RURAL BROADBAND AND THE NEXT GENERATION OF AMERICAN JOBS

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EXECUTIVE SUMMARY

Technology is shaping the next generation of American jobs. Manufacturing, agriculture and health care are among sectors that are demanding more highly-skilled employees than in the past. The need for increased training and education is an imperative for many rural areas that face demographic and economic challenges. While some rural areas have enjoyed population increases in the past several years, many rural areas are challenged by static or decreasing population. Likewise, while some rural areas have exhibited reassuring recovery from the Great Recession, others continue to face the lingering impacts of economic struggle. These changes come at a time when many jobs demand increased skills.

It is projected that science, technology, engineering and math (STEM) jobs will continue to grow alongside increasing demand for workers with middle-skill abilities. Career and Technical Education, or CTE, and traditional college settings can prepare students to meet changing job markets. In rural areas, broadband can be used to support secondary and postsecondary education and training: broadband-enabled services can be used to overcome instances in which small or insular areas lack sufficient economies of scale to support interest in advanced or specialized courses. Regional collaboration among educators and industry can tailor training to support local markets. These efforts can improve local economic stability, as data indicate that higher wages correlate to education.

Small rural communications providers can play a critical role in these efforts. Many offer fiber-based broadband services that can support distance education, and many also work closely with educators and industry to develop opportunities for students to acquire STEM and middle-skills. Work-training programs, apprenticeships and focused classroom instruction can help develop students skills and lay the groundwork for economic opportunities in rural areas.

I. INTRODUCTION

The closing quarter of the 20th century witnessed fundamental economic shifts in the United States. The late 1970s endured conditions that included high inflation rates and manufacturing plant closures; a sense of despondency hovered over areas that for decades had promised residents and youth secure job opportunities and solid middle-class wages. The phrase "Rust Belt" emerged to describe challenges in formerly robust production regions. Some places hit hardest during these years eventually recovered, but even for those spaces, the "new normal" was far different than the past. Factories that were the industrial equivalent of a family store where multiple generations could work side-by-side no longer guaranteed prosperity.

In recent years, rural America has faced a similar track of challenges. In some instances, economic obstacles are compounded by conditions that are uniquely rural—including smaller overall populations or industrial bases as compared with urban areas—that are less able to absorb economic shock than larger regions. This paper will examine current population trends in rural America; review evolving U.S. labor markets; and explore how broadband-enabled services can support rural efforts to meet the next generation of American jobs.

II. OVERVIEW OF RURAL DEMOGRAPHIC TRENDS

Although rural America has experienced an overall population decline since the mid-20th century, recent data indicate positive upturns for some rural regions.[1] Forty-six million people live in rural America, which encompasses 72% of the U.S. landmass.[2] Over the past half-century, overall rural populations have declined. In 1950, rural spaces were home to 36%

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[1] At the outset of this discussion, it is useful to note that "rural" is not a consistently defined term, even among various offices of the U.S. government. The U.S. Census Bureau defines "rural" as any area that is not "urban": an urban area is one with (a) an "urbanized area" with at least 50,000 people, or (b) an "urban cluster of at least 2,500 and fewer than 50,000 people (United States Census Bureau website, "Urban and Rural Classification" (https://www.census.gov/geo/reference/urban-rural.html). In comparison, the Economic Research Service (ERS) of the USDA invokes population thresholds, but also considers whether "outlying counties" are "economically tied to the core counties as measured by labor-force commuting," among other criteria (United States Department of Agriculture, Economic Research Services website, "What Is Rural?" (http://www.ers.usda.gov/topics/rural-economy-population/rural-classifications/what-is-rural.aspx). In contrast, the U.S. Office of Management and Budget (OMB) utilizes a separate set of definitions for urbanized areas that revolve around Metropolitan Statistical Areas and Micropolitan Statistical Areas. Like the USDA approach, OMB considers economic ties, such as those evidenced by commuting workers, between places. OMB notes, however, that its classifications "do not equate to an urban-rural classification" (United States Office of Management and Budget, Bulletin No. 13-01, "Revised Delineations of Metropolitan Statistical Areas, Micropolitan Statistical Areas, and Combined Statistical Areas, and Guidance on Uses of the Delineations of These Areas," at 3 (Feb. 28, 2013) (https://www.whitehouse.gov/sites/default/files/omb/bulletins/2013/b-13-01.pdf).

[2] Kenneth J. Johnson and Daniel T. Lichter, "Rural Depopulation in a Rapidly Urbanizing America," National Issue Brief #139, Carsey Research, Carsey School of Public Policy, University of New Hampshire (Winter 2019) (Johnson and Lichter).

of the U.S. population.[3] By 2010, that proportion had dropped to 19.3%.[4] In the beginning of the 21st century, the proposition that rural counties were "dying" achieved attention among the press and academics. Researchers attributed declining population rates to several factors, including "natural decrease" (i.e., death rates that exceeded birth rates). Natural decrease was noted in 60% of rural counties, and was partly attributable to older residents who "aged in place."[5] Simultaneous out-migration of young adults also contributed to the decrease, with follow-on impacts from a reduction in women of childbearing age and a resulting decrease in rural births.[6] Although overall population in nonmetro counties increased between July 2016 and July 2017,[7] the years between 2010 and 2014 saw an overall population loss in nonmetro America.[8] Ninety-one percent of all U.S. counties that are depopulating are rural, and more than 80% of farm counties are depopulating.[9] Overall, 35% of rural counties are depopulating.[10] Johnson and Lichter report that remote rural counties experience negative impacts at nearly twice the rate of rural counties that are adjacent to urban areas that offer "labor markets, services and economic activities."[11] These trends complicate hopes for reassuring rebounds following the Great Recession.

Some positive trends, however, have emerged since the Great Recession. The Economic Research Service (ERS) of the U.S. Department of Agriculture reports that some rural counties realized increased populations in 2016–17 for the first time this decade. These gains were determined to be the result of in-migration rather than "natural change" (i.e., higher birth rates than death rates). Positive changes in net migration were seen in 1,100 rural counties (58%) between 2012 and 2013 and 2016 and 2017.[12] Johnson and Lichter (supra. n.2) note overall patterns that emerge from the data: generally, regions that experienced declines continued on those paths; regions with fluctuating populations over the decades experienced modest growth;

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3 Table of Urban and Rural Population, 1900–1990, U.S. Census Bureau (Oct. 1995) (https://www.census.gov/population/censusdata/urpop0090.txt).

4 "New Census Data Show Differences Between Urban and Rural Populations," U.S. Census Bureau (Dec. 8, 2016) (https://www.census.gov/newsroom/press-releases/2016/cb16-210.html).

5 Johnson and Lichter at 2.

6 Johnson and Lichter at 2.

7 "Components of Population Change," Economic Research Service, U.S. Department of Agriculture (https://www.ers.usda.gov/topics/rural-economy-population/population-migration/components-of-population-change/)
(last visited Mar. 6, 2019, 18:20).

8 "Recent Population Change," Economic Research Service, U.S. Department of Agriculture (http://www.ers.usda.gov/topics/rural-economy-population/population-migration/recent-population-change.aspx)
(last visited Oct. 7, 2015, 17:45).

9 Johnson and Lichter at 1, 2.

10 Johnson and Lichter at 1.

11 Johnson and Lichter at 2.

12 "Rural America at a Glance: 2018 Edition" Economic Information Bulletin 100, Economic Research Service, U.S. Department of Agriculture at 2 (Nov. 2018) (https://www.ers.usda.gov/webdocs/publications/90556/eib-200.pdf) (ERS).

and regions that experienced consistent growth over time enjoyed strong upturns in recent years.[13] These data implicate not only economic impacts, but educational impacts as well. Declining populations that include fewer K–12 students can force schools to reduce offerings or consolidate with other area schools. Smaller enrollments would generally be expected to be reflected in commensurate reductions in full-time instructors and other staff. In contrast, schools with increasing enrollments would be expected to encounter deltas at which more staff can be hired and expanded course offerings considered.[14]

ERS notes that gains in population coincided with declining unemployment, increased incomes and declining poverty.[15] Rural unemployment declined from 10.3% in 2010 to 4.4% in 2017, roughly matching trends in urban areas. However, while 650,000 new jobs were created in rural counties, an aging rural America led to declines in the overall labor force and decrease in employment of 280,000, leaving a net gain of 370,000 rural jobs.[16] And, a gap between rural and urban employment persists: while unemployment rates have declined at similar rates in rural and urban areas, urban employment growth rates have outpaced rural employment growth.[17] Rural America includes 14% of the U.S. population but accounted for only 4% of employment gains.[18] And, while rural poverty rates are declining, urban poverty rates are declining at a faster rate.[19]

As many rural areas confront population declines, they face lasting imprints of the Great Recession despite the various localized gains outlined above. Two prevailing factors have been identified: (1) the disappearance of traditional blue-collar jobs, and (2) spillover impacts from out-migration that decrease the chances that new businesses, even if smaller, would emerge. The comparatively strong performance of some rural regions, however, indicates that successful regions may serve as sources to develop best practices.[20] Those areas may be studied to determine the impact of careful strategies that may include regional collaboration and investment, and how these lessons can be exported to other regions.

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13 Johnson and Lichter report counties with overall declines lost 34% of their population between 1950-2010; counties with decades of growth and decline enjoyed a net growth a 5%; and, rural counties that were at their peak in 2010 overall enjoyed an overall growth rate of 75%. Johnson and Lichter at 2.

14 *See, generally*, Ian C. Kinkley and John T. Yun, "Student Population Change in Rural Illinois Schools and Its Implications for School Leaders," 40 The Rural Educator 1, National Rural Education Association, at 45 (2019).

15 ERS at 1.

16 ERS at 1.

17 ERS at 2.

18 ERS at 2.

19 ERS at 4.

20 *See*, "Steel Sharpens Steel: A Conversation About Regional Thinking for Rural America," Smart Rural Community, NTCA–The Rural Broadband Association (2017) (https://www.ntca.org/sites/default/files/documents/2017-12/SRC_whitepaper_steele_sharpens_steel.pdf).

III. APPROACHES FOR THE EVOLVING U.S. JOB MARKET

A. MIDDLE-SKILL JOBS

Since 2000, manufacturing jobs in rural areas have declined by 20%.[21] Historically, rural manufacturers provided a stable place of employment for their communities and a source of implicit support for other area businesses that factory employees rely upon, such as groceries or other retailers. According to Forbes, the manufacturing sector produces strong multiplier impacts: Every six manufacturing jobs creates seven indirect jobs elsewhere, and every dollar of manufactured goods triggers $1.40 output elsewhere.[22] Accordingly, localized follow-on impacts are felt sharply when local manufacturing declines, particularly because manufacturing wages are typically high and therefore can support reliable consumer spending. The Bureau of Labor Statistics (BLS) ranks manufacturing salaries as slightly higher than the average wage for all occupations (by way of comparison, the average manufacturing wage is almost twice the average wage for leisure and hospitality).[23] As will be discussed more fully below, manufacturing is enjoying a resurgence. And, while urban regions such as Salt Lake City, Phoenix, Louisville, Las Vegas and Troy, Mich., are enjoying gains, Forbes characterizes "small towns in the Rust Belt" as having "the most encouraging growth."[24] The gains, however, are generally relative to overall decline that preceded them and do not necessarily represent a net increase over prior peaks.

The overall decline in traditional manufacturing jobs runs a parallel track to trends in public education that no longer prepare students for immediate entry to the workforce: non-college tracks are disappearing from U.S. high schools.[25] This does not necessarily reflect a strict cause-and-effect, but rather may be viewed as an encouraging sign that secondary schools are reacting to changes in the job market. A noted economist has observed, "The first three industrial revolutions were driven by coal and stream, then electricity and the automobile, then computing. Now we may be witnessing the rise of the fourth: an economy powered

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21 Reid Wilson, "Rural Poverty Skyrockets as Jobs Move Away," The Hill (Dec. 17, 2017).

22 Joel Kotkin and Michael Shires, "Where U.S. Manufacturing Is Thriving in 2018," Forbes (May 23, 2018) (https://www.forbes.com/sites/joelkotkin/2018/05/23/where-u-s-manufacturing-is-thriving-in-2018/#6cbbcac753b3)
(Kotkin and Shires).

23 *See*, Manufacturing: NAICS 31-33, Bureau of Labor Statistics, U.S. Department of Labor (average hourly earnings of all employees, $27.21) (https://www.bls.gov/iag/tgs/iag31-33.htm) (last visited Mar. 6, 2019, 18:47); May 2017 National Occupational Employment and Wage Estimates, Bureau of Labor Statistics, U.S. Department of Labor (average hourly wage for all occupations, $24.34) (https://www.bls.gov/oes/current/oes_nat.htm#00-0000); *and*, Leisure and Hospitality, Bureau of Labor Statistics, U.S. Department of Labor (average hourly earnings of all employees, $16.30)
(https://www.bls.gov/iag/tgs/iag70.htm) (last visited Mar. 6, 2019, 18:50).

24 Kotkin and Shires.

25 David Stern, "Pathways or Pipelines: Keep High School Students' Future Options Open While Developing Technical Skills and Knowledge," Graduate School of Education, U.C. Berkley, at 1 (2015) (Stern).

by the mobile internet, automation and artificial intelligence."[26] Many jobs that historically did not demand postsecondary education now prefer those credentials. Sixty-five percent of recent online vacancies for executive secretaries and executive assistants required a college degree; in contrast, only 19% of people currently holding those positions have a college degree.[27] These trends may reflect two conditions. In the first instance, high schools in the 20th century often created separate tracks for college-bound and work-bound students. Now, Common Core State Standards endeavor to prepare all students for college *and* work.[28] Accordingly, employers may simply be responding to a market that provides a larger pool of candidates with postsecondary education. Alternatively, the demand for postsecondary credentials for jobs that previously did not require them may reflect changes that are tied to technology and its integration in the workplace, either in office or industrial settings.[29]

For either reason, these trends indicate a need to prepare students for greater educational instruction. A U.S. congressional report predicts that by 2020, nearly 66% of all jobs will require some postsecondary training or education.[30] The acquisition of those credentials can take the form of Career and Technical Education (CTE) or traditional postsecondary college (either two-year or four-year) and should bode well for workers when held against long-standing findings that education is a key element for high earnings. These trends are witnessed across both rural and urban areas as median earnings increase in relation to educational attainment.[31]

Two categories are poised for demand: middle-skill and STEM jobs. About one-third of current U.S. jobs are considered middle-skill, and one-third of the 30 fastest growing jobs are middle-skill.[32] Middle-skill jobs include those in which one-third of workers have some college or an associate degree, including emergency medical technicians (EMTs), therapists, teacher assistants and information technology.[33] There is some inherent conflict in reported

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[26] Christopher Mims, "Inside the New Industrial Revolution," Wall Street Journal, R1, *quoting* Klaus Schwab, World Economic Forum ((Nov. 13, 2018).

[27] Alicia Sasser Modestino, "The Importance of Middle Skill Jobs," Issues in Science and Technology, Vol. XXXIII, No. 1 (Fall 2016) (https://issues.org/the-importance-of-middle skill-jobs/).

[28] *See*, William H. Young, "Common Core State Standards: College and Career Readiness," National Association of Scholars (Aug. 22, 2013) (https://www.nas.org/articles/common_core_state_standards_college_and_career_readiness).

[29] *See*, Stern at 5.

[30] "Expanding Opportunities Through Middle Skills Education," Joint Economic Committee Democrats, U.S. Senate, Sen. Martin Heinrich, Ranking Member (2018) at 1 (internal citation omitted) (Heinrich) (https://www.jec.senate.gov/public/_cache/files/25915db9-709b-4b09-87f5-768cc6fe8206/middle skills-pathways.pdf).

[31] "Rural Education at a Glance, 2017 Edition," Economic Information Bulletin 171, Economic Research Service, United States Department of Agriculture, at 4 (Apr. 2017) (https://www.ers.usda.gov/webdocs/publications/83078/eib-171.pdf?v=0) (ERS Education).

[32] Heinrich at 2 (internal citation omitted).

[33] Modestino.

data that must be addressed: in 2014, BLS reported that low- and high-skill jobs were growing while middle-skill jobs were decreasing.[34] However, some of these trends may be explained by how "middle-skill" is defined. A Federal Reserve Bank of Dallas research economist defines middle-skill as "cognitive routine and manual routine jobs . . . that require the ability to follow precise, well-understood procedures which can, in principle, be carried out by a computer."[35] Other reports, however, define middle-skill jobs as those requiring problem solving and human intervention that cannot be automated, such as health care, high-tech manufacturing and information technology.[36] When those jobs are included, middle-skill workforce participation is found to have increased from 28.7% of the population in 2006 to 33.4% in 2016.[37] In 2017, BLS predicted health care occupations to increase 23.6% and health care and technical practitioners to increase 15.3% from 2016 through 2026.[38] These are jobs that characterize many middle-skill opportunities—jobs that require more than a high school diploma or GED but which do not require a four-year college degree.

As described above, manufacturing jobs are experiencing a resurgence. As of August 2018, 508,000 U.S. manufacturing jobs were unfilled.[39] Current labor shortages are attributed to the changing skills sets necessary to fill those positions coupled with a lack of available workers;[40] a similar observation has been made of middle-skill jobs overall.[41] Challenges filling manufacturing jobs may be compounded by misperceptions of current manufacturing environments.[42] But, unlike factories from the early and mid-20th century that could be perceived as dark and dirty, modern factories that house robots must be clean

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[34] *See*, Demetrio Scopelliti, "Middle Skill Jobs Decline as U.S. Labor Market Becomes More Polarized," Monthly Labor Review, U.S. Bureau of Labor Statistics (Oct. 2014) (https://www.bls.gov/opub/mlr/2014/beyond-bls/pdf/middle skill-jobs-decline-as-us-labor-market-becomes-more-polarized.pdf).

[35] Anton Cheremukhin, "Middle Skill Jobs Lost in U.S. Labor Market Polarization," Economic Letter, Federal Reserve Bank of Dallas, Vol. 9, No. 5 (May 2014) (https://www.dallasfed.org/~/media/documents/research/eclett/2014/el1405.pdf).

[36] Modestino. *See, also*, Harry Holzer, "Job Market Polarization and U.S. Worker Skills: A Tale of Two Middles," Economic Studies at Brookings, The Brookings Institution, at 1 (Apr. 2015) ("Decisions on how to define this part of the labor market can affect measured outcomes, with results varying across different points in time.") (https://www.brookings.edu/wp-content/uploads/2016/06/polarization_jobs_policy_holzer.pdf) (Holzer).

[37] Modestino. *See, also*, Holzer, *id*., noting "we have large numbers of business owners and their trade associations claiming that middle skill job growth remains substantial—and that, if anything, they have great difficulty filling the vacant middle skill jobs they now have." Holzer at 1.

[38] "Employment Projections: 2016–2026 Summary," Economic News Release, Bureau of Labor Statistics, U.S. Department of Labor, USDL-17-1429 (Oct. 2017) (https://www.bls.gov/news.release/ecopro.nr0.htm).

[39] "2018 Deloitte and the Manufacturing Institute Skills Gap and the Future of Work Study," Deloitte Insights and the Manufacturing Institute, at 3 (2018) (http://www.themanufacturinginstitute.org/~/media/E323C4D8F75A470E8C96D7A07F0A14FB/DI_2018_Deloitte_MFI_skills_gap_FoW_study.pdf) (Deloitte).

[40] Deloitte at 4.

[41] *See, i.e*., Holzer, *supra* n.36, at 1, noting difficulty business owners report in filling middle-skill jobs.

[42] Deloitte at 5.

and cool to ensure the proper operation of robots and other vital machinery.[43] About 50% of manufacturers rely on robots, cobots and other high-tech approaches.[44]

Even in the face of increased automation, however, many jobs cannot be outsourced or automated. Increasing automation may reduce job availability in certain fields, but automation should not be viewed as destructive to the overall job market. Factory automation in the Industrial Revolution eliminated some jobs but created others. Rather than being a destructive force, it enabled broader development that demanded human attention. And, as one author predicted, "In the future, the top jobs are robot engineer and elder care-giver. … Jobs requiring warmth and compassion will likely still be filled by humans, because the people being cared for don't want robots in that role."[45] Middle-skill opportunities that are represented by these jobs (and others) are expected to exceed available workers by 1.3% in next five years, according to one report.[46] Management, finance, information technology and health care are often referred to as high-skill but include many middle-skill positions.[47] Health care, in particular, cannot be automated or outsourced.[48] And, jobs that require problem solving demand a "human touch;" these jobs have been identified as including computer support specialists, web developers and engineering technicians.[49] With this outlook, there is sufficient support to create curricula at the secondary and postsecondary level to prepare students for middle-skill jobs.

B. STEM JOBS

An intersection with middle-skills jobs are positions in the STEM sector. Similar to the challenge of categorizing middle-skill jobs, there are multiple definitions of STEM jobs, which in turn can create some difficulty in measuring the STEM sector. For example, the National Science Foundation (NSF) includes social scientists in STEM jobs, but not science or engineering managers. By contrast, the U.S. Department of Commerce includes science and engineering managers but does not count social scientists.[50] A University of Wisconsin-Madison report observes that the lack of standard definitions frustrates accurate analysis of

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43 Emily Hanford, "A Company Short on Skilled Workers Creates Its Own College-Degree Program," American RadioWorks (Sep. 17, 2014) (http://www.americanradioworks.org/segments/toyota-college-degree-program/) (Hanford).

44 Deloitte at 5.

45 Christopher Mims, "What's the Next Big Thing in Tech? It's Up to Us," Wall Street Journal, Nov. 16, 2018 (https://www.wsj.com/articles/whats-the-next-big-thing-in-tech-its-up-to-us-1542376800).

46 Modestino.

47 Modestino.

48 Modestino.

49 *See*, Gabriella C. Gonzalez and Robert Bozick, "Back to Work: Middle Skill Jobs in the STEM Economy," The RAND Blog, RAND Corporation (Aug. 2016) (https://www.rand.org/blog/2016/08/back-to-work-middle skill-jobs-in-the-stem-economy.html) (RAND).

50 Stephen Sawchuk, "Is STEM Oversold as a Better Path to Jobs?" Education Week (May 22, 2018).

the STEM market.[51] Although some STEM jobs require a college degree, many do not. The University of Wisconsin–Madison study reports a range of 37%–71% jobs requiring a college degree, depending on the organization that provided the estimate and the definition for STEM used by that organization.[52] STEM jobs can also include middle-skill jobs, particularly when those positions may require less than a bachelor's degree. These include web developers, geological and petroleum technicians, and agricultural and food science workers.[53]

As noted above, it can be expected that traditional "blue collar" STEM jobs in industries such as manufacturing, health care and construction will increasingly require postsecondary certificates or an associate degree.[54] For example, agencies using a "more inclusive" definition of STEM will present a larger number of STEM jobs in the workforce.[55] There are, however, consistent findings that the market for STEM jobs is robust and offers well-paying positions. BLS reported 8.6 million STEM jobs in 2015, an increase of 10.5% from 2009, as compared with 5.2% job growth for non-STEM occupations.[56] BLS concludes that STEM positions constitute 10% of all U.S. jobs and on average pay almost twice the U.S. average wage.[57] These collective findings are consistent with the determination that STEM jobs are generally "far more plentiful than is generally understood, and they pay more than the typical jobs available to those with less than a bachelor's degree."[58] These data argue for STEM tracks in general education programs already aimed at developing middle-skills.

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51 Amanda Oleson, Matthew Hora and Ross J. Benbow, "What Is a STEM Job? How Different Interpretations of the Acronym Result in Disparate Labor Market Projections," Wisconsin Center for Education Research, University of Wisconsin-Madison at 2 (Sep. 2014) (Oleson, et. al.).

52 Oleson, *et al*. at 13.

53 Stella Fayer, Alan Lacey and Audrey Watson, "STEM Occupations: Past, Present and Future," Bureau of Labor Statistics, U.S. Department of Labor and ILR School, Cornell University, at 13, 15 (Jan. 2017) (https://digitalcommons.ilr.cornell.edu/cgi/viewcontent.cgi?article=2928&context=key_workplace) (Fayer, *et al*.).

54 Sawchuk; *see, also*, Ian Rosenblum and Richard Kazis, "Middle Skill Stem State Policy Framework," Jobs for the Future and Achieving the Dream, at 4 (2014) (internal citation omitted) (https://files.eric.ed.gov/fulltext/ED556763.pdf) (Rosenbaum and Kazis).

55 Oleson, *et al*.. at 8.

56 Fayer, *et al*.

57 John I. Jones, "An Overview of Employment and Wages in Science, Technology, Engineering and Match (STEM) Groups," Employment & Unemployment, Bureau of Labor Statistics, U.S. Department of Labor and ILR School, Cornell University, at 3 (Apr. 2014) (https://digitalcommons.ilr.cornell.edu/cgi/viewcontent.cgi?article=2279&context=key_workplace).

58 Rosenblum and Kazis at 1.

C. CAREER AND TECHNICAL EDUCATION

As noted earlier, past approaches that prepared high school students for either work or college have given way to Common Core State Standards that are intended to prepare all students for college and work.[59] Historically, schools guiding students directly toward work accomplished this goal via vocational training. These "shop" courses were often viewed as suitable for less academically-oriented students, creating a stigma that attached itself to vocational training and participating students. In recent years, however, vocational training has been reframed as CTE.[60]

In much the way a college degree is an indicator for higher earnings, some studies indicate that CTE training correlates positively to higher earnings. While CTE concentrators are less likely to pursue postsecondary education,[61] studies of CTE students who did not pursue postsecondary education revealed higher earning rates for high school graduates who enrolled in CTE courses than their peers who did not.[62] Stern also notes a series of studies conducted across 20 years found earnings correlated positively to the number of CTE courses taken, but in an overview of several efforts cautions, "the findings and discussion do not inspire much confidence in the possibility of reaching clear conclusions from correlational data about how much CTE classes cause increases in earnings."[63] Other reports take a more positive perspective, finding in various state studies increased earnings that range from 14% to 28% across different professions supported by CTE.[64] The U.S. Department of Education (DOE) reports that 95% of public high school students in 2009 attended a school that either offered CTE on-campus or with a partnering school.[65] The DOE also found "the most common occupational CTE subject areas for secondary students were

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59 Stern at 4.

60 Stern notes this evolution is evidenced in federal legislation, which in the 1984 Carl D. Perkins Vocational and Technical Education Act defined vocational education as preparing students for careers "other than careers requiring a baccalaureate, master's, or doctoral degree." *See*, Carl D. Perkins Vocational and Technical Education Act of 1998, Pub. Law 105-332 (1998). In 2006, the reauthorization of the Perkins Act changed the name of Act from "Vocational and Technical" to "Career and Technical," and eliminated the prohibition on funding programs that could require a bachelor's or advanced degree. In 2014, the Department of Education, which administers the Perkins Act, changed from Office of Vocational and Adult Education to Office of Career, Technical and Adult Education. *See*, "Office of Vocational and Adult Education Becomes Office of Career, Technical and Adult Education," Home Room, U.S. Department of Education (Feb. 7, 2014) (https://blog.ed.gov/2014/02/office-of-vocational-and-adult-education-becomes-office-of-career-technical-and-adult-education/).

61 Stern at 11 (internal citation omitted).

62 Stern at 8.

63 Stern at 9.

64 Ann Huff Stevens, "What Works in Career and Technical Education (CTE)? A Review of Evidence and Suggested Policy Directions," University of California, Davis, and National Bureau of Economic Research, at 43, 44 (2019) (https://assets.aspeninstitute.org/content/uploads/2019/01/1.2-Pgs-40-54-What-Works-in-Career-and-Technical-Education.pdf?_ga=2.219392272.846192663.1553723880-249793350.1553723880).

65 "National Assessment of Career and Technical Education: Final Report to Congress," National Assessment of Career and Technical Education, U.S. Department of Education, at 16 (2014) (https://www2.ed.gov/rschstat/eval/sectech/nacte/career-technical-education/final-report.pdf) (NACTE).

business, communications and design, and computer and information sciences."[66] Although in recent years overall participation in CTE participation has declined slightly, demographic differences across racial and economic categories are declining as participation from among various demographic categories is achieving greater equivalent proportionality.[67]

Coordination to create effective CTE models has been addressed by numerous parties. An organization of state educational officials published "CTE on the Frontier: Rural Strategy Guide" to help state leaders assess and then improve local CTE initiatives. The paper offers a series of issues and questions to help users identify gaps, potential resources, opportunities for partnerships and other critical issues.[68] Other reports reveal evidence of collaboration among employers and school districts in building CTE programs, including participation on advisory councils, advice on labor force trends, information on industry standards and offering presentations to CTE students.[69] These efforts indicate focused attention on broadening the sphere of CTE training. CTE preparation can be achieved through apprenticeships and on-the-job-training.

Apprenticeship programs have played an important role in job training and placement. The placement rate for apprentices is 91%.[70] In 2012, 360,000 people were in registered programs that offered on-the-job experience.[71] Employees earn more over time, and employers save on recruitment costs. Between 1998 and 2012, however, the number of apprenticeship programs in the United States decreased 36%.[72] Some of this decrease can be attributed to declines in union participation and the loss of union-employer training and promotion; only 12% of the total workforce and 7% of the private sector were unionized in 2012.[73] Successful apprenticeship programs can be aligned with community colleges to create regional "workforce preparation."[74] Coordination among local educational, industrial and government leaders is important as job markets evolve. As noted in one report,

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66 NACTE at 19.

67 *See*, NACTE at 18, 19; Stern at 7.

68 *See*, "CTE on the Frontier: Rural Strategy Guide," Advance CTE (https://careertech.org/resource/cte-frontier-rural-strategy-guide).

69 "Career and Technical Education Programs in Public School Districts: 2016–17," Institute of Education Sciences, National Center for Education Statistics, at 3 (2018) (https://files.eric.ed.gov/fulltext/ED582132.pdf)
(IES/NCES).

70 Heinrich at 6.

71 Thomas A. Kochan, David Finegold and Paul Osterman, "Who Can Fix the 'Middle Skills' Gap?" Harvard Business Review (Dec. 2012) (Kochan, *et al*.).

72 Kochan, *et al*.

73 Kochan, *et al*.

74 *See*, Melinda Mechur, Karp "Community College Pathways," Community College Research Center, Teachers College, Columbia University, New York City, at 17 (2015) (https://sites.nationalacademies.org/cs/groups/pgasite/documents/webpage/pga_167787.pdf) (Karp). Examples of rural broadband providers supporting these types of efforts are discussed below in Section III.

> The efficacy of education and training programs and their ability to adapt to changing skill requirements has also been identified as a potential source of friction in middle skill labor markets. Institutions that provide education and training for middle skill workers, particularly community colleges, often have inadequate resources and weak incentives to expand capacity in their technical workforce courses or to boost completion rates.[75]

Partnerships among industry and educators can help ensure that coursework is up-to-date with current trends. In an Advanced Technical Education program administered by the National Science Foundation, curriculum materials were presented to the auto industry for review. The industry identified areas for correction and improvement, and revisions were made accordingly.[76]

CTE instruction combined with job/work experience has been identified as a significant benefit.[77] A notable example is the Kentucky Federation for Advanced Manufacturing Education (KYFAME). KYFAME is a partnership of regional manufacturers and colleges that support apprenticeship-type programs to create a force of skilled workers. By way of example, the Toyota Advanced Manufacturing Technician (AMT) Program is a joint undertaking of Toyota and Bluegrass Community and Technical College. The program is aimed at offering participants an opportunity to earn an associate degree while working at Toyota. A major difference between the AMT program and pure technical college is the inclusion of math, humanities and public speaking in the curriculum. Participants are expected to not simply resolve problems but to master the skills necessary to communicate effectively and work with a team to develop a resolution. These so-called "soft skills" are increasingly necessary as the need to communicate increasingly-complex information grows. The KYFAME selection process is competitive and "break[s] down the myth" that being good with one's hands is mutually exclusive to academic superiority.[78]

D. COLLEGE PREPARATION

In the discussion of middle-skill, STEM and CTE, it is important to include the role of colleges in honing these skills. Community colleges have been identified as a "primary source of well-prepared middle-skill STEM workers."[79] Karp reports approximately 7 million students attend community colleges, which award about 500,000 occupational credentials each year.[80] These equip graduates with greater earning potential as compared to peers with a

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[75] Modestino.

[76] Karp at 18.

[77] *See*, Stern at 3.

[78] Hanford, *supra* n.43.

[79] Rosenbaum and Kazis at 2.

[80] Karp at 4.

high school diploma or college coursework that do not earn a diploma.[81] A successful college experience, however, depends on sufficient preparation in high school. This preparation relies on two principal factors: sufficient academic offerings and proper student guidance. For small rural schools, distance education can play a significant role. Where an insufficient number of students fails to create the critical mass necessary to support a local classroom instructor, distance education can gather geographically dispersed students for instruction. Using technology to partner with other high schools and postsecondary institutions, administrators can create programs that help students prepare for guided postsecondary education. Moreover, partnerships with other area institutions can help students prepare for regional job markets.

High schools can help prepare students for careers by creating core coursework paths that can be applied to multiple disciplines. These can be blended with academic guidance that enables students to obtain information to assess how various career opportunities might mesh with their interests. This can help students and educators define a curriculum that will ensure that secondary school graduates do not confront an educational gap as they enter technical schools, colleges or other postsecondary experiences. The National Center for Education Statistics reports that 32% of public-school districts reported that all of their CTE programming is designed as a pathway to "related postsecondary programs," and that 33% reported that most of their CTE programming is structured in that way.[82]

School districts can also work with postsecondary institutions to determine how college-credit or other accredited work can be taken in the secondary school setting. "Early college" programs allow high school students to take college courses while in high school, and to graduate with both a high school and associate degree. Students take courses during their junior and senior years of high school; the costs are typically borne by the local school district.[83] These can include "stackable credits" or other easy-to-transfer credits from school to school. "Stackable credits" are earned in certificate programs in which participants can earn a certificate, move into a job, and the return to education and "add" prior-earned credits toward a "larger" subsequent degree. These credits can be drawn upon later to count toward other programs or four-year college degrees.[84]

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81 Karp at 8 (internal citation omitted).

82 IES/NCES at 2.

83 Ann Allen and J. Kessa Roberts, "Space and Place in Rural College Implementation: A Look at Two Early College Programs in Ohio," 40 The Rural Educator 1, National Rural Education Association, at 29, 30 (2019) (Allen and Roberts).

84 Ames Brown, "A New Way to Cut the Cost of College: Stackable Credentials," Forbes (Oct. 17, 2016) (https://www.forbes.com/sites/amesbrown/2016/10/17/a-new-way-to-cut-the-cost-of-college/).

IV. THE ROLE OF RURAL BROADBAND

In a typical analysis, the challenge of filling vacant middle-skill jobs would presumably be met by relying on usual market incentives. Employers would offer higher wages to attract workers. Those opportunities, in turn, would encourage prospective employees to secure the education and training necessary to secure those jobs. However, students preparing for careers defined by automation and internet of things (IoT) evolutions will demand computer and digital skills alongside problem solving and critical thinking.[85] These skills should be introduced, age-appropriately, at K–12 level and not approached initially only at the postsecondary level.

> One report cautions:
>
> Inadequate development of basic skills in the K–12 system, especially in science and mathematics, can limit the ability of individuals to invest in technical middle skill postsecondary training down the road in occupations such as health care. Finally, inaccurate or outdated perceptions of certain occupations, such as manufacturing, can also reduce incentives for individuals to invest in training notwithstanding the strong job prospects in those sectors.[86]

These principles are important when considering the growth of STEM and middle-skill jobs. The STEM economy is anticipated to increase 17% from 2016–2018, with 2.4 million job vacancies.[87] CTE training will be increasingly important as consumer and industrial goods become more complicated and require more skilled workers for manufacturing and repair. Successful postsecondary education for rural America should be considered be a key factor in ensuring long-term economic viability for rural regions that seek to attract businesses and provide local labor forces. Growth can be impeded if employers cannot fill critical positions in health care, technology and skilled manufacturing.[88] This risk also implicates consideration for an aging rural America that would be served by health care workers; CTE certificates and associate degrees for health sciences increased 137% between 2002 and 2012.[89] And, distance education can provide opportunities for students to continue their education "at home," mitigating some needs to leave the community in order to pursue postsecondary education.

Accordingly, as educational attainment is recognized as necessary to meet the next generation of American jobs, current disadvantages must be overcome. The American Enterprise Institute reports that in 2012, less than 66% of rural schools offered AP courses, as compared with 77%, 82% and 91% of town, urban and suburban schools, respectively.[90] The concern for ensuring

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85 *See*, Deloitte at 7.

86 Modestino.

87 RAND.

88 *See*, Karp at 2 (internal citation omitted).

89 NACTE.

90 Nat Malkus, "The AP Peak: Public Schools Offering Advanced Placement, 2000–12," American Enterprise

educational opportunities transcends the individual welfare of students and workers and implicates overall economic growth that could be frustrated if there is a lack of skilled workers. ERS reports rural counties with low levels of educational attainment suffer poor economic outcomes as compared with counties that have higher levels of educational attainment.[91] BLS reports that adults 25 and older who lack a high school diploma have unemployment rates of 5.4%; those with less than a high school education have unemployment rates of 8%.

Fortunately, rural America appears to have taken a head start on the challenge. ERS reports educational attainment in rural areas is increasing. In 1970, more than half (56%) of rural adults 25 years and older did not have a high school diploma. That share dropped to 15% in 2015.[92] Most rural adults have a high school diploma or equivalent (GED), and nearly 30% have a bachelor's degree or higher. Educational achievements among young rural adults is increasing,[93] a trend that bodes well for strategies aimed at meeting evolving labor market needs. Youth who live in areas with broadband are found to have earned higher scores on college entrance exams such as the SAT or ACT.[94] And, while lack of broadband may also compound difficulties for students who have pre-existing limited avenues to "elite academic institutions,"[95] areas served by small, locally-operated broadband providers are not constrained by those concerns. More than 70% of NTCA–The Rural Broadband Association members can provide 25 Mbps and higher to their customers.[96]

Rural broadband providers are playing vital roles, leveraging their networks and working closely with local educational institutions. Rainbow Communications of Hiawatha, Kan., provides fiber connectivity to Highland Community College, the oldest college in the state. The network enables the college to offer numerous courses at various sites. CTE courses include building trades and medical coding. The college also supports the agricultural industry through courses that include precision agriculture and diesel mechanics; both are necessary as farms rely increasingly on precision agriculture that blends traditional

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Institute, Figure 4 and accompanying text (2016) (http://www.aei.org/publication/the-ap-peak-public-schools-offering-advanced-placement-2000-12/) (Malkus).

91 ERS identifies 467 counties as "low education"—counties where 20% or more of adults 25 to 64 do not have a high school diploma; nearly 80% of these counties are rural. Average poverty rates in rural low-education counties are approximately 8% higher than all other rural counties. 40% of rural low-education counties are also persistent-poverty counties. Low-education counties also indicate poverty, with poverty rates of 20% or higher, and high unemployment rates. ERS Education at 5, 6.

92 ERS Education at 2.

93 ERS Education at 3.

94 Lisa J. Dettling, Sarena F. Goodman and Jonathan Smith, "Every Little Bit Counts: The Impact of High-Speed Internet on the Transition to College," Finance and Economics Discussion Series, Divisions of Research & Statistics and Monetary Affairs, Federal Reserve Board, Washington, D.C., at 27 (2015-108).

95 *Id*.

96 "Broadband/Internet Availability Survey Report," NTCA–The Rural Broadband Association, Arlington, Va. (2018) (https://www.ntca.org/sites/default/files/documents/2018-12/2018%20Broadband%20Survey%20Report_FINAL.pdf).

mechanical equipment with analytical tech and GPS guided systems. Webster-Calhoun Cooperative Telephone Association (WCCTA) in Fort Dodge, Iowa, provides broadband that enables local high school students to earn college credits through distance education. Students can take up to 23 credits of college courses through a partnership with Iowa Central Community College. In Brainerd, Minn., CTC works with Bridges Career Academies & Workplace Connection, which brings together high schools, local colleges and businesses to provide career guidance and training. The initiative focuses on building local career opportunities. Nex-Tech in Lenora, Kan., works with local charitable foundations and public utilities to support high school and college internships. Students earn at least $10.00 per hour and are offered technical and nontechnical career experiences, including agriculture, economic development, automobile restoration, medical services, computer technology, art, banking, legal and others. Similar to CTC, the program works to highlight local job market opportunities. Matanuska Telephone Association in Wasilla, Alaska, gives young students a head-start, sponsoring the MTA Coding Academy. Each year, this program gives more than 500 middle school students a chance to experience computer science through coding, art, STEM and industrial tech. The program is part of the everyday curriculum for the students. These courses offer opportunities to learn, *inter alia*, binary conversion, basic programming, HTML/CSS, App Lab (App Inventor through MIT), robotics and 3D design and printing. Efforts are strong in Tribal lands, as well. In New Mexico, the Mescalero Apache School captured a $20,000 Samsung Solve for Tomorrow award. The nationwide competition develops STEM research and applications. Student members of the Mescalero Apache STEM Group addressed the nutrition needs of the local elderly and developed solar-powered aquaponic systems to grow vegetables. The school is served by Mescalero Apache Telecom, a Tribally-owned broadband provider.

Rural broadband can play a critical role to prepare students for the next generation of American jobs. Distance education is compiling a strong track record: A 2005 study found no significant difference between the writing skills of on-campus and off-campus students.[97] Studies examining student satisfaction found no statistically significant differences.[98] Distance education can be a tool to correct lack of specialization that may exist in small rural schools that cannot provide as broad a range of courses as larger schools can, either because of affordability or demand. Distance education can also assist early college, particularly in rural areas that lack resources to support the increased expenses these endeavors may demand. Moreover, distance education can mitigate ancillary conditions that can affect early college initiatives: Allen and Roberts propose that in areas where public transportation is not readily available, participation in off-campus courses could be limited to those students

[97] Chris Zirkle and Edward C. Fletcher, Utilization of Distance Education in Career and Technical Education (CTE) Teacher Education, at 5 (Zirkle and Fletcher)

[98] Zirkle and Fletcher at 6.

who have access to private transportation.[99] Broadband-enabled distance education allows all eligible students who have access to broadband to participate. Distance education can also provide flexibility for working students and accommodate ongoing family obligations.

While broadband-enabled education offers promise, there are some limitations. Undertakings like KYFAME and apprenticeships will continue to require opportunities for hands-on experience. Certain aspects of health care education are obtained through texts and classroom instruction, but clinical experience is a necessary component as well. Accordingly, distance education is not a "silver bullet," but rather "silver buckshot"—a critical tool in the overall effort to enable greater education and job-training opportunities. Combined with other local and regional strategies, broadband-enabled instruction can enable the acquisition of critical skills necessary to meet the next generation of American jobs.

V. CONCLUSION

Data indicate significant changes that are occurring and will continue to occur in the U.S. job market. These data include labor statistics as well as overall market trends that reveal the greater inclusion of technology in both the manufacture and use of industrial and consumer goods. Properly and strategically crafted secondary and postsecondary education can prepare students for middle-skill and STEM jobs. Rural regions that face economic and demographic challenges may consider, either individually or on a collaborative regional basis, efforts to coordinate educational and industrial leaders to formulate structured educational and job training programming to meet evolving labor market opportunities and needs.

[99] *See*, Allen and Roberts at 31.

About NTCA–The Rural Broadband Association: *NTCA–The Rural Broadband Association is the premier association representing approximately 850 independent, community-based telecommunications companies that are leading innovation in rural and small-town America. NTCA advocates on behalf of its members in the legislative and regulatory arenas, and it provides training and development; publications and industry events; and an array of employee benefit programs. In an era of exploding technology, deregulation and marketplace competition, NTCA's members are leading the IP evolution for rural consumers, delivering technologies that make rural communities vibrant places in which to live and do business. Because of their efforts, rural America is fertile ground for innovation in economic development and commerce, education, health care, government services, security and smart energy use. Visit us at www.ntca.org.*

About Smart Rural Community: *Smart Rural Community℠ is an initiative of NTCA–The Rural Broadband Association. Smart Rural Community comprises programming relating to and promoting rural broadband networks and their broadband-enabled applications that communities can leverage to foster innovative economic development, education, energy distribution and use, health care, government services, public safety and other vital functions. Smart Rural Community administers award and grant programs and supports educational programming through original research and white papers that investigate issues relating to rural broadband deployment, adoption and use. For information please visit www.ntca.org/smart.*

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Additional Smart Rural Community White Papers:

"Beyond Rural Walls: A Scholars' Conversation About Rural and Urban Spaces," Joshua Seidemann, Editor, NTCA–The Rural Broadband Association (2016).

"Steel Sharpens Steel: A Conversation About Regional Thinking for Rural America," Joshua Seidemann, Editor, NTCA–The Rural Broadband Association (2017).

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