recognize that they need a specific strategy to grow tech employment and support technology-based innovation across sectors in rural communities — it will be crucial to meaningful regional economic growth. This recognition should spur intense discovery with local industry and key partners like higher ed institutions to determine where there is an opportunity to grow tech adoption and tech employment, and what barriers there are to enabling such growth.

Second, national leaders need to recognize that our national economy will be stronger with a more equal distribution of tech employment, tech talent, and tech innovation. Current and potential

federal programs that are aimed at supporting innovation-based economic growth or strengthening tech adoption, such as cybersecurity and broadband programs, should be targeted to support rural tech growth to generate demand for rural tech talent. Federal agencies should stimulate demand for rural tech workers by leveraging the federal procurement system and tax credits to incentivize new tech hires in rural areas.

Third, public and private funders need to support a wave of highly accessible, short-term, industry-based programs that prioritize equipping rural adults from all backgrounds with enough skills to seek entry-level tech roles. These programs can also be adapted to help entry-level tech workers continue growing so that they can advance to mid-tier roles.

In short, there must be a concerted national effort to boost demand for tech workers and increase the diverse supply of tech workers in rural places. Only then will we be able to achieve shared prosperity made possible by tech employment and tech business growth, and fully leverage the diversity and talent of rural people and places.

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APPENDICES

Appendix A: Case study — Code Labs

In 2014, Chris Carnell and James Stapleton, Ph. D., opened Codefi in downtown Cape Girardeau, Missouri, with a coworking space and technology incubator. Carnell and Stapleton, both technologists and entrepreneurs, met at the local university and recognized the need to diversify the local economy by intentionally cultivating an ecosystem that could support the launch and growth of tech startups. While Codefi had early success supporting new startups, they quickly realized that in order to support the growth of tech companies, they needed to grow the local tech talent pool. In 2016, they introduced LaunchCode's Python training program. They recruited participants from the local area, covered the cost of their participation with grants, and provided instructors who worked as professional developers in the local area. The group quickly learned that rural communities needed a new approach to training a workforce, so in 2017 they designed their own program and launched Code Labs. With each cohort, Codefi has used learning and feedback from participants and employer partners to refine the program. Now, five years later, Code Labs has graduated 150 individuals, and with federal support from the U.S. Department of Labor and Delta Regional Authority have expanded to communities in southeast Missouri and west Kentucky. Code Labs has started working with community and technical colleges to identify participants, and is actively exploring how to formalize relationships with community and technical education providers, through either accreditation or bringing the Code Labs model to existing programs. In 2022, with support from the Missouri Technology Corporation they will be expanding across all of southern Missouri.

Program structure: Code Labs offers a 20-week front-end development course and a 20-week back-end development course. Initially designed for incumbent workers, participants are expected to dedicate 20 to 25 hours per week to the program, which provides more structure than self-paced methods but is achievable for those who need to keep working and are not able to dedicate full-time to learning. Participants spend the first 16 weeks learning how to code using languages and tools commonly used by local businesses, and the last four weeks completing a project under the guidance of a local employer. The program uses a "flipped classroom" model where participants are given assignments to practice and learn on their own, then twice a week they meet in a classroom with instructors for three- to four-hour sessions where they discuss what they learned, do live coding projects, and problem-solve together. While initially participants met in person in Codefi's coworking space, during COVID they transitioned to a virtual model using Zoom. Now, there is a hybrid approach with both in-person and virtual classroom time. During the last hour of each class participants are paired up to work on a project together. The program is designed to prepare participants for what working as a developer is truly like. Code Labs instructors will often set up

assignments that simulate real-world problems that participants might encounter working on a development team. For example, they could purposefully create problems with a code merge, or set up a situation where the participants discover the tools they have are out-of-date.

Work-based learning and job search preparation: In the final four weeks of the program, participants are paired with a local employer to complete a project. Code Labs uses this part of the process to simulate a job search and hiring process. Code Labs recruits different employers to participate and then works with them to identify projects. Code Labs instructors also work with the participants to put together technical resumes to prepare for mock interviews with the employers. Participants are matched to employers in teams, and Code Labs instructors serve as liaisons to the employer representatives and help provide technical project management support for the teams. At this point, participants are putting to use not only the technical programming skills they learned during their training, but also the practical project management and team collaboration skills they gained. For example, Code Labs has integrated teaching participants how to publish code to GitHub. They are currently experimenting with ways to track participants' productivity using agile practices with project management tools such as Jira and share that as part of their professional profile. Agile development teams often use point systems to classify the level of complexity associated with particular tasks. You can then use this point system to estimate time frames for development, where a developer or team has what's known as"velocity," or the speed with which they can complete coding tasks. In these ways, Code Labs is anchoring its program and job search support to industry-based practices. It has begun building out a rural source platform where graduates will have professional profiles featuring their portfolio of work, and resources for employers to identify quality hires. Recently, Code Labs has started extending the work-based learning of its program by using grant funds to pay a select number of participants who are finishing the program to continue working for up to 20 hours a week on employer projects. Called the Rural Source paid work experience, they've developed communities of practice to provide these individuals with processes and a team to help further their training; such as a technical lead who is their coding mentor, a technical project manager, structured sprints and standups, and reflections.

Cost: There is no cost to participants. Codefi has subsidized the cost of the program through state, federal, and private grants. Codefi's costs have included (a) curriculum, (b) instructors, (c) software and tools, (d) classroom space, (e) marketing and communication, and (f) program management.

Instructors: From the beginning, Codefi has prioritized recruiting instructors who are professional developers employed locally. This ensures that the instruction is tightly aligned with the local tech industry and instructors have knowledge of the local market and employers' talent needs. As the program has expanded, they've recruited from a national talent pool, but still require instructors or "code coaches" to be based in the local market, either southern Missouri or west Kentucky.

Participant selection: In the beginning, Code Labs required applicants to complete a logic and computational thinking test and they selected the applicants with the highest scores. But Code Labs learned that high test scores were not necessarily the strongest indicator of success through the program. Instead, it found that participants who could dedicate the time to the program and participants who were most highly motivated to complete the program performed the best. As a result, Code Labs no longer requires applicants to complete a logic test. Now applicants are asked to complete pre-work, which could be a free introduction to an HTML/CSS course where they are asked to complete up to 10 to 20 hours of assignments. The pre-work demonstrates an applicant's willingness to dedicate time to learning to code and to persist when teaching oneself new skills.

Code Labs supplements this pre-work with a 30-minute phone interview where they learn more about the applicant, their personal and professional situation and goals, and their motivation to participate in the program. Over time, Code Labs has also worked to diversify its applicant pool. The incoming cohorts are now 45% women, noticeably better than the 73% male in the rural tech workforce. Increasingly. Code Labs participants have mostly been made up of incumbent workers who are looking to switch into the tech field or gain tech skills to advance within their current field. Some participants are also small business owners seeking tech skills to promote the growth of their business. With its expansion into additional communities, Code Labs is also starting to collect data on the barriers that potential participants face to participating in the program, such as access to child care, reliable Internet and a device, or other challenges. Based on what it learns, Code Labs expects to make changes to the program and bring in partners to address barriers to participation.

Key features:

- Prioritizing interaction and collaboration: Code Labs has learned that the most successful participants are the ones who have the most interaction with other participants in the program — whether fellow participants, instructors, coaches or employers. A core philosophy of Code Labs is that its instructors are not just training how to code, but teaching how to learn. They engineer this learning environment by constantly pushing participants to ask questions, seek out help, and work together to solve problems. Thus, the participants who make the most progress and learn the most are frequently the participants who have interacted and collaborated with others the most. Not surprisingly, this also mirrors how tech workers interact and learn with each other on the job.
- Staying flexible and constantly adapting: From the beginning, Codefi has embraced a rapid learning cycle, continually adapting Code Labs to reflect what is learned. The program managers regularly gather feedback from participants, code coaches, and employers, and make changes — sometimes mid-course — when there is evidence that an updated approach could yield better results for participants and their employer partners. As Chris Carnell explained, "[O]ur ultimate goal is how can we align both the employer and the workers, goals and objectives?"
- Grounded in current industry practices and technology: Unlike traditional computer science courses or even self-paced online bootcamps, Code Labs offers participants the opportunity to use tools, practices, and work in ways that mirror how tech gets done in the "real world." For example, most coding programs have participants learning to code in web browsers. But in reality, when programmers produce code, it is usually "pushed" to a platform like GitHub where other members of the team "pull" it down to integrate into the product. Employers pointed out that they had to spend too much time teaching new employees how to do this in GitHub, including how to troubleshoot problems with merging code. So, Code Labs built working with GitHub into its program. Now, participants who complete Code Labs are familiar with this industry standard.
- Low barrier to entry: There are no degree requirements, testing prerequisites, prior coding experience, or tuition payments necessary to enroll in Code Labs. While 20 to 25 hours a week is a significant time commitment, it is still possible for Code Labs participants to work part-time, take classes or meet other family obligations while enrolled in the program. This is a significant advantage over other programs — whether non-traditional bootcamps or college or university degree programs — that require full-time enrollment and upfront tuition payments. Even bootcamps that offer income sharing agreements come with a financial cost to participants.

Appendix B: Case study — SALT: Southern Automation Logistics and Technology

Tech entrepreneur Stacey Roach and his partners have built a company in Georgia focused on helping other startups and businesses use technology effectively. In the process, he's become singularly focused on how to get more companies to adopt technology to fuel innovation and attract tech workers to sustain innovation in rural areas and smaller markets. In his words, Roach grew up "pretty poor" in Georgia and was a first-generation college student at Georgia Southern University (GSU), where he earned a degree in computer science. He has been motivated to grow tech talent in Georgia, starting first in Dalton, a small city in rural north Georgia, and now moving on to the "low country" areas of Statesboro and its closest big city, Savannah. When his firm, Inventure IT, expanded from Dalton to the Statesboro-Savannah area, he connected with Dominique Halaby, the new associate provost for innovation and commercialization at GSU. Halaby had recently established the Business Innovation Group, an incubator and coworking space in downtown Statesboro in collaboration with the city's economic development authority. Motivated in part to solve his own company's talent needs and also by the opportunity to give back to the community and his alma mater, Roach collaborated with Halaby to establish a pathway for GSU students into tech jobs. In 2020, Roach and his business partners — Jeremy Fletcher, Lee McKinney, Brent Newsome, and Dr. Sidney Smith — established SALT: Southern Automation Logistics and Technology in partnership with GSU, bringing industry and academia together to provide work-based learning experiences to college students. In less than two years, over 30 GSU students have completed SALT apprenticeships. Now, SALT is in the process of expanding to Savannah State, an historically black college in nearby Savannah.

Program structure: SALT's software engineering apprenticeship provides a structured way to engage computer science students in "real world" projects with local employers while gaining exposure to a variety of software development roles. Each incoming cohort has about 20 apprentices. Once selected, apprentices are told to commit one semester to the program, but plan for two semesters. In reality, a number of apprentices stay with the program through college graduation. The first semester students are in the "bronze" class. The 14-week program starts with a one-week orientation where students are onboarded as new employees, provided a fully equipped workstation, introduced to the software and systems they will need for work, and given an overview of the program and expectations around participation. Apprentices then begin to work on assignments that give them exposure to the full software development lifecycle.

Students allocate 20 hours per week to the apprenticeship and they are paid for their time. SALT acts as the employer of record for the students, so even if they are working on projects for other participating employers, SALT manages the apprentices' work and participation in the program. SALT instructors give weekly "tech talks" where they introduce new concepts and software tools to the students, and provide them resources to do additional learning online (e.g., YouTube links, Pluralsight, or other online learning platforms). They also lead "Q&A" sessions where students can continue to learn and raise issues or questions in a group setting. SALT instructors and mentors point out that this approach helps spread learning, as opposed to one-to-one question and response between a student and instructor, while establishing and reinforcing a culture where people feel comfortable asking questions. Students are embedded within professional software development teams that are building and maintaining applications for participating employers. The student apprentices are treated as junior members of the team. They are given assignments and fully integrated into team activities, including the use of scrum practices to self-organize work. Due to COVID some "tech talks" have been virtual, but apprentices are generally expected to be in the

SALT/Inventure IT workspace where they can easily access mentors and instructors to problem-solve and collaborate with other apprentices. Near the end of the 14-week period, the SALT mentors and apprentices nominate a subset of apprentices to advance to the "silver" class in the next semester. The silver apprentices are able to take on more advanced work, and begin to mentor the incoming "bronze" apprentices. "Gold" apprentices stay on beyond two semesters, and they too continue to work on employer projects while mentoring incoming apprentices.

Work-based learning and job preparation: SALT apprentices are working on development projects that have been selected by participating employers. In that sense, everything they are working on relates to an application that is already deployed or will be deployed by a business. For example, one of the participating employers has a physician clinic's practice management system that the apprentices work on with Inventure IT staff. SALT takes the apprentices to the clinic so they can see how the software is used by staff to support patient check-in and registration, exam room management, and scheduling, billing, and other processes. By working on these projects, SALT apprentices gain exposure to the entire software development lifecycle, and importantly, how to use agile methodologies and scrum practices. The apprentices work within the corporate partners' technology stacks. So, for example, they may be using Microsoft platforms for web development, database development, application development (both web and mobile), as well server environments and source control. They participate all the way through the deployment process, from development, testing, and quality assurance to production. Along the way, they gain exposure to different roles and specialties within a software team. This direct experience positions students well for continued employment either with SALT's corporate partners or with other companies. While there is no formal career counseling or job search support, SALT co-founders and instructors regularly help students network, introduce them to job opportunities, and serve as references. While the program has not been tracking formal metrics, many reported that almost all students who have passed through the apprenticeship program have been hired in a tech role.

Cost: So far, Inventure IT and its participating employers have self-funded the program. They have covered the cost of renting space in GSU's downtown Business Innovation Group, outfitting professional workstations for the apprentices, paying wages to the students, and subsidizing staff time for instructing and coaching apprentices. The participating employers have also covered the cost of the more fun elements that contribute to community building, such as providing "swag" like t-shirts, hats, and backpacks, and organizing social outings and meals. From Roach's point of view these investments are worth it because they are "vetting potential employees, reducing recruiting costs, and expanding our brand." While eventually the program may evolve into a non-profit structure, by starting it as an employer-backed enterprise they've been able to build and test what works and ensure they are aligning closely with local industry needs and opportunities.

Instructors: Inventure IT and other participating employers identify staff members who are expected to spend 20% of their time mentoring, coaching, and providing guidance to student apprentices. Many of these staff members are senior-level software engineers with 20 years or more of experience. But more junior-level staff members, including those who graduated from the SALT apprenticeship program and are now employed by Inventure IT or participating employers, are also expected to allocate time to mentoring and coaching the current class of apprentices.

Participant selection: For its software engineering apprenticeship, SALT recruits students who ideally have completed at least a few basic programming courses in college. While some prior experience is preferable, it is not required. As SALT Executive Director Gracie Smith explained,

"We're willing to take anyone who really has a passion to learn and wants to succeed." The SALT program is advertised on the university's job and internship platform, Handshake, typically the semester before the next apprenticeship cohort starts. The SALT program has relied heavily on referrals and word-of-mouth with GSU students and faculty affiliated with the computer science program. However, after the first year, SALT leaders realized that by prioritizing recruiting computer science students they were ending up with a predominantly male cohort, reinforcing the gender patterns seen across the tech industry. Smith had gone through the SALT program and recognized more could be done to reach women who are interested in technology but may not be computer science majors. She started to promote the program through college sororities and in a concerted effort to recruit women. Since then, the SALT program has gone from 10% female to about 50% female. To date, about 50% of the SALT apprentices have been white and about 50% have been people of color. Smith says that they've emphasized creating an inclusive and affirming environment from the beginning.

Key features

- Higher ed partnership: So far, SALT has limited its program to college students who are currently enrolled in Georgia Southern University or Savannah State, or recent graduates of those institutions who still have access to the university's online internship and entry-level job platform. This means that students can pair their classroom-based instruction with work-based learning through SALT. All GSU computer science students are required to complete internships in order to graduate, and the SALT program fulfills this requirement for participating students. Savannah State is exploring offering course credit for SALT participation. According to SALT founder Stacey Roach, the universities want students to gain practical, real-world experience that they can't get in the classroom, and being able to offer credit further incentivizes participation in the program.
- Robust mentoring and access to professional support from a variety of people: SALT apprentices regularly engage with professional developers as part of a software development team, but also through the "Tech Talks" and "Q&A" sessions organized by the program. In addition, SALT apprentices who have been with the program for a couple semesters and are now at the silver or gold level function a bit like "graduate teaching assistants." They frequently mentor the newest cohort, share how they learned to do certain tasks and help to overcome challenges. This collaborative environment accelerates the apprentices' learning and exposes them to multiple different roles and ways of working together to solve problems.
- Apprentices are embedded in professional software development teams working on "real" projects for local companies: As Jeremy Fletcher, CTO of Inventure IT, described, "[We] actually get them involved in real stuff, you know, real projects, real software, real things that are going out and people are actually using." SALT apprentices prized this part of their experience and contrasted it to what they experience in the college classroom. Unlike school projects which are produced for a professor but will not actually be used by anyone in real life, SALT projects involve producing and maintaining applications for local companies. As a result they are gaining skills and insights that make them significantly more experienced and employable than a student that has only classroom-based experience. This also means that students are quickly exposed to a wide variety of roles and associated with developing and maintaining software. If they were simply creating a mobile app on their own for a school project, they wouldn't be exposed to other issues such as how the app integrates with existing technology in use at a company.

- Flexible approach to matching students' interests with work opportunities: While the SALT program is anchored in software engineering, apprentices are exposed to a wide variety of roles and technologies. Some apprentices become more interested in product management or project management, others are drawn to UX work and front-end development, and some become more interested in back-end development and system architecture. The SALT program directors find ways to support an apprentice's continued growth in their area of interest. Likewise, if an apprentice is motivated to continue learning and has become a productive member of the team, they are encouraged to stay on and continue contributing to projects.

Appendix C: Extended methodology

When seeking to understand how to grow a diverse talent pool of tech workers and strong tech employment in rural places, it is most essential to turn to those who best know the context: the workers, employers, learners, and training providers living and working in rural places. Following preliminary data analysis and a series of discovery interviews with stakeholders in multiple rural regions around the country, we conducted both qualitative interviews to capture lived experience, and quantitative surveys to capture a breadth of views across rural adults and rural employers.

Labor market data analysis

To explore tech employment among non-technology businesses in rural areas, we obtained a custom data set through the labor market research firm EMSI BG. The analysis focuses on a set of industries, which we call "core non-tech industries," that are commonly found in rural areas and utilize technology in their operations. There industries include:

Banks	Colleges, universities, and professional schools	Elementary and secondary schools	Government	Hospitals
Insurance carriers	Manufacturing	Mining	Other finance and insurance	Utilities

Together, these industry groups accounted for 6,076,133 rural jobs in 2019, representing 35% of rural wage and salary employment. Within each industry, the analysis considers employment across 12 occupation groups drawn from the federal computer and math occupations grouping:

Computer systems analysts	Information security analysts	Computer and information research scientists	Computer network support specialists	Computer user support specialists	Computer network architects
Network and computer systems administrators	Database administrators and architects	Computer programmers	Software developers and software quality assurance analysts and testers	Web developers and digital interface designers	All other computer occupations

The EMSI data provides counts of workers employed in a county across each occupation-industry group. To shed light on the employment behavior of rural businesses in these industries, we compared the rate of tech employment within these rural non-tech industries, to the national rate of tech employment for the same industries.

Surveys

We fielded two surveys. First, the Rural Adult Survey was designed to measure rural adults' awareness of an interest in tech jobs and training. In December 2021, 1,213 rural residents over the age of 18 from across the U.S. completed this online survey, which was available in both English and Spanish. The results from the survey are generalizable. To implement the survey, CORI worked with the survey research firm SSRS, who distributed the survey to its Opinion Panel among U.S. adults ages 18 or older who reside in non-metropolitan (rural) areas. Eligible respondents were screened based on current residential zip code. Data were weighted to represent the target population of U.S. adults ages 18 or older residing in rural communities (those residing in micropolitan areas with a population of less than 50,000). The margin of sampling error for the complete set of weighted data is ± 3.9 percentage points. Margins of error for subgroups will be larger.

The second survey, the Rural Employer Survey, was designed to gather insight into rural employers' views on technology and their talent needs. We fielded the Rural Employer Survey in nine communities, including several that are part of CORI's Rural Innovation Network. In January 2022, 110 rural employers across many industries in nine rural communities completed the Rural Employer Survey.[56] It is important to note that 74% of responses came from two rural communities: Taos, New Mexico, and Emporia, Kansas. Although this second survey provides important insight into employer perspectives, particularly when viewed in context with our qualitative interviews, its limited scope makes the results non-generalizable.

Qualitative interviews and community selection

We wanted to enrich our understanding of the survey data by learning more about the experience of people in the rural tech field, and to do so, we held 56 interviews with a range of stakeholders in rural communities, most heavily in Stevens Point, Wisconsin (Portage County); Statesboro, Georgia (Bulloch County); and Cape Girardeau, Missouri (Cape Girardeau and Scott counties). This involved in-depth conversations with the staff of a few local institutions, including Code Labs in Cape Girardeau, Southern Automation Logistics and Technology (SALT) in Statesboro, and the University of Wisconsin-Stevens Point. We also interviewed a select number of rural learners and program managers affiliated with two rural pilot programs run in partnership with national training providers in Taos, New Mexico (Taos County), and Emporia, Kansas (Lyon County), to gain insight into tech training programs that are not place-specific.

To identify these communities, we started by determining which rural counties stood out from their peers in at least one of two categories: the amount of tech talent produced (as measured by computer science and math graduates in IPEDS), and the amount of tech employment (as measured by the number of adults employed in computer and math occupations in ACS). This data analysis

56 It is important to note that 74% of responses came from two rural communities combined: Taos, New Mexico and Emporia, Kansas.

led us to Portage County, which exhibits higher-than-average employment in computer and math occupations, and higher-than-average computer science graduates as compared to other rural counties. Similarly, Bulloch County exhibits higher-than-average computer science graduates as compared to other rural counties, but room to grow to increase its local tech employment. Cape Girardeau was selected because of the unique approach that the local innovator Codefi has taken to partnering with tech employers to develop and grow the tech talent pool locally.

In addition to selection based on the metrics depicted above, it was important to ensure that the communities of study were demographically diverse because rural America as a whole is demographically diverse. While as a whole the rural population is about 77.9% white, 8.8% Hispanic/Latinx, 7.9% Black, 2.1% Indigenous/Native American, and 1% Asian, broken down on regional, state, and local levels, community makeups are often more diverse.[57] The community contexts below will delve into the demographic makeups of the communities of study.

Community context

The qualitative research presented in this report is centered around three main places: Stevens Point, Wisconsin (Portage County), Statesboro, Georgia (Bulloch County), and Cape Girardeau, Missouri (at the crux of Cape Girardeau County and Scott County).

Stevens Point, a city of about 25,600 people, is located in central Wisconsin, about two hours north of the larger metropolitan area of Madison. On the whole, the residents of Portage County are 91% white, 3% Asian, 3% Hispanic, and 1% Black.[58] As the county seat for Portage County, Stevens Point is home to University of Wisconsin-Stevens Point (UWSP) and Mid-State Technical College, and has a higher-than-average rate of computer and math graduates, as well as a higher-than-average employment of workers in computer and math jobs.[59] These higher ed institutions have a history of engaging with local industry around program and curriculum development as well as work-based learning opportunities. The largest industries in the Portage County economy are agriculture, food processing, manufacturing, insurance, forestry, and dairy.[60] When it comes to tech employment, tech jobs tend to be concentrated in the insurance industry, though there are a few educational software companies and other tech companies that also employ tech workers.

To offer insight into the southeast part of the country, we turned to Statesboro, Georgia. Statesboro, with a population of about 55,600, is part of rural Bulloch County and is situated in about halfway between Atlanta and Jacksonville, Florida. In Bulloch County, residents are 64% white, 31% Black, 4% Hispanic, and 2% Asian. The largest industries in the region include manufacturing and healthcare. One of the main drivers of the area's economy is Georgia Southern University (GSU), and while the county has a higher-than-average rate of computer and math graduates, it has a lower-than-average rate of employment in computer and math jobs.[61] GSU has been leveraging its assets

57 American Community Survey, (2019). ACS demographic and housing estimates. 2019 1-Year estimates Subject Tables.

58 American Community Survey, (2019). ACS demographic and housing estimates: Bulloch County, Cape Girardeau County Taos County, Lyon County, and Portage County. 2019 1-Year estimates Subject Tables.

59 CORI analysis of Integrated Postsecondary Education Data System (IPEDS) (2020) and 2019 ACS data.

60 Portage County Business Council. (2022). Business and Industry.

61 CORI analysis of Integrated Postsecondary Education Data System (IPEDS) (2020) and 2019 ACS data.

to support the growth of an entrepreneurship and innovation ecosystem. For example, GSU's downtown Business Innovation Group has become a focal point for local entrepreneurs and has enabled partnerships such as the Southern Automation Logistics and Technology (SALT), a private sector-led effort to provide GSU students with apprenticeships working on software development projects for local companies (see Appendix B for more extensive case study on SALT).

The third location of focus is Cape Girardeau, a Mississippi River town of about 40,000 located in southeastern Missouri near the border with Kentucky and Illinois. In Cape Girardeau County, Missouri, residents are 86% white, 7% Black, 2% Hispanic, and 2% Asian. It lies at the crux of Cape Girardeau County and Scott County. Cape Girardeau was historically a manufacturing city, but now — like so many rural cities across the country — it is reliant on the service sector economy, although manufacturing still plays a role in the region.[62] Healthcare is also a prominent industry, and many of those employed in tech jobs locally are in healthcare or medical technology. A member of the Rural Innovation Network, Cape Girardeau drew our attention because it is home to Codefi, a downtown coworking and startup hub that has intentionally focused on building local tech talent through its Youth Coding League program for kids and its Code Labs full stack development program for adults in southeast Missouri and western Kentucky (see Appendix A for more extensive case study of Code Labs).

Although Taos, New Mexico (Taos County), and Emporia, Kansas (Lyon County), were not as central to the report as the other three communities, the conversations we had with program officers and learners working with national training providers were based in these places, and 75% of the Rural Employer Survey responses came from these communities. Those we spoke to in these communities represented a more diverse swath of demographics than the conversations we had on a whole with residents of the other locales. In Taos County, residents are 57% Hispanic, 35% white, and 6% Native American/Indigenous; and in Lyon County, residents are 71% white, 21% Hispanic, 2% Black, and 2% Asian.

62 Gascon, C. & McGillicuddy, J. (2016). Some Sectors Are Strong in Cape Girardeau, but Recovery from Recession Remains Elusive. Federal Reserve Bank of St. Louis.